Port Kembla Gas Terminal

Spoil Management Plan
Early Enabling Works

Australian Industrial Energy

26 May 2021

→ **The Power of Commitment**

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Acronyms

Acronym	Definition
ACM	asbestos containing material
AHD	Australian Height Datum
AIE	Australian Industrial Energy
AMP	Asbestos Management Plan
AQMP	Air Quality Management Plan
ARCP	Asbestos Removal Control Plan
AS	Australian Standards
AS-B	Bonded asbestos
AS-A	Friable asbestos
ASS	Acid Sulfate Soils
ASSMAC	Acid Sulfate Soils Management Advisory Committee
ASSMP	Acid Sulfate Soils Management Plan
BaP	Benzo(a)Pyrene
Bgl	Below ground surface
BTEXN	Benzene, toluene, ethyl benzene and xylenes plus naphthalene
CD	Chart Datum
EMS	Construction Environmental Management Plan
CLM Act	*Contaminated Land Management Act 1997*
COPC	Contaminant of Potential Concern
CSM	Conceptual site model
CSSI	Critical State Significant Infrastructure
CTMP	Construction Traffic Management Plan
CWQMP	Construction Water Quality Management Plan
Demolition Plan	Demolition Plan for Berth 101
DEMP	Dredge Excavation Management Plan
DGVs	Default Guideline Values
DICL	ductile iron cement lined
DPIE	Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
ENM	Excavated Natural Material
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	Environment Protection Authority
EPL	Environmental Protection Licence
ESCP	Erosion and Sediment Control Plan
FSRU	Floating Storage and Regasification Unit
GHD	GHD Pty Ltd
GSW	General solid waste

Acronym	Definition
HAT	Highest Astronomical Tide
HIL D	Health Investigation Level
HDD	Horizontal Directional Drill
HSL	Health Screening Levels
KPIs	Key Performance Indicators
LAT	Lowest Astronomical Tide
LAA	licenced asbestos assessor
LM	Lineal metres
LNG	Liquefied Natural Gas
MBD	Marine Berth Construction and Dredging
MHW	Mean High Water
MLW	Mean Low Water
MOC	Management of Change
NAPL	non-aqueous phase liquid
NEPC	National Environmental Protection (Assessment of site Contamination) Amendment Measure 2013
NEPM	*National Environment Protection (Assessment of Site Contamination) Measure 1999*
NPG	Pipeline Installation including tie-ins
OHDSCA	Outer Harbour Dredged Spoil Containment Area
ORF	Onshore Receiving Facilities
PAH	Polycyclic aromatic hydrocarbons
PANSW	Port Authority of NSW
PCB	Polychlorinated Biphenyl
PKCT	Port Kembla Coal Terminal
PKGT	Port Kembla Gas Terminal
PKGT EIS	Port Kembla Gas Terminal Environmental Impact Statement
PKHD	Port Kembla Height Datum (0m PKHD = 0.87m AHD)
POEO Act	*Protection of the Environment Operations Act 1997*
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
RSW	Restricted Solid Waste
RWP	Remediation Works Plan
SAQP	Sampling Analysis Quality Plan
Sea Dumping Act	*Environment Protection (Sea Dumping) Act 1981 (*Commonwealth*)*
SMP	Spoil Management Plan
SPR	source-pathway-receptor
SRD SEPP	State Environmental Planning Policy (State and Regional Development)
TEQ	Toxicity Equivalence Quotient
TRH	Total recoverable hydrocarbons
TTE	Tertiary Treated Effluent

Acronym	Definition
UFP	Unexpected Finds Protocol
VENM	Virgin Excavated Natural Material
WA DoH	Western Australian Department of Health
WHS Act	*Work Health and Safety (National Uniform Legislation) Act 2011*

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1. Introduction

1.1 Overview

This Spoil Management Plan (SMP) for the Early Enabling Works phase of the Marine Berth Construction and Dredging (MBD) package of work has been developed as a sub-plan to the Port Kembla Gas Terminal Project (PKGT)(the Project) Environmental Management Strategy (EMS).

This SMP sits over a number of other issue-specific plans including the Construction Water Quality Management Plan (CWQMP), Demolition Plan for Berth 101 (Demolition Plan) (refer to Appendix A) and the contaminated spoil protocol prepared in the form of a Remediation Work Plan (RWP) for this stage of the Project (refer to Appendix B). This SMP addresses the requirements of the Project Infrastructure Approval (SSI 9471).

1.2 Background

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 in excess of 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 Regasification Unit (FSRU) and new infrastructure to connect the terminal to the existing gas network.

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 and to meet an obligation in the lease of the site to demolish existing wharf infrastructure by 29 September 2021.

1.3 Purpose and scope

This SMP identifies waste streams likely to be produced during the course of the Early Enabling Works of the MBD. The SMP ensures appropriate management of these waste streams in accordance with relevant state legislation, Infrastructure Approval conditions and contractual obligations.

From time-to-time, certain events as specified in Schedule 4, Condition 4 of the Infrastructure Approval may necessitate revision of this SMP. These events include the following:

– Occurrence of a reportable incident.
– An independent environmental audit (12 months after operations commence – not appliable to this SMP for Stage 1 Early Enabling Works).
– A modification of the Infrastructure Approval based upon a substantive change to design or construction methodology.

– A specific request from the Planning Secretary.

Within 3 months of any of the above-listed events occurring, unless otherwise agreed with the Planning Secretary, AIE must review, and if necessary, revise the SMP to the satisfaction of the Planning Secretary.

Where this review leads to revisions to the SMP, 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. Any measures identified in the revision to improve the environmental performance of the Project will be implemented as soon as practicable following the approval of the Planning Secretary.

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 the existing import and export terminal and multiple other cargo, logistics, bulk goods and industrial facilities.

Port Kembla is situated about two kilometres south of central 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.

Land zoning in the region includes special and industrial uses at Port Kembla and a mix of primarily residential and commercial uses in 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. The Princes Highway provides access to Port Kembla through turnoffs at Masters Road, Five Islands Road, and Northcliffe Drive and is utilised including by heavy vehicles travelling to and 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 such as coal, grain, copper and steel from Port Kembla. The natural environmental values in Port Kembla and the surrounding land are limited given the extensive industrial, commercial and residential development. Waterways in the region include Gurungaty Waterway, Allan's Creek, American Creek and Byarong Creek. Nearby open space includes JJ Kelly Park and Wollongong Golf Club to the north and larger open area to the south.

The Project will be predominantly located within land zoned for port and industrial uses. Berth and wharf facilities would be situated at Berth 101 in the Inner Harbour while the gas pipeline would extend around the periphery of port land from Berth 101 to a tie-in point at Cringila.

A site overview is provided as Figure 2.1.

Figure 2.1 Indicative Project layout

2.2 Project construction scope of work

The Project construction scope of work has been divided into the three main packages (with associated activities), as outlined in Table 2.1. This SMP applies only to the Early Enabling Works associated with the MBD.

Table 2.1 Construction work pages

Stage	Package	Proposed commencement	Activities	Applicability to this SMP
1	Early Enabling Works	May 2021	Early Enabling Works. 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.	Applicable.
2	MBD	November 2021	Quay wall construction.	Not applicable.
			Excavation/dredging.	Not applicable.
			Wharf facilities construction including mooring system, navigational aids and associated works.	Not applicable.
	Onshore Receiving Facilities (ORF)		Construction of the ORF, which comprises of three areas: Wharf Topside Area; Utility Area; and Common Area. Installation of a small section of pipeline within the Berth 101 site boundary.*	Not applicable.
3	Pipeline Installation including tie-ins (NGP)	March 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.	Not appliable.

2.3 Early Enabling Works for MBD

The site of the Early Enabling Works is the former Port Kembla Coal Terminal (PKCT) Bulk Products Berth. The removal of existing structures and services is required to facilitate subsequent development stages of the Project. The scope of the Early Enabling Works will involve the following tasks:

– Excavation down to level of RL +2.5 metres Port Kembla Height Datum (PKHD) to allow removal of existing structures and services and facilitate construction of the quay wall
– Demolition/removal of Berth 101 and aboveground structures.
– Demolition/removal of aboveground and underground services.
– Removal of existing stockpiles from site.
– Transport of spoil via road from the MBD Site Compound to the Emplacement Cell Construction Site.
– Platform excavation and stockpiling.
– Processing demolished materials (for re-use or recycling) by others.
– CPT in the Outer Harbour.

An outline of the tasks associated with the Early Enabling Works is provided in Section 2.3.1 through Section 2.3.5. The Early Enabling Works are shown graphically in Figure 2.2.

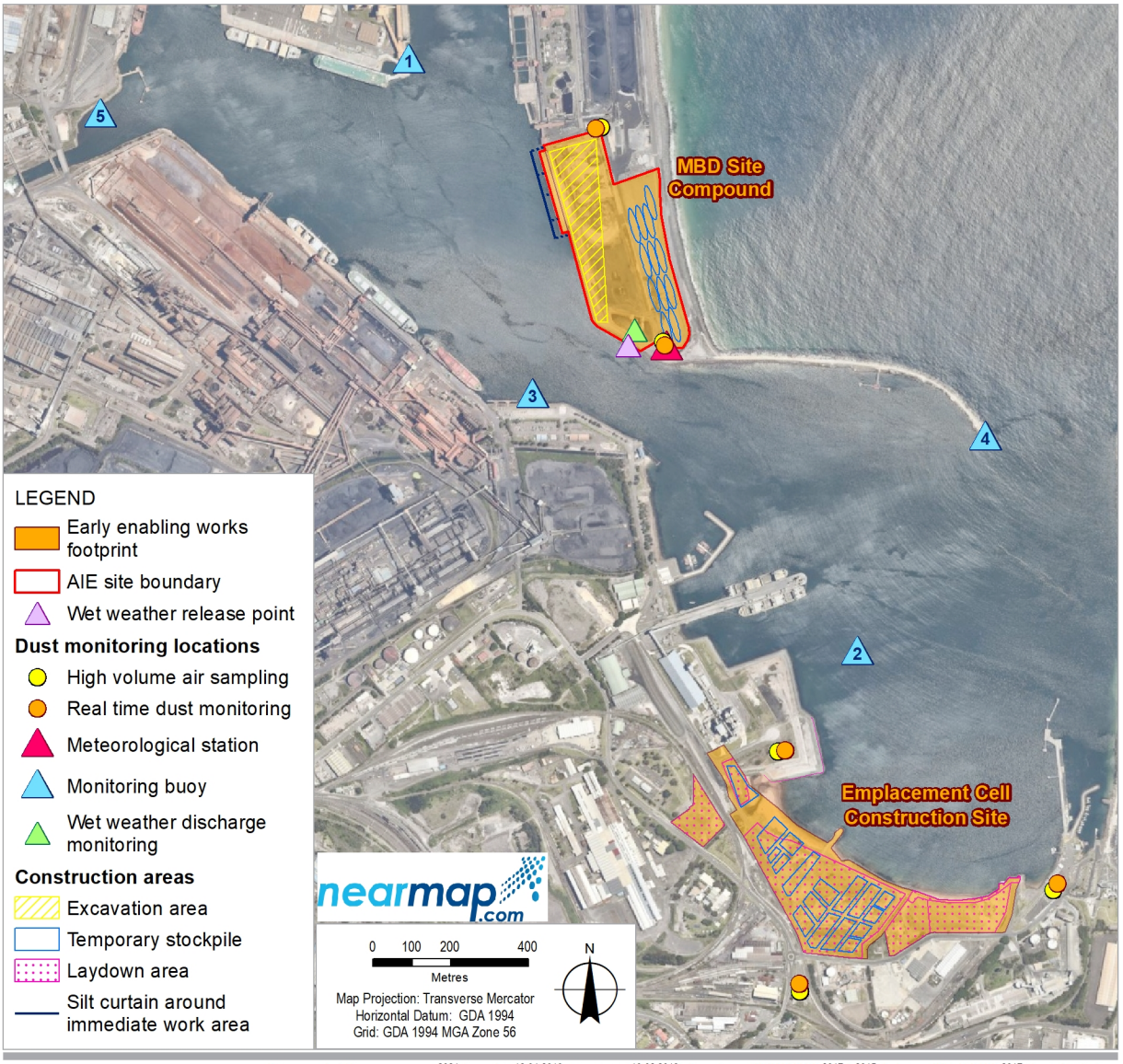

Figure 2.2 Early Enabling Works outline

2.3.1 Excavation

Excavation is required to facilitate the removal of existing aboveground and underground structures and services within the MBD Site Compound to a level of RL +2.5 metres on PKHD.

The proposed excavation zone generally extends from Road No. 7 at the northern end of the West Stockyard to the South Ponds and across to Road No. 9 as shown by the yellow shaded area in Figure 2.3.

Figure 2.3 Proposed excavation zone within MBD Site Compound

It is proposed to segregate, manage, stockpile and transport excavated materials into the following categories:

- Fill materials and concrete suitable for re-use for wharf construction will be crushed (concrete and oversized material) on-site and stockpiled in the East Stockyard (refer to Figure 2.3).
- Excess materials suitable for placement in the Outer Harbour will be transported to the Emplacement Cell Construction Site (refer to Figure 2.2 and Figure 2.4).
- Revetment rock armour will be stockpiled for reuse, if removed.
- Recyclable material such as steel, cables, etc. will be transported off site for recycling.
- Waste materials that are unsuitable as fill or for recycling will be disposed off-site at an approved landfill facility.

Figure 2.4 Emplacement Cell Construction Site

2.3.1.1 Demolition/removal of structures

All structures, foundations, piling, paving, site services, etc. within the excavation zone require demolition and removal. The proposed structures for demolition are summarised in Table 2.2. Demolition work is to be carried out in accordance with *Australian Standards (AS) 2601-2001: The Demolition of Structures*.

Table 2.2 Structures to be demolished/removed during Early Enabling Works for MBD

Structure	Works required
Tower T1	Remove any remaining miscellaneous steel work as necessary (e.g., handrails and guardrails)
Tower T2 and T3	Demolish headstock and cut-off any piles at RL+1.5 m PKHD.
Tower T1, T3, T4 and T6 Clean Out Pits/ Drains	Demolish any remaining miscellaneous steel work, the Clean Out Pit and associated drains.
Conveyor C3	Demolish any pavement/gutter and cut-off any piling in the excavation zone
T3 Pond	Demolish any remaining miscellaneous steel work, the pit and associated drain.
Tower T5 gantries	Demolish the remaining footings and headstock and cut-off piles at RL +1.5m PKHD. The two southern gantries require complete removal of the headstock and piles.
Conveyor C5 Gantry Walls	Demolish the remaining West Stockyard walls (inverted precast concrete T sections).
Reclaim conveyors C6 and C7	Demolish all remaining parts including the reclaim hopper, paving and any foundations/piling/footings.
West shore clean out pit	Demolish any remaining miscellaneous steel work, the pit and associated drain.
West Stockyard Hardstand Area	Demolish and excavate the hardstand to RL + 2.5 m PKHD. The excavation of the hardstand shall extend to 3 m beyond the tie rod anchors (the hardstand area is constructed of 300 mm heavily bound base course (road building material), 340 mm lightly bound base course (80% blast furnace slag and 20% granulated blast furnace slag) and 200 mm of engineered fill.
Light Towers	Demolish the foundations and remove associated cabling. Demolish and remove all other light towers from the site.
Berth 101	Berth 101 comprises a concrete deck supported by 568 concrete and timber piles, tie rods and dead man blocks. There is also a fendering system comprising timber piling,

Structure	Works required
	timber waling and rubber fenders, various utilities and a sheet pile cut-off wall (approximately 175 m long) along the landside of the berth. Works required include cut and remove the concrete deck, remove tie rods and anchor blocks. Removal of piles will be via a crane positioned on a barge immediately adjacent to the wharf structure. Silt curtains will be positioned surrounding the work area during the removal of piles. AIE has an obligation under its lease agreement to demolish the Wharf at Berth 101 by 29 September 2021.
Substation	Undertake asbestos containing material (ACM) inspections and testing of materials prior to demolition (as required). Where ACM is confirmed, remove and dispose off-site by licensed contractor with clearance certificate. Demolish building and transformer bays including underground foundations and conduits. Remove and dispose of any remaining cables from Substation within the site.
Mooring lines	Remove lines and blocks.
Sewer tanks	Two underground concrete sewer tanks are located on the south side of Tower TS8. Demolish the tanks following pump out and flushing.

2.3.1.2 Demolition/removal of services

Numerous services are currently located in the excavation zone and will be demolished and removed generally down to RL +1.5 metres PKHD as part of the excavation process. The services that will be demolished/removed are summarised in Table 2.3.

Table 2.3 Services to be demolished/removed during Early Enabling Works for MBD

Structure	Works required
Bunker oil pipeline	The existing bunker oil pipeline extends from storage facilities on the southern shore of Port Kembla, under The Cut to the oil berth at the northern breakwater. A 300 mm carbon steel pipeline extends underground (approximately 600 mm clear cover) along the western shore of the site to Berth 101. An above ground section then passes under Berth 101 and on to Berth 102 to the north. The pipeline sections, both underground and running under Berth 101 require removal with management and disposal of any residual hydrocarbons. It is proposed to cut the pipeline into transportable lengths and removed from site to an appropriate and approved location. Beyond the excavation zone, the pipeline will remain in-situ and will be capped at both ends with suitable identification.
Domestic water pipeline	An underground potable water supply pipeline currently runs underground on the eastern side of Tower TS8 to supply Berth 101 and a ductile iron cement lined (DICL) pipeline continues along the western shore of Berth 101 supplying the Port Authority of NSW (PANSW) meter compound at the south of the site. An abandoned pipeline formed from ACM runs parallel to the DICL pipeline. A licenced removal company shall be engaged to remove and transport the asbestos material in a safe manner to an approved disposal site. An asbestos clearance certificate shall be provided following removal. All abandoned domestic water piping is to be removed within the excavation zone. Beyond the excavation zone, the pipeline shall remain in the ground and be capped at both ends.
Electricity supply	Electricity is supplied from the PKCT 11 kV South Substation and distributed in Substation B (south of Berth 101). These supplies include: An underground 11 kV electricity cable (approximately 900 mm cover) from Substation B to the PANSW pad-mounted transformer at the southern end of the site. Several 415 V cables from Substation B to Pumps 01 at the South Ponds, to Pumps 09 and 17 at drain pit sumps and to light poles across the site Control cabling for pumps, lights and water spray nozzles. The substation building will be demolished with all cables in the excavation zone removed.
Telecommunications	The telecommunications cable extends from a pit near PKCT South Substation to a pit near the PANSW meter compound. The route of the cable is uncertain, however, it is understood to follow the western shore. During demolition works, the cable is required to be removed and disposed of. Any cable beyond the excavation zone, is to remain in-situ.

Structure	Works required
Tertiary treated effluent	Tertiary Treated Effluent (TTE) is supplied to PKCT for firefighting and dust suppression sprays. An interconnected ring main circles around both the East and West Stockyards supplying dust suppression sprays and fire hydrants. The pipelines and sprays serving the West Stockyard will be demolished and removed. The western incoming supply shall be capped near Tower TS7 and at the branch from West Stockyard to the PKCT truck wash. The spray system for the East Stockyard is not required and will be demolished. The TTE pipeline along the eastern side (Seawall Road) is to remain in-service. The TTE pipeline along Road No. 9 shall be capped on the western side of PANSW meter compound.

During demolition, stormwater from the site will be directed to Southern Pond. The overflow pipes at the Southern Pond is AIE's licensed discharge point into Port Kembla Harbour.

As the demolition work proceeds, the contractor will ensure stormwater runoff always flows to the Southern Pond in accordance with AIE's Environment Protection Licence (EPL) conditions.

All demolition works will be carried out in accordance with *AS 2601-2001: The Demolition of Structures,* or its latest version in accordance with the Infrastructure Approval.

2.3.2 Removal of stockpiles

Two large stockpiles, approximately 700 metres^3 to 800 metres^3 of mixed sandy gravel material are present in the south-western section of the site. The stockpiles also contain inclusions of slag gravel, cobbles, concrete and boulders. Both stockpiles will be removed as part of the Early Enabling Works and will be characterised (visual and sampling, as required) for re-use.

2.3.3 Transport of spoil from MBD Site Compound to Emplacement Cell Construction Site

Approximately 50,000 metres ^{3} of spoil will need to be transported via road from the MBD Site Compound and stockpiled at the Emplacement Cell Construction Site.

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

Spoil will be characterised prior to transport based on the source location, the availability of any existing data and additional sampling and analysis, as required.

2.3.4 Processing of demolished materials (reuse and recycling)

Demolished materials which are sound, suitable and approved by AIE and the auditor may be re-used in the works, subject to approval. Materials for re-use may include:

– Uncontaminated excavated material as fill.
– Crushed concrete as fill.

Excavation of a platform to stockpile up to 70,000 metres ^{3} of material will be undertaken in the East Stockyard.

Materials for re-use are to be stockpiled and stored in the East Stockyard until further stages of the works proceed.

Materials suitable for recycling will be preserved during the demolition works and removed and stored on-site in the eastern stockyard as directed by AIE until collected or removed from site by appropriate contractors.

2.3.5 Cone Penetration Testing

CPT will be undertaken at 50 to 60 locations within the Outer Harbour to inform the design and alignment of the Emplacement Cell. CPT locations will target alignment of Emplacement Cell and proposed fill area. Works comprise of surveying the seabed level and geotechnical testing (including CPT) via a purpose-built CPT rig attached to a small jack barge, portable 15t CPT rig and jack up barge.

2.4 Program for Early Enabling Works of MBD

Early Enabling Works for the MBD is anticipated to commence in May 2021. It is estimated to be completed in six months.

3. Responsibilities

The Project team is responsible for all activities associated with the Early Enabling Works, including the implementation and maintenance of the various air quality mitigation/management measures. The Project team is outlined in the Organisational Chart in the Covering EMS. Relevant roles and responsibilities for the SMP are outlined in Table 3.1.

Table 3.1 Roles and responsibilities

Project role	Responsibility
AIE Project Director	– Responsible for the overall funding and direction of civil and environmental works associated with the Early Enabling Works. – Ensuring provision of adequate resources to achieve the environmental objectives for the project including ensuring sufficient resourcing for the Environmental Team, Engineering and Construction Teams.
AIE Construction Manager	– Proactively stewards the effective implementation of the Early Enabling works in accordance with requirements of the Infrastructure Approval (SSI9471), Environmental Strategy and all related sub-plans – Demonstrate proactive support for environmental requirements
AIE HS&E Manager	– Implementation and updates of all Health, Safety and Environmental Management Strategies and sub-plans – Ongoing liaison and engagement with government agencies and point of escalation for any environmental incidents – Identifying environmental issues as they arise and proposing solutions – Environmental Reporting
Liberty Industrial Project Manager	– On-site Project management and control. – Decision-making authority relating to environmental performance of the construction program – Authority over Project construction and site activities in accordance with the EMS. – Ensure relevant training is provided to all Project staff prior to commencing individual activities. – Reports to AIE Construction Manager on environmental matters. – Ensures appropriate Contractor resources are allocated to implement the environmental requirements. – Responsible for planning and scheduling of construction, and to ensure operations are conducted in accordance with statutory requirements and the EMS. – Monitors performance against environmental Key Performance Indicators (KPI's). – Ensures that all environmental objectives associated with the Project are achieved. – Day-to-day decision-making authority relating to environmental performance of construction activities and direct site activities and construction. – To provide resources to ensure environmental compliance and continuous improvement. – Ensure all personnel are aware of any changes to EMS, SMP and improved procedures. – Ensure this SMP is implemented for the duration of the Early Enabling Works.
Liberty Industrial Construction Foreman	– Implement requirements contained in the EMS and Sub-Plans, work procedures and standard drawings. – Maintaining open and transparent communication with other Project discipline managers and other areas of the Project. – Reporting of hazards and incidents and implementing any rectification measures. – Ensures appropriate contractor resources are allocated. – Orders STOP WORK for any environmental breaches and reports incidents to the Project Manager. – Ensure this SMP is implemented for the duration of the Early Enabling Works.

Project role	Responsibility
Liberty Industrial Environmental Representative	– Delivers environmentally focussed toolbox talks. – Provides environmental advice, assistance, and direction to Project Manager to ensure construction activities are conducted in accordance with regulatory legislation and this AQMP. – Develop strong working relationships with the AIE team and Consultants. – Ensure environmental risks are appropriately identified, communicated, and effectively managed. – The Environmental Rep can order Stop Work for any unacceptable environmental risk or breach of conditions. – Ensure communication of relevant environmental information to Project personnel. – Provide specialist advice and input as required – Ensure construction manager, superintendents and field supervisors fully understand the environmental constraints and how construction practices must ensure any such constraints are considered and mitigated against during construction. – Orders STOP WORK for any environmental breaches and immediately reports incidents to Liberty Industrial Project Manager and AIE HSE Manager.
AIE Environmental Representative	– Develop strong working relationships with the Demolition Team and Consultants. – Ensure environmental risks are appropriately identified, communicated, and effectively managed. – Instruct and advise management team on compliance issues. – Provide specialist advice and input as required. – Co-ordinate internal audits of the SMP. – Conduct audit review as required. – Reports on the performance of the SMP and recommends changes or improvements to Project Manager. – Orders STOP WORK for any environmental breaches and immediately reports incidents to the AIE Construction Manager and AIE HSE Manager. – Conducts investigation and response to environmental complaints and inquiries, where required
Licenced asbestos assessor	– Implementation of the Asbestos Removal Control Plan (ARCP) – Identification of asbestos, including type and controls required (friable or non-friable) – Providing clearance inspections for plant and equipment – Clearance inspections of demolition sites, service removal trenches, proposed reuse material or as required (excluding validation) – Air monitoring in accordance with the ARCP.
Subcontractors and construction personnel	– Undertake an environmental induction prior to taking access to site – Comply with legislative requirements – Participate in weekly inspections and audits – Follow environmental procedures – Report all environmental incidents and hazards – Introduce environmental topics to prestart meetings – Ensure that all relevant permits and clearances are in place prior to commencing work

4. Legislative requirements

The legislative requirements applicable to the Early Enabling Works for the MBD are listed in Table 4.1.

Table 4.1 Legislation applicable to the SMP

Legislation or relevant guideline	Description	Applicability
State		
Environmental Planning and Assessment Act 1979(EP&A Act).	The EP&A Act describes the processes for development assessment in NSW, managing land use and implementing environmental planning instruments. The Act outlines certain permitting and licensing streaming and exclusion provisions that will apply to the work.	The Project has been approved under Section 5.19 of the EP&A Act as CSSI. Relevant consent conditions applicable to Stage 1 Early Enabling Works are outlined in Section 5.
Protection of the Environment Operations Act 1997 (POEO Act)	Provides the statutory framework for managing pollution in NSW, including the procedures for issuing licences for environmental protection on aspects such as waste, air, water and noise pollution control. Companies and property owners are legally bound to control emissions (including particulates and deposited dust) from construction sites under the POEO Act.	An application for an EPL to guide construction and operation of the Project is being processed by the NSW Environment Protection Authority (EPA).
Protection of the Environment Operations (General) Regulation 2009	Contains penalty notice provisions for infringements under the POEO Act.	Applicable in the case of infringement of POEO Act.

5. Planning requirements

The planning requirements and the corresponding spoil and contamination management measures applicable to the Early Enabling Works for the MBD are listed in Table 5.1. Management measures are detailed in Section 8 through Section 10.

The planning requirements include the conditions set out in Infrastructure Approval SSI 9471 dated 24th April 2019 and the mitigation/management measures outlined in the Port Kembla Gas Terminal Environmental Impact Statement (PKGT EIS).

Table 5.1 Approval conditions

Requirement	Reference	Responsibility	Evidence	Applicability to this SMP
PKGT EIS Management Measures				
One or more of the following is proposed for assessing the potential risk to human health the two Benzo(a)Pyrene (BaP) Toxicity Equivalence Quotient (TEQ) hotspots identified at GHB09 and GBH26: – Development of a human health risk assessment for BaP (TEQ), to further refine the potential risk posed by these contaminants to future construction workers. Given the short duration of the works relative to the standard exposure assumptions in a commercial/industrial scenario, it is likely that derived site specific target levels for BaP (TEQ) would be higher than adopted for this assessment. – Additional investigation to delineate the vertical and lateral extent of BaP (TEQ). The investigation would involve step out borehole locations which will target materials at depths between 4 m and 5 m, to assess if the contamination is isolated or widespread. – The source of BaP (TEQ) at GHB09 and GBH26 was not identified nor was there apparent evidence of this contamination present at the time of sampling. The contamination may be a characteristic of the fill material, meaning it could be randomly distributed throughout the fill matrix. Therefore, in addition to further investigation, bioavailability testing is also recommended so that the risk to human health is better understood and appropriate safety control measures can be adopted during construction. The laboratory is presently maintaining these samples pending further analysis.	EIS Measure C01	– AIE HS&E Manager – Environmental Consultant	RWP (Appendix B)	Applicable
Removal of any remnant ACM fragments from the ground surface. The removal should be undertaken by a licenced removalist in accordance with relevant SafeWork NSW codes of practice. Following removal, a licenced asbestos assessor should inspect the site and provide a clearance certificate confirming removal of asbestos.	EIS Measure C02	– AIE HS&E Manager – Liberty Industrial Project Manager – Liberty Industrial Environment Rep – Licenced asbestos assessor	Section 8.2	Applicable
Inclusion of an unexpected finds protocol for contamination in the EMS for the work associated with construction activities.	EIS Measure C03	– AIE HS&E Manager – Liberty Industrial Project Manager	Section 8.5 Appendix C	Applicable
Preparation of an Acid Sulfate Soil Management Plan (ASSMP) by a consultant experienced in the identification and management of ASS. This will also include appropriate management and/or treatment of Acid Sulfate	EIS Measure C04	– AIE HS&E Manager – Environmental Consultant	Section 8.5	Not applicable - ASS material not predicted to be encountered for

Requirement	Reference	Responsibility	Evidence	Applicability to this SMP
Soils (ASS). The ASSMP will be developed in line with the requirements of the Acid Sulfate Soils Management Advisory Committee Guidelines (ASSMAC, August 1998 and as updated). The ASSMP will be prepared to identify, manage and treat the ASS encountered during excavation and dredging to minimise the production of acid leachate.				depth of excavation for Early Enabling Works
Preparation and implementation of a EMS to include an unexpected finds protocol (UFP) to effectively manage the potential contamination issues identified from both a human health and environmental perspective. This would include: – ID – Issue – Measure – Timing the assessment of materials to be disturbed across the site to inform appropriate management strategies	EIS Measure C05	– AIE HS&E Manager – Liberty Industrial Project Manager	Appendix C	Applicable
Assessment and classification of all material to be disposed of offsite as per NSW EPA (2014) *Waste Classification Guidelines, Part 1: Classifying Waste* and *Part 4: Acid Sulfate Soils* prior to off-site disposal.	EIS Measure C06	– AIE HS&E Manager – Liberty Industrial Environment Rep	Section 9	Applicable
Infrastructure Approval Requirements (SSI 9471)				
The Proponent must ensure that all demolition work is carried out in accordance with *AS 2601-2001: The Demolition of Structures*, or its latest version	Schedule 2, Condition 11	– AIE Construction Manager – Liberty Industrial Project Manager – Construction Foreman	Section 2.3	Applicable
The Proponent must ensure that any construction activities in identified areas of ASS risk are undertaken in accordance with ASS Manual (ASSMAC, 1998).	Schedule 3, Condition 6	– AIE HS&E Manager – Liberty Industrial Project Manager	ASSMP to be prepared for MBD stage of development	Not applicable- ASS material not predicted to be encountered for Early Enabling Works
The Proponent must not transport more than 360,000 cubic metres of spoil to the disposal areas by road and must maintain records of the volume of spoil transported by road and track compliance against this condition	Schedule 3 Condition 7	– AIE Construction Manager – Liberty Industrial Project Manager	Section 2.3 Also refer to CTMP	Applicable – Early works limited to 50,000 cubic metres transport by road.
Contaminated Spoil Protocol that includes:	Schedule 3 Condition 11 (a)	– AIE HS&E Manager – Liberty Industrial Environmental Rep	Appendix B (RWP)	Applicable

Requirement	Reference	Responsibility	Evidence	Applicability to this SMP
– procedures for identifying and managing unexpected finds of contaminated or asbestos containing materials along the pipeline route and at Berth 101; – a strategy for addressing any contamination that has been encountered, if required (including the remediation and/or removal of contaminated soil or groundwater); and – details on how environmental and health risks will be mitigated and managed		– Construction Foreman		
Dredge and Excavation Management Plan that: – includes an investigation of all reasonable and feasible measures to reduce the road haulage of spoil; – describes all activities to be undertaken during dredging, excavation and disposal works; – describes in detail the location and depth of disposal areas during all stages of construction, including the final form of the emplaced material;	Schedule 3 Condition 11 (b)	– AIE HS&E Manager – Liberty Industrial Environmental Rep – Construction Foreman	Detailed description of excavation and spoil management procedures for Early Works included in Section 2.3 and Section 8	Not applicable
– includes procedures for handling, transporting, storing and disposing of dredge and excavated material, including: • potentially acid forming material; • contaminated material; and • asbestos containing materials.	Schedule 3 Condition 11 (b)	– AIE HS&E Manager – Environmental Consultant – Liberty Industrial Environmental Rep – Construction Foreman	Section 8.2 Section 8.6	Applicable
– includes a description of measures that would be implemented to: • minimise the generation and dispersion of sediments during dredging and disposal; • minimise soil erosion and discharge of sediment and other pollutants to lands and/or Port Kembla harbour • monitor and manage odours and air emissions during handling of sediments or from stored material prior to emplacement within the disposal area; and • includes contingency measures in the event of a failure of the silt curtains.	Schedule 3 Condition 11 (b)	– AIE HS&E Manager – Liberty Industrial Environmental Rep – Dredging Project Manager – Construction Foreman	Refer to CWQMP) , Dredge and Excavation Management Plan, and Air Quality Management Plan (AQMP)	Not applicable for Stage 1 (dredging and disposal not undertaken during Stage 1 Early Enabling Works)
– a Water Quality Monitoring Plan that includes:	Schedule 3 Condition 11 (c)	– AIE HS&E Manager – Liberty Industrial Environmental Rep	CWQMP	Not applicable for Stage 1 (dredging and disposal not undertaken during

Requirement	Reference	Responsibility	Evidence	Applicability to this SMP
• 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.				Stage 1 Early Enabling Works)
The Proponent must implement the approved SMP for the development.	Schedule 3 Condition 12	– AIE HS&E Manager – Liberty Industrial Project Manager	This Plan	Applicable
The Proponent : (a) must minimise the waste generated by the development	Schedule 3 Condition 36(a)	– AIE HS&E Manager – Liberty Industrial Project Manager	Section 9.1	Applicable
(b) classify all waste generated on site in accordance with the *Waste Classification Guidelines* (NSW EPA 2014), or its latest version;	Schedule 3 Condition 36(b)	– Liberty Industrial Environmental Representative	Section 9.8 Appendix B	Applicable
(c) store and handle all waste generated on site in accordance with its classification; and	Schedule 3 Condition 36(c)	– Construction Foreman	Section 9	Applicable
(d) ensure all waste is disposed of off-site at appropriately licenced facilities	Schedule 3 Condition 36(d)	– Construction Foreman	Section 8.8	Applicable
Within 3 months, unless otherwise agreed with the Planning Secretary, of: (a) the submission of an incident report under condition 5 below; (b) the submission of an audit report under condition 9 below; and (c) the approval of any modification to the conditions of this approval; or (d) a direction of the Planning Secretary under condition 4 of schedule 2;	Schedule 4 Condition 4	– AIE HS&E Manager – Liberty Industrial Project Manager – Liberty Industrial Environmental Representative	Section 1.3 Section 9.9	Applicable

Requirement	Reference	Responsibility	Evidence	Applicability to this SMP
the Proponent must review, and if necessary revise, the strategies, plans, and programs required under this approval to the satisfaction of the Planning Secretary. Where this review leads to revisions in any such document, 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.				
Incident Notification The Department must be notified in writing to compliance@planning.nsw.gov.au immediately after the Proponent becomes aware of an incident on site. The notification must identify the development, including the application number, and set out the location and nature of the incident.	IA Mod 1 Schedule 4, Condition 5	– AIE HS&E Manager – Liberty Industrial Project Manager – Liberty Industrial Environmental Representative	Section 9.7	Applicable
Non-compliance Notification The Department must be notified in writing to compliance@planning.nsw.gov.au within 7 days after the Proponent becomes aware of any non-compliance. 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.	IA Mod 1 Schedule 4, Condition 6	– AIE HS&E Manager – Liberty Industrial Project Manager – Liberty Industrial Environmental Representative	Section 9.7	Applicable
Compliance reporting The Proponent must provide regular compliance reporting 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.	IA Mod 2 Schedule 4, Condition 7	– AIE HS&E Manager – Liberty Industrial Project Manager – Liberty Industrial Environmental Representative	Section 9.9	Applicable
Regular Reporting The Proponent must provide regular reporting on the environmental performance of the development on its website in accordance with the reporting requirements in any strategies, plans or programs approved under the conditions of this approval.	IA Mod Schedule 4, Condition 8	– AIE HS&E Manager – Liberty Industrial Project Manager – Liberty Industrial Environmental Representative	Section 9.9	Applicable
Independent Environmental Audit Twelve months after the commencement of operations and every 3 years thereafter, unless the Planning Secretary directs otherwise, the Proponent must commission and pay the full cost of an Independent Environmental Audit of the development. This audit must:	IA Mod Schedule 4, Condition 9	– AIE HS&E Manager	EMS	Not applicable for Stage 1

Requirement	Reference	Responsibility	Evidence	Applicability to this SMP
(a) be conducted by a suitably qualified lead auditor and suitably qualified, experienced and independent team of experts in any field specified by the Planning Secretary, whose appointment has been endorsed by the Planning Secretary (b) include consultation with the relevant agencies (c) assess the environmental performance of the development and assess whether it is complying with the requirements in this approval, and any relevant EPL (including any assessment, plan or program required under these approvals) (d) include a comprehensive Hazard Audit of the development in accordance with the Department's publication Hazardous Industry Planning Advisory paper No. 5, 'Hazard Audit Guidelines'. This audit must also: verify that an inspection, testing and preventative maintenance program has been developed, implemented and maintained to ensure the reliability and availability of key safety critical equipment include checking of the Management of Change (MOC) records and verification that the MOC process has been implemented appropriately confirm that the operation is consistent with the information provided in the Final Hazard Analysis; and verify that certificates issued by DNV-GL for the FSRU and all equipment and systems on board are up to date (e) review the adequacy of any strategies, plans or programs required under the abovementioned approvals; and (f) recommend appropriate measures or actions to improve the environmental performance of the development, and/or any strategy, plan or program required under the abovementioned approvals; and (g) be conducted and reported to the satisfaction of the Planning Secretary.				
Access to Information From the commencement of development under this approval, the Proponent shall: – Make copies of the following information publicly available on its website: • the EIS • current statutory approvals for the development	IA Mod 1 Schedule 4, Condition 12	– AIE Project Manager. – AIE HS&E Manager	Section 1.3	Applicable

Requirement	Reference	Responsibility	Evidence	Applicability to this SMP
• approved strategies, plans or programs required under the conditions of this approval • a comprehensive summary of the monitoring results of the development, reported in accordance with the specifications in any conditions of this approval, or any approved plans and programs • a summary of complaints, which is to be updated monthly • any independent environmental audit, and the Proponent's response to the recommendations in any audit • any other matter required by the Planning Secretary and • keep this information up to date.				

Notes:

The objectives related to Emplacement cell within Schedule 3, Sections 8 and 11 are addressed in the Emplacement cell Report

The Emergency Spill plan (so-called SOPEP) covers in details oil related pollution and handling. This is covered in a separate document and is available online on AIE's website.

5.1 Guidelines for management of spoil

The framework for the management of spoil for the Project was developed with reference to guidelines listed below, with detailed assessment criteria included in Section 7 of the RWP (Appendix B).

5.1.1 National Environmental Protection (Assessment of site Contamination) Measure 1999 (as amended 2013) (NEPC, 2013)

The *National Environment Protection (Assessment of Site Contamination) Measure 1999* (referred to here as the NEPM) was produced by the federal National Environmental Protection Council (NEPC) in 1999 and was revised and updated in 2013 by way of the National Environmental Protection (Assessment of site Contamination) Amendment Measure 2013 (NEPC, 2013). The amended NEPM is still referred to as the NEPM 1999. The NEPM provides a national framework for conducting assessments of contaminated sites in Australia.

The purpose of the NEPM is to "*establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry."*

The desired environmental outcome for this NEPM is "*to provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination."*

The NEPM addresses assessment of contamination and does not provide specific guidance for remediation or management of risk, although principles for remediation and management of contaminated sites are presented in Volume 1 of the NEPM, as discussed in Section 9.2 of the RWP (Appendix B).

The NEPM includes two Schedules:

– Schedule A comprises a flowchart of the recommended general process for the assessment of site contamination and its relationship to the management of site contamination.
– Schedule B consists of technical guidelines about site assessment criteria, site investigation procedures, laboratory analyses, human health risk assessment, ecological risk assessment, derivation of investigation levels, groundwater risk assessment, community engagement and risk consultation and competencies and acceptance of environmental auditors and related professionals.

In broad terms, the assessment process can be described as:

– Tier 1 Preliminary investigation, laboratory analysis and interpretation, development of a conceptual site model (CSM) and assessment of results with reference to investigations or screening levels. The need for risk-based remediation assessment to derive response levels and/or the need for remediation is evaluated.
– Where required, Tier 1, Tier 2 or 3 Detailed investigation/Site specific risk assessment, laboratory analysis and interpretation are completed, and the requirement for remediation is evaluated.

5.1.2 State guidelines

NSW has a comprehensive suite of guidelines relating to assessment and management of contamination, administered by the EPA under the *Contaminated Land Management Act 1997* (CLM Act) and the POEO Act. These include the following:

- NSW EPA (1995), Contaminated Sites: Sampling Design Guidelines (NSW EPA, 1995).
- NSW EPA (2020), Consultants reporting on contaminated land – Contaminated land guidelines (NSW EPA, 2020).
- NSW EPA (2017), Contaminated Sites: Guidelines for NSW Site Auditor Scheme (3rd ed.) (NSW EPA, 2017).
- NSW EPA (2014a). Waste Classification Guidelines Part 1: Classification of Waste (NSW EPA, 2014a).
- NSW EPA (2014b). Waste Classification Guidelines Part 4: Acid sulfate soils (NSW EPA, 2014b).

Guidelines approved under the CLM Act also include:

- National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended 2013 (NEPC, 2013).
- Australian and New Zealand - Toxicant Default Guideline Values for Sediment Quality (ANZG, 2018a).
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Canberra ACT, Australia and New Zealand Governments and Australian state and territory governments (ANZG, 2018b).
- Friebel, E and Nadebaum, P (2011). Health screening levels for petroleum hydrocarbons in soil and Groundwater. CRC CARE Technical Report no. 10. CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia, 2011. (Friebel & Nadebaum, 2011).

Other guidelines used in the framework for assessment of asbestos contamination include:

- Western Australian Department of Health (WA DoH) Guidelines for Remediation and Management of Asbestos Contaminated Sites in Western Australia (WA DoH, 2009).
- Work Health and Safety Act and asbestos removal regulations and code of practice.

AIE and its appointed contractor, Liberty Industrial, have a legal obligation under the *Work Health and Safety (National Uniform Legislation) Act 2011*, (WHS Act) and prescribed in the Work Health and Safety (National Uniform Legislation) Regulations 2017, to ensure the work health and safety of its workers, subcontractors and visitors.

As there is a potential for asbestos to be encountered within fill or as subsurface structures at the site, the primary legislative requirements detailing AIE's obligations regarding the presence of asbestos (if it is encountered) on the site are listed as follows:

– WHS Act.
– Work Health and Safety Regulations 2017 (NSW).
– How to Manage and Control Asbestos in the Workplace, 2019 SafeWork NSW (SafeWork NSW, 2019a).
– How to Safely Remove Asbestos, 2019 SafeWork NSW (SafeWork NSW, 2019b).

6. Summary of site conditions

The following summary is based on information from the previous GHD investigations (GHD, 2018a), (GHD, 2021a) and (GHD, 2021b). Reference should be made to these reports for more detailed information including aerial photographs and site photographs.

6.1 Site identification

The site for the Early Enabling Works is shown in Figure 2.2.The MBD Site Compound is bounded by the PKCT to the north and the shoreline and breakwater to the south. Existing Berth 101 is on the western side of the site. Seawall Road along the eastern shore currently allows public access.

The Emplacement Cell Construction site is shown in Figure 2.2 and Figure 2.4. The Emplacement Cell site is located to the south across the Port Kembla harbour from the MBD Site Compound. Old Port Road provides access to the Emplacement Cell site.

Site identification details and surrounding land uses are summarised in Table 6.1 and Table 6.2.

Table 6.1 Site identification details (MBD Site Compound)

Address:	Berth 101 and Bulk Product Area, Port Kembla, NSW
Site co-ordinates:	307013 m E; 6184616 m N (southern point of excavation area)
Title identification:	Part Lot 22 DP 1128396
Approximate area:	Approx. 10ha
Current owner	NSW Ports
Zoning:	SP1 – Special Activities SEPP (Three Ports) 2013
Local government area:	Wollongong
County / Parish :	Camden / Wollongong
Current land use:	Industrial – Ports
Adjoining land uses:	Industrial including coal terminal

Table 6.2 Site identification details (Emplacement Cell Construction Site)

Address:	Emplacement Cell Construction Site, Port Kembla, NSW
Site co-ordinates:	307687 m E, 6183129 m N (middle point of Emplacement Cell)
Title identification:	Lot 6 DP 1236743
Approximate area:	Approx. 17 ha
Current owner	NSW Ports
Zoning:	IN3 – Heavy Industrial SEPP (Three Ports) 2013
Local government area:	Wollongong
County / Parish:	Camden / Wollongong
Current land use:	Industrial
Adjoining land uses:	Industrial

6.2 Port Kembla Chart Datum and tidal fluctuations

The Australian Tides Manual Special Publication No 9 Version 5 (ICSM, 2018) summarises the various datums used around Australia to predict tidal behaviour. An understanding of the tidal terminology is required when comparing chart datums, tidal effects on ASS and the potential for acid production. Table 6.3 provides a definition of the relevant terminology and gives the average limits observed at Port Kembla, and Figure 6.1 shows the tidal variation at Port Kembla from 1957 to 2020 (Fox Environmental Consulting, 2020).

Table 6.3 Explanation of terms and datums used in Australian ports

Term	Purpose	Definition[1]	Port Kembla
Highest Astronomical Tide (HAT)	Landward limit of the tidal interface.	The highest level of water which can be predicted to occur under any combination of astronomical conditions.	2.33m CD (+1.458m AHD)[2]
Lowest Astronomical Tide (LAT)	Baseline for the purposes of defining Australia's maritime boundaries.	The lowest tide level which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions.	-0.0217m CD (-0.655 m AHD)
Mean High Water (MHW)	Common datum for cadastral mapping and common limit for topographic mapping.	The average of all high waters observed	~1.80m CD (+1.458m AHD)[2]
Mean Sea Level	Average limit of tides	Arithmetic mean of hourly heights of sea over a sufficient period of time	~0.910m CD (0.0m AHD)[3,4]
Mean Low Water (MLW)	Used as the limit of Australian States As definition of 'low water'	Arithmetic mean of all low water heights of sea over a sufficient period of time	~0.20m CD (-0.655m AHD)[2]
Australian Height Datum (AHD)	National vertical Datum of Australia and refers to Australian Height Datum 71 for Australian Mainland	AHD71 is a surface that passes through approximate MSL measured between 1966 and 1968 at 30 tide gauges around the Australian mainland	0.0mAHD (0.872m CD)[3,4]
Chart Datum (CD)	Local Port Kembla Sea Level Datum	In use since at least 1957	0.0m CD (-0.872m AHD)[3,4]

Table notes:

[1] Definitions taken from Australian Tides manual v5 (ICSM, 2018)

[2] Mean High Water and Mean Low Water taken from monthly recorded sea levels for Port Kembla - 1957 to 2020 http://www.bom.gov.au/ntc/IDO70000/IDO70000_60420_SLD.shtml

[3] Chart Datum from http://www.bom.gov.au/oceanography/Projects/abslmp/data/data.shtml

[4] MSL at Port Kembla also given as 0.910m CD on http://www.bom.gov.au/ntc/IDO70000/IDO70000_60420_SLD.shtml

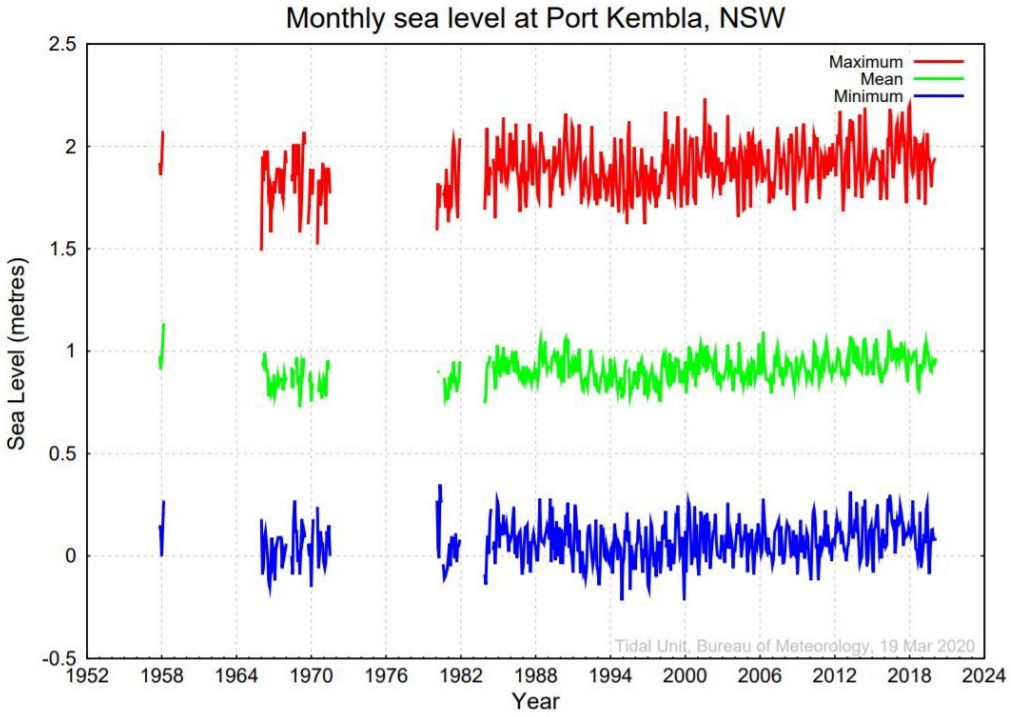

Figure 6.1: Monthly Tidal Range in LAT Port Kembla Harbour (source: Bureau of Meteorology (BoM) website)

6.3 Sensitive environments

Port Kembla Inner Harbour is located immediately west of the site. Port Kembla Outer Harbour is located immediately south-east of the site.

The Inner and Outer Harbours are highly modified and industrial settings receiving stormwater runoff and waste discharge from neighbouring industries. Prior to 1955, the Inner Harbour was previously Tom Thumbs Lagoon, a remnant saline coastal lagoon, which has been progressively reclaimed by the Port Kembla Steelworks. Originally 500 ha in area, the lagoon is now 50 ha (GHD, 2018a).

The Tasman Sea is located approximately 250 metres east of the site.

6.4 Topography and drainage

Google Earth Pro indicates the site lies at an elevation between 3 metres and 5 metres AHD. The elevation of previous investigation locations was surveyed by a registered survey and was recorded between 4.073 metres and 6.708 metres AHD (GHD, 2018a).

Information obtained from Google Earth Pro indicates that the berth gently slopes down towards the south and west.

Surface water is generally directed to the PKCT stormwater system, which includes a number of settlement ponds; one of which is located immediately south-east of Berth 101, the southern pond. It is expected in high rainfall events that surface water will flow directly into the harbour.

6.5 Soil landscape

The Wollongong-Port Hacking 1:100 000 Soil Landscape Series Sheet 9029-9129 (Soil Conservation Service of NSW, 1990) indicates the site is situated within a disturbed terrain soil landscape, which is described as:

– Disturbed terrain:
  - The topography varies from level plains to undulating terrain and has been disturbed by human activity to a depth of at least 100 centimetres. The original soil has been removed, greatly disturbed or buried. Most

of these areas have been levelled to slopes of<5 per cent. Landfill includes soil, rock, building and waste material. The original vegetation has been completely cleared.

- Limitations are dependent on nature of fill material and include subsidence resulting in a mass movement hazard, soil impermeability leading to poor drainage, and low fertility. Care must be taken when these sites are developed. A survey at a suitable scale as well as geotechnical analysis should be undertaken because of variability of materials throughout the sites. Seek advice from local councils concerning localised areas of disturbed terrain.

The ASS Risk Map (DLWC, 1997) indicates that the Berth (in red outline) is situated in an area mapped as disturbed terrain at an elevation of >4 metres (shown in grey shading) in Figure 6.2. Estuarine sediments exist within the harbour and are mapped as high probability of ASS.

Low risk ASS was identified in probable reclaimed sands and alluvial / tidal sands encountered at depths between 0 metres and 25 metres below ground surface (bgl). The probable reclaimed sands had pockets and lenses of high risk ASS. Estuarine material encountered at depths between 0.4 metres and 25 metres bgl, typically below the alluvium, was assessed as high risk ASS.

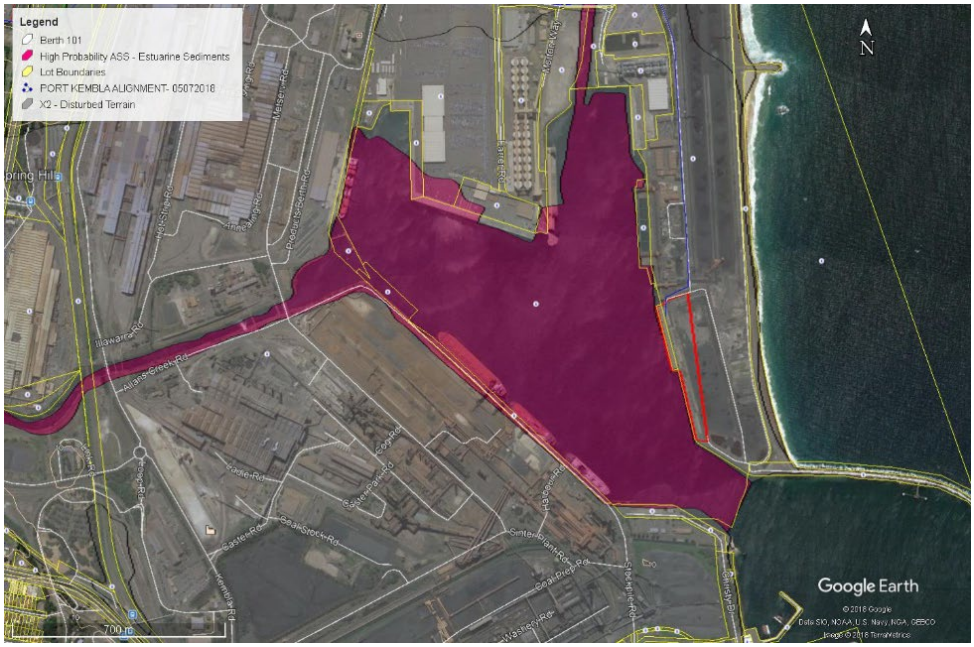

Figure 6.2: ASS risk map (DLWC, 1997)

6.6 Geology

6.6.1 Regional geology

The 1:100,000 Geological Series Sheet of Wollongong-Port Hacking (Geological Survey of NSW, 1985) indicates that the regional underlying geology is Quaternary sediments described as quartz and lithic fluvial sand, silt, and clay. The Quaternary sediments are likely to be underlain by the Budgong Sandstone which is described as red, brown, and grey lithic sandstone.

6.6.2 Site specific geology

Fill was encountered at all previous investigation locations up to 5.5 metres depth, typically comprising gravelly sand and sandy gravel (Fill) overlying sand (probable reclaimed sand –Unit 1A/1B) (refer to Table 6.3). Natural sands, assumed to be likely alluvium, were encountered from 3.2 metres, graduating to finer alluvial deposits (silts and clays) to the maximum depth of investigation (GHD, 2018a).

The Worley Parsons geotechnical investigation extended below GHD's target investigation depths and encountered residual deposits of sandy clay and clay which were logged from 12 metres to 29.7 metres bgl.

Bedrock is understood to have been encountered at the geotechnical boreholes from a depth of 17.6 metres to 29.5 metres.

The Fill and Unit 1A/1B materials encountered during the GHD 2018 investigation are summarised in Table 6.4. Some variability was observed in the fill unit, however, the material encountered in Unit 1 was reasonably consistent across the site.

Table 6.4 Generalised material descriptions for Fill and Unit 1

Stratigraphic Unit	Generalised description	Corresponding Stratigraphic Unit
Fill	Gravelly sand, sand, silt, black, dark brown, grey, some to trace, silts and cobbles. Foreign materials, coalwash, coal, slag, steel, wood, concrete.	Fill
Probable Reclaimed Sands	SAND, brown, pale brown, yellow, orange, fine to coarse grained, trace amounts of shell fragments, fine to coarse gravel, silt bands and layers, clayey sand layers, trace iron stained sand, fine black sand layers (probable heavy mineral sands), rounded to sub-rounded gravel, clay lenses and layers. Foreign materials: charcoal, wood and coal.	1A / 1B This was categorised as 'Fill Unit 2' in the GHD 2018 investigation but has since been reassigned as Unit 1
	Clayey SAND, black, dark grey, grey, fine to coarse grained sand, medium to high plasticity clay, trace silt, shell fragments, gravel.	1B
	Gravelly CLAY, black, dark grey, grey, low to medium plasticity, fine to coarse grained angular to sub-angular gravel, trace of fine to coarse grained sand.	1B
Possible Alluvium / Tidal Sands	SAND, brown, pale brown, yellow, orange, fine to coarse grained, trace amounts of shell fragments, fine to coarse gravel, silt bands and layers, clayey sand layers, trace iron stained sand, fine black sand layers (probable heavy mineral sands), rounded to sub-rounded gravel, clay lenses and layers.	1A

6.7 Hydrogeology

6.7.1 WaterNSW database

A Lotsearch report (Lotsearch, 2020) indicates there are six registered groundwater bores east of the site, five of which are in Part Lot 22 as shown in Figure 6.3. The bores were registered for monitoring purposes and installed in 2011 and 2012 to depths between 6 metres and 7.5 metres bgl. No information on salinity, standing water level, or yield was recorded. The locations of these monitoring bores are generally consistent with those installed by Douglas Partners, except for GW112710 and Douglas Partners monitoring well 205 (Douglas Partners, 2014) Monitoring well 205 is located south-west of GW1127709 but does not appear to be registered.

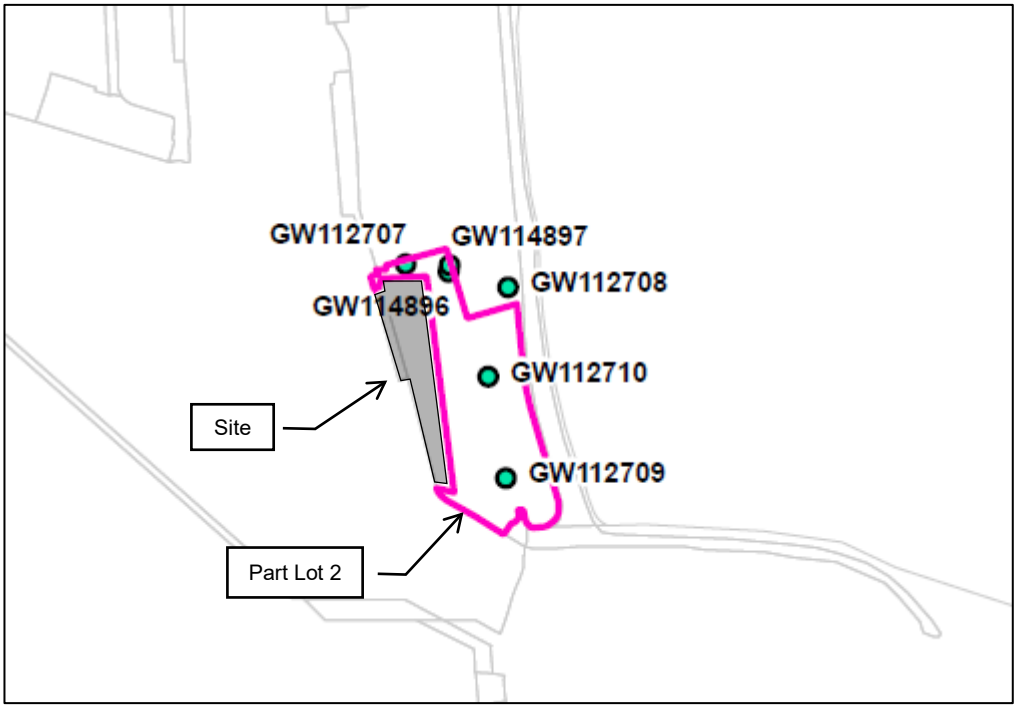

Figure 6.3: Registered groundwater bores (Lotsearch, 2020)

6.7.2 Site specific

Groundwater inflows were encountered in all boreholes, except GBH34 and GBH36, at depths between about 3.7 metres and 5.0 metres bgl. GBH36 refused at 0.15 metres bgl. Six groundwater monitoring wells (MW2, MW3, MW6, 201, 204, 205) were installed on-site as part of previous investigations undertaken by Douglas Partners in 2011 and more recently by GHD in 2018. Groundwater was measured at depths between 4.01 metres and 4.90 metres bgl on 18 October 2018.

No hydrocarbon odours were noted in groundwater during drilling or sampling at any of the wells. No evidence of non-aqueous phase liquid (NAPL) was observed during groundwater sampling. No odours or sheens were noted on the surface of the groundwater from monitoring wells during purging and sampling for the remaining locations.

Douglas Partners (2014) stated that groundwater flow direction was towards the south-west, that is, towards the Inner Harbour. However, it was further stated that groundwater flow direction was unlikely to be homogeneous across the site due to water bodies along three sides, various filling material and tidal influences. These factors were considered to form localised flow patterns.

6.8 Climate information

The closest weather stations to the site are:

– Port Kembla (BSL Central Lab) (Station No. 68131, Lat: 34.47° S, Lon: 150.88° E, Elevation: 9 metres) for rainfall.
– Bellambi Automatic Weather Station (AWS) (Station No. 68228, Lat: 34.37° S, Lon: 150.93° E, Elevation: 10 metres) for temperature.

The Port Kembla station is approximately 1.9 kilometres south-west of the site, whilst Bellambi station is approximately 10.5 kilometres north-east of the site.

Table 6.5 provides a summary of annual mean for temperature and rainfall. No information was available on evaporation and wind.

Table 6.5 Summary of annual climate statistics

Climate data	Data range	Minimum	Maximum	Mean	Median
Rainfall (mm)	1963 to 2020	406.1	1847.1	1096.9	1057.9
Average daily temperature (°C)	1997 to 2020	20.8	22.1	21.4	21.4
Wind speed (km/h)	1997 to 2020	-	141	13	-

6.9 Site conditions

Site conditions were described in GHD (2021,a) and were based on observations during fieldworks conducted between October and December 2020.

The area was previously investigated by GHD in 2018 (GHD, 2018a) and is approximately 3.3 ha in area. The area incorporates Berth 101 and the area immediately to the south, and a section of the Western Bulk Stockyard, as shown on Figure 6.4. The site is not currently in use. There is no permanent vegetation or trees in the investigation area, only small patches of grasses and weeds. The area does not appear to have substantially changed since the 2018 investigation (GHD, 2018a).

An electrical substation was seen on the western side of the site, at the southern end of the berth. This area was largely fenced off with brick structures built around some areas. The substation was in relatively good condition with no leaks or damage observed. Anthropogenic material was observed generally scattered across the whole site, including slag, steel, plastic and wood.

Several services are present within the site including an above ground water pipe which was observed on the western side, positioned in a north-south direction. A buried low pressure oil pipeline was also present along a similar alignment running to the west of the water pipe. An asbestos water pipe is located east of the substation and shown as a green line on Figure 6.4 below. In 2018, two fragments of suspected ACM were identified on the surface near the substation and removed for assessment. No suspected ACM was observed, here or elsewhere on the site during the 2020 investigation.

Two large stockpiles, approximately 700 metres^3 to 800 metres^3 of mixed sandy gravel material were observed in the south-western section of the site. Slag gravel, cobbles, concrete and boulders were seen mixed with this stockpiled material. The stockpiles were partially covered with vegetation.

In 2018, coal stockpiling was occurring in the southern end of the investigation area, during the GHD (2021b) investigation, no remnant coal stockpiles, or evidence of ongoing stockpiling activities were observed.

Large industrial equipment and plant including coal loaders were observed on paved areas in the east of the site, on the western side of the Western Bulk Stockyard.

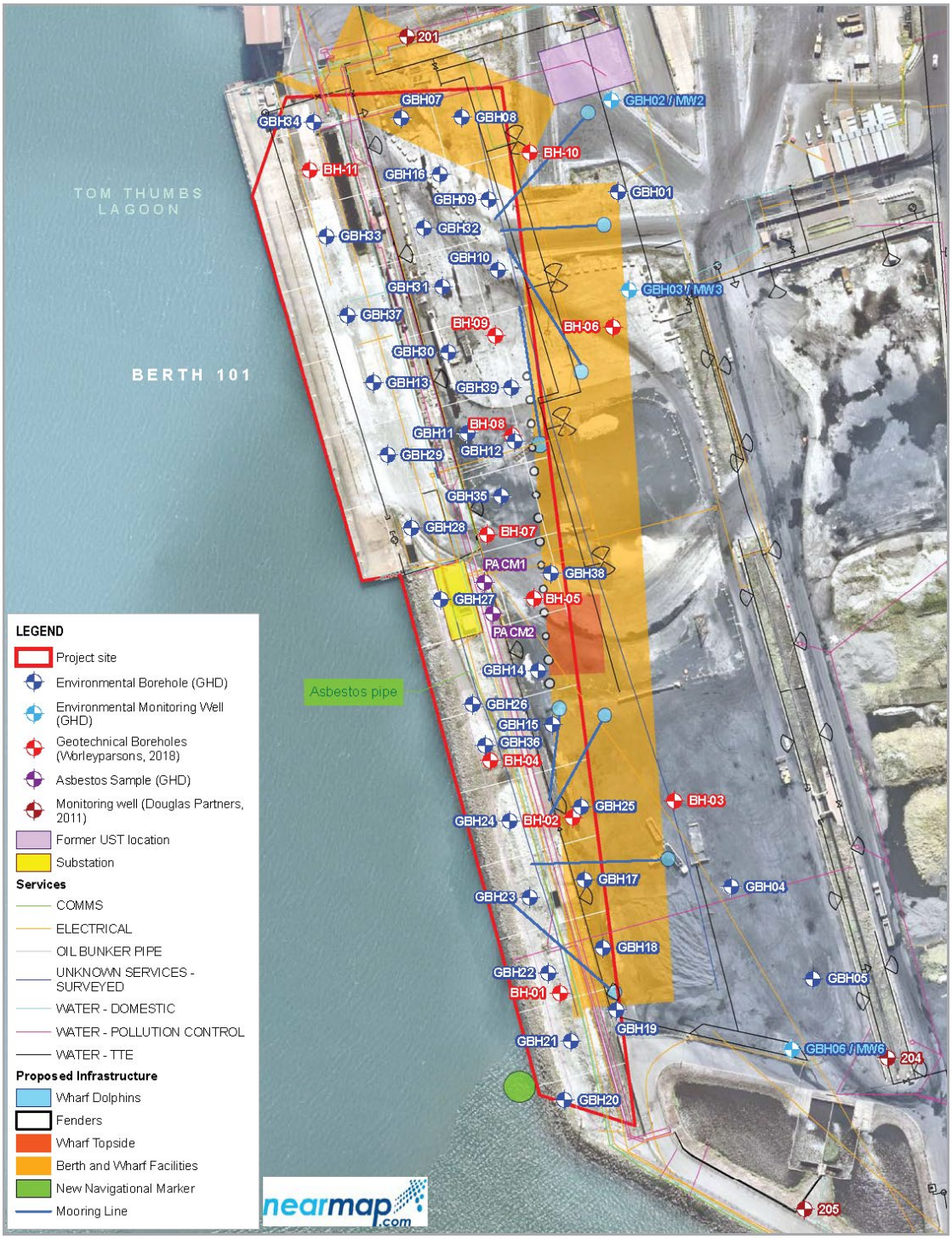

Figure 6.4 Approximate Sampling Locations from 2018 investigations

7. Site contamination status

The following review of the site contamination status is based on the results from GHD (2018a), (2021a) and (2021b). Further details of contamination investigations completed for the site are included in the RWP (Appendix B).

7.1 Soils

Based on the review of all previous investigations at the site, the following areas were identified as potentially posing a risk to human health and/or the environment for redevelopment of the site without appropriate remediation and/or management to reduce the risk of potential impacts to sensitive health and ecological receptors to allow for continued commercial/industrial land use:

– Identified hotspots:
  - GBH09 – BaP and Total recoverable hydrocarbons (TRH) above Health Investigation Level (HIL)/Health Screening Levels (HSL)D. Following additional investigations, delineated vertically and in all directions and deemed to be localised.
  - GBH26 - BaP and TRH above HIL/HSL D. Following additional investigations, the lateral extent for GBH26 is unknown in the eastern and western directions.
– Substation:
  - PCB concentrations above Default Guideline Values (DGVs) in surface soils. Depth of investigations limited, not delineated vertically.
– Fill across the site:
  - One location within Berth 101 area (GBH13A) was identified with elevated BaP TEQ above the HIL-D and not vertically delineated and some odorous and discoloured soils were identified with a potential for unidentified hotspots of contamination to exist. Further, on the western side of conveyor No. 7. fill was noted to contain coal, concrete timber and slag.
– Subsurface structures / services:
  - Existing subsurface oil pipeline and ACM water pipe identified on site and ACM building materials on site (substation)
– Stockpiles
  - Two large stockpiles with a potential to contain contaminated materials.

7.2 Groundwater

Previous investigations have indicated elevated concentrations of arsenic, copper, mercury, lead, nickel, zinc and ammonia across the site indicating some potential impact to groundwater from former site operation and fill materials on site. However, the groundwater conditions at the site are not considered to represent significant impacts to environmentally sensitive receptors and, at this stage, do not require specific remediation or management for continued commercial/industrial land use. It is expected that levels of contaminants in groundwater will attenuate over time with the planned demolition and excavation of fill materials on the site.

Continuation of the groundwater monitoring program throughout the demolition and post demolition period would increase the groundwater data set with the ability to further investigate anomalous results and analyse trends in groundwater characteristics and chemistry.

GHD recommends two groundwater monitoring events to occur during site demolition Early Enabling Works as follows:

– Initial event – prior to commencement of site remediation works.
– Second event – following completion of site remediation.

Samples would be collected from the existing monitoring wells (where available) using GHD's standard field operating procedures (as per GHD (2018a) and (2021a)) and will be analysed for the previously identified contaminants of concern including field parameters, heavy metals, TRH, Benzene, toluene, ethyl benzene and xylenes plus naphthalene (BTEXN), Polycyclic aromatic hydrocarbons (PAH) and ammonia.

7.3 Data gaps

The following data gaps are required to be investigated prior to or as part of the proposed demolition Early Enabling Works.

7.3.1 Above and below ground infrastructure

The presence of remaining infrastructure both above and below ground has prevented investigation of soils in areas of remaining infrastructure, and it was recommended that intrusive investigations are conducted once these are demolished/removed. As investigations are proposed to be conducted concurrent with demolition/remediation works, allowance should be made for contingencies as the presence and/or extent of contaminated materials is unknown at this stage and cannot be detailed in the RWP (Appendix B).

The objectives for the additional investigations are to collect data from where spatial data gaps exist across the site, so that sufficient information can be obtained to confirm site conditions and inform preliminary decisions regarding segregation / characterisation of materials and the suitability for re-use (i.e., contaminated soils will be removed regardless of contamination either in demolition stage or as part of the subsequent bulk excavation).

7.3.2 Excavated fill

As the presence of unidentified contaminated fill materials in investigation areas of the site cannot be discounted, it is recommended that excavation of the fill to the required levels is supervised by the environmental consultants with unexpected finds protocols in place. Materials displaying distinct odours, unusual colour changes or containing suspected contaminated fill materials (ACM, extensive slag or coke, etc.) should be segregated and analysed as required prior to a decision made for re-use or disposal off site.

7.3.3 Stockpiles

As the presence of contaminated materials within the large fill stockpiles in the south western portion of site cannot be discounted, it is recommended that these materials are visually characterised with suspected contaminated materials segregated and analysed as required prior to a decision made for re-use or disposal off site.

7.3.4 Waste classification

During remediation works, any soils segregated and proposed for disposal off-site must be classified in accordance with the *Waste Classification Guidelines Part 1: Classifying Waste* (NSW EPA, 2021a) and *Waste Classification Guidelines Part 4: Acid Sulfate Soils* (NSW EPA, 2014b).

7.4 Updated conceptual site model

A CSM is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The development of a CSM is an essential part of all site assessments and provides the framework for identifying contamination sources and how potential receptors may be exposed to contamination.

7.4.1 Potential sources

Based on the previous investigations, the following areas of environmental concern were identified and associated with the following activities and potential sources of contamination:

– Fill – used in the construction of Berth 101 and adjoining areas including identified hot spots of contamination (GBH09 and GBH26). Contaminants of concern include TRH, BTEX, PAH and heavy metals.

– Electrical substation – presence of Polychlorinated Biphenyl (PCB) contaminated soils beneath and surrounding the structure. ACM contained within building materials including wall /ceiling linings and conduits. Contaminants of concern include TRH, PCBs and ACM.
– Buried oil pipeline and ACM water pipeline – potential for spill and leaks from oil pipeline and transfer of ACM to soils through pipe wear and tear and damage. Contaminants of concern include TRH and ACM.
– Stockpiles – Two large stockpiles of fill materials with identified slag gravels that may contain contaminated materials.

7.4.2 Potential exposure pathways

The primary exposure pathways by which potential receptors could be exposed to the Contaminant of Potential Concern (CoPC) are considered to be:

– Direct contact with contaminated soil or groundwater.
– Inhalation of dust from contaminated soils.
– Inhalation of vapours/gases generated by contaminated soil.

7.4.3 Potential receptors

The key receptors of interest include:

– Future site workers and users:
  - Site workers involved in the demolition and remediation works at the site in which the impacted material is disturbed.
  - Individuals involved in potential future construction and maintenance of the site. Intrusive maintenance workers: carrying out repairs or installation on subsurface utilities. It is expected that minor excavation activity could occur in the future (e.g., for installation of additional services).
– Marine ecological receptors: The primary ecological receptor of any identified contamination is considered to be marine aquatic ecosystems of the Inner and Outer Harbour. The Inner and Outer Harbours are highly modified industrial settings receiving stormwater runoff and waste discharge from neighbouring industries.

7.5 Source-pathway-receptor (SPR) linkages

Initial receptors are considered to be site workers involved with earth works associated with demolition and excavation activities, that is, those coming into direct contact with soil or potentially hazardous materials. Earthworks are to involve shallow to deep excavations across the site to achieve required construction levels or to remove identified contamination, stockpile management, including stockpiled materials which have been identified as unsuitable for placement in the OHDSCA. This exposure scenario provides an increase likelihood that workers will be in direct contact with soil and exposed to dust via inhalation generated during excavation and stockpiling. Therefore, the SPR linkages could be complete.

Based on results of the previous investigation, vapours and gases have not been identified as exposure pathways. Therefore, the SPR linkages are assessed incomplete for vapour inhalation as this form of contamination has not been identified.

Based on review of the potential SPR linkages, the proposed development may provide direct contact/ingestion exposure pathways to contamination, if present, to workers involved in remediation of impacted soils and to aquatic ecosystems.

It is considered that the potential for the identified SPR linkages to workers to be complete following demolition / remediation will be significantly reduced.

7.6 Emplacement Cell Construction Site

Approximately 50,000 cubic metres of spoil will be stockpiled at the Emplacement Cell Construction Site. An existing 90,000 cubic metre stockpile is located on the site which is comprised primarily of rocky sandstone material sourced from the construction of the GPT retail centre in Wollongong in 2012. NSW Ports have provided

copies of historical documentation classifying the material as Virgin Excavated Natural Material, although it is noted that site observations suggest construction materials such as concrete, timber and plastic may have also been placed there during the later stages of stockpiling.

AIE are currently undertaking further geotechnical and contamination analysis to confirm the suitability of the stockpile for reuse as part of the project and confirm the contamination status of the stockpile and the broader Emplacement Cell Construction Site.

All applicable spoil management and stockpiling procedures in Section 8 and 9 of this plan will be applied at the Emplacement Cell Construction Site and a detailed erosion and sediment control plan will be prepared and submitted to DPI&E one month prior to transport of material.

8. Spoil management

This section provides a description of the steps and procedures required to protect health, safety and the environment during the enabling works phase of the Project. The procedures have been developed as part of the detailed RWP included in Appendix B.

8.1 Site mobilisation for Early Enabling Works

Management of the site mobilisation process is to be included in Liberty Industrial's work plans including the following:

– Site access and security – Liberty Industrial will be responsible for ensuring the security of all work areas and all plant and equipment maintained on-site during remediation works. This includes signage, control of site access (authorised personnel and vehicles only) and safety inductions and documentation.
– Plant re-fuelling/maintenance/cleaning - Liberty Industrial will be responsible for designating locations/areas for equipment refuelling, maintenance, and cleaning activities undertaken during the site works (as required) and to ensure all vehicles leaving the site are free of any contaminated material. No refuelling or maintenance activities outside of these areas shall be undertaken without specific approval from the AIE Project Manager.
– Traffic control - Liberty Industrial will be responsible for ensuring adequate traffic control measures are in place to ensure site safety and take into consideration the entry and egress of vehicles from the main site entrance in accordance with the Construction Traffic Management Plan (CTMP).
– Environmental controls - Liberty Industrial will be responsible for installing and maintaining environmental controls consistent with relevant management plans.

8.2 Site demolition

As described in Section 2.3, the remaining above and below ground infrastructure within the excavation zone is required to be demolished.

8.2.1 Asbestos building materials

Asbestos is likely to be present at the following locations:

– Wall and ceiling linings and conduit within Substation B.
– Subsurface pipework containing asbestos associated with the water supply along the western shoreline.

Prior to demolition, site structures will be surveyed for asbestos and other hazardous building materials. Asbestos and other hazardous building materials will be removed in structures where it has been identified. An inspection will be undertaken, and clearance certificate provided by an appropriately licenced asbestos assessor (LAA) confirming appropriate removal has occurred. Once a clearance certificate has been issued, and an Asbestos Management Plan (AMP) has been prepared, then demolition will be allowed to proceed.

With respect to any known or potential asbestos building material, the planning of demolition works associated with any asset needs to be undertaken carefully and in accordance with the relevant legislation and guidelines. It should include consideration of the following:

– Requirements of an overarching AMP or similar.
– Recognition that any identified asbestos building material is the minimum amount of asbestos material that may be present.
– Subsequent recognition that the scope and limitations of prior building material survey(s) may result in additional unidentified asbestos materials being present. This may require works to address known information gaps including:
    - Additional surveying and assuming that asbestos building material may be present in areas not previously accessed.

- Completing an asbestos building material risk analysis and incorporating suitable provisions into contract/specifications.
- Potential for Liberty Industrial to undertake their own independent asbestos building material survey (may use existing information) for additional assurance.

It is recommended that demolition works are undertaken in close consultation and under the supervision of an experienced environmental consultant to ensure that appropriate contamination control measures and validation requirements are completed in accordance with guidelines and legislation. During building demolition, an LAA should also be present.

If suspected asbestos materials are encountered during demolition and excavations that were not previously identified, it is recommended that Liberty Industrial undertake additional precautionary testing. In particular, the following testing should be included:

– Any fibrous or otherwise suspect cement building materials (with particular reference to buried debris or moulded fibre cement pipework) observed on the site, should be treated as ACM or sampled and analysed for asbestos fibres.
– Any bituminous water proofing membranes or similar should be treated as ACM or sampled and analysed for asbestos fibres.
– Any other material suspected of being a hazard to health should be sampled and analysed prior to continuing with demolition activity.

Cross trenching (e.g., perpendicular to suspected pipe/underground service alignment) will be completed in areas where subsurface pipes and other infrastructure are known to have been located, with reference to historical site layout plans and drawings to ensure all pipes/infrastructure has been located and subsequently removed. Validation sampling will be undertaken within areas of previous subsurface pipes or infrastructure containing asbestos to assess underlying soils for contamination.

8.2.2 Asbestos clearance and validation

Asbestos clearance works will include the steps outlined in Table 8.1.

Table 8.1 Asbestos remediation responsibilities

Activity	Responsibility
Full site inspection/clearance following demolition of infrastructure (Substation B) and trenching to remove underground pipes with full time supervision from the independent environmental consultant. These works will include sampling of soils from beneath pipes and structures containing ACM (refer to Section 8.4). The Contractor shall provide detailed procedures for removal of underground pipes for review by AIE and the environmental consultant, prior to commencing remediation or subsurface demolition activities.	AIE Environmental Representative Liberty Industrial Project Manager
Should the site inspection/validation indicate ACM remains following demolition, the asbestos removal contractor will be required to emu pick any affected areas to remove visible fragments of ACM in consultation with the Environmental Consultant. A systematic approach should be adopted whereby picking personnel should be spaced no more than one metre apart and walk a series of traverse lines in a grid pattern with a minimum of three passes across the site. If fragments are partially buried, surface raking of the top 100 mm should be undertaken to disturb the sub-surface soils and remove any partially buried fragments. Visual assessment of raked surface to be undertaken in consultation with the Environmental Consultant.	AIE Environmental Representative Liberty Industrial Project Manager

Activity	Responsibility
Transport recovered asbestos material by licensed waste transporter, to an appropriately licensed site for disposal.	AIE Environmental Representative Liberty Industrial Project Manager

Note: * A licenced bonded asbestos removal contractor (AS-B) would be required for this works, however the contractor should also be licenced for friable asbestos removal (AS-A) in case friable asbestos should be encountered during the remediation works.

8.2.3 Materials handing

Materials generated as a result of the demolition/removal activities of above and below ground structures during the Early Enabling Works will be segregated according to the following:

– Suitability for recycling (e.g., structural steel, reinforcing rebar).
– Suitability for re-use (e.g., concrete, including materials that require processing including downsizing).
– Disposal off-site of unsuitable materials as in accordance with NSW EPA (2014a and/or 2014b).

Temporary storage of demolition debris/other waste materials and recyclable metals will occur on-site at the southern end of the East Stockyard. Storage areas shall be established by Liberty Industrial within the allowable working areas.

Liberty Industrial will implement measures to control dust caused by the demolition works in accordance with the AQMP.

8.3 Demolition of hardstand

Following demolition of above ground structures, further removal of concrete slabs and paving, concrete foundations/footings and extraction of piles will occur as applicable to suit the construction of the new wharf.

The hardstand area is constructed of 300 millimetres of heavily bound base course (road building material), 340 millimetres lightly bound base course (80% blast furnace slag and 20% granulated blast furnace slag) and 200 millimetres of engineered fill.

As above (Section 8.2.3), materials will be segregated based on existing data or additional characterisation for either recycling, re-use or disposal off site.

8.4 Additional investigation/validation

As described in Section 7, soils beneath the above and below ground infrastructure require investigation following demolition/removal. The data from the investigations will inform decisions regarding site status and segregation/characterisation of materials with regard to re-use on site or disposal off-site. Given the extent of investigations undertaken at the site to date, sample locations will be based on a judgemental sampling pattern, with samples collected from within the footprint of the former infrastructure or trench from disused pipelines. These works will be undertaken following site demolition and in conjunction with any other identified remediation requirements.

The analyses are based on contaminants of concern identified in previous investigations and experience with other similar sites. Investigations will be undertaken in accordance with the sampling and analysis plan summarised in Table 8.2, which may be revised during the site works in consultation with the Site Auditor and approval from AIE.

Table 8.2 SAQP – Additional investigations/validation

Area	No. of locations	Target depth (m)	Parameters	No. of analyses
Substation building				
Building footprint (approx. 225 m^2)	5	3.0 m	PCBs	5
ACM conduit	Unknown 1 per 10 LM (min 3)	Trench base	Asbestos (3)	TBC
Oil pipeline				
Pipework validation Est. 280 lineal metres (LM)	28 1 per 10 LM	Trench base	TRH/Metals (1)	28
ACM water pipeline				
Pipework validation Est. 418 LM	40 1 per 10 LM	Trench base	Asbestos (3)	40
Other structures				
Tower T1, T3, T4 and T6 Clean Out Pits	Based on UFP. 2 per pit	Excavation base	Metals (1)/TRH/PAH	TBC
T3 Pond	Based on UFP up to 4	Excavation base	Metals (1)/TRH/PAH	TBC
West shore clean out pit	Based on UFP up to 4	Excavation base	Metals (1)/TRH/PAH	TBC
Sewer tanks	Based on UFP 2 per tank	Excavation base	Metals (1)/TRH/PAH	TBC
Stockpiles				
Stockpile characterisation	TBC	Full depth of stockpile	Metals (1)/TRH/PAH Asbestos (3)	TBC (4)
QA/QC				
QC duplicates (2)	10% overall	-	TRH/PAHs/Metals (1)	TBC
Rinsates	1 per day (as required)	-	TRH/PAHs/Metals (1)	TBC
Trip blanks	1 per batch (as required)	-	TRH/PAHs/Metals (1)	TBC
Trip Spikes	1 per batch (as required)	-	TRH/BTEXN	TBC

Table notes:
TBC – To be confirmed
LM – Lineal metres
1. Metals comprise As, Cd, Cr, Cu, Pb, Ni, Zn and Hg
2. Blind and split Quality Control samples at a rate of approximately 10%
3. Analysis for asbestos would initially be for absence/presence. If present, a quantitative assessment as per NEPM 2013 guidelines would be required
4. Sampling density will be in accordance with NEPM (2013) Schedule B2 and VIC EPA.

All fieldwork will be undertaken by experienced Environmental Professionals and completed in accordance with the relevant Standard Operating Procedures for fieldwork activities which are based on relevant industry guidelines and best practice.

At this stage, it is proposed that sample locations will be collected with the aid of a backhoe or tracked excavator (supplied by Liberty Industrial) to a maximum depth of three metres below current surface levels. Samples will be collected from representative undisturbed soils and will generally include surface 0-0.1 metres (if required), 0.5 metres and every 1.0 metres thereafter. Additional samples may be collected should stratigraphy differ from that

expected or where evidence of odours or staining is noted (if observed). Quality assurance and quality control are described in the RWP (Appendix B).

Soils penetrated during the investigation will be described in accordance with the Unified Soil Classification System, with features such as seepage, decolourisation, staining, odours and other indications of contamination being noted. This information will be recorded on the field sheets, completed for the sampling locations.

Sample's representative of the depth of fill at each location will be analysed to delineate the depth of identified contamination. Samples will be analysed for parameters to be of potential concern in these areas as summarised in Table 8.2 above and assessed against the criteria in Section 11.36 of the RWP (Appendix B).

The requirements for analysis for other parameters or analysis of samples from other depth intervals will be discussed with AIE and the Site Auditor.

8.5 Excavation

The proposed works will involve excavation to RL 2.5 metres PKHD (this equates to approximately 1.6 metres to 4.2 metres bgl) with the nominated excavation zone between Road No. 7 at the northern end of the West Stockyard to the South Ponds and across to Road No. 9. This stage of the demolition Early Enabling Works is based on the assumption that, prior to excavation, the following works will have been undertaken:

– All above and below ground infrastructure has been demolished with asbestos clearances completed. Demolition materials have been segregated for recycling, reuse or disposal.
– Soils within substation footprint and beneath the oil pipeline and ACM pipeline have been investigated and any additional areas with elevated CoPC have been identified.

Based on the results of the additional investigations and validation, excavation works may also be required to include areas of contamination identified during the additional investigations, removal of subsurface infrastructure or as part of the UFP. The UFP Incident Notification procedure is included as Appendix C.

Excavated materials will be stockpiled and maintained at the East Stockyard and southern zone of the West Stockyard in the MBD Site Compound or at the Emplacement Cell Construction Site.

8.5.1 Excavation responsibilities

One of the components of the proposed works at the site will be the bulk excavation of materials (hardstand, Fill, Unit 1 etc). The excavation works (following demolition (Section 8.2) and additional investigations (Section 8.4) will generally include the following steps as outlined in Table 8.3 below.

Table 8.3 Excavation works responsibilities

Activity	Responsibility
– Locate the areas designated for further investigation works based on investigations to date (Figure 6.4). Identified areas to be marked on site and excavation procedures reviewed by the remediation Contractor in consultation with the Environmental Consultant, including required management measures to protect health and safety and the environment.	– AIE HSE Manager – Liberty Industrial Construction Foreman – AIE Environmental Representative
– Excavation of contaminated material. All excavations shall be undertaken in consultation with the Environmental Consultant, to guide excavations on the basis of visual and olfactory observations as well as on the basis of previous analytical results.	– Liberty Industrial Construction Foreman – AIE Environmental Representative
– Segregation and stockpiling of different waste streams from the excavation based on visual assessment and results of previous investigations. (see Section 8.7)	– Liberty Industrial Construction Foreman – AIE Environmental Representative
– Characterisation of excavated material for either re-use on site or waste classification/disposal purposes, if appropriate (based on visual assessment and previous results). Collection and analysis of additional samples if required for adequate characterisation of materials.	– Liberty Industrial Construction Foreman – AIE Environmental Representative

Activity	Responsibility
– Transport and placement of materials suitable for re-use on-site to a designated area in the eastern stockyard for future use. The stockpile area must have environmental controls in place prior to placement.	– Liberty Industrial Construction Foreman
– Transport of excess materials to Outer Harbour stockpile area at Emplacement Cell Construction Site for future re-use or placement within the OHDSCA.	– Liberty Industrial Construction Foreman
– Waste classification of unsuitable excavated materials for disposal purposes (sampling and analysis by Environmental Consultant, equipment by Contractor). See Section 11.3 of RWP (Appendix B).	– Liberty Industrial Environment Representative – Environmental Consultant
– Transport contaminated material by licensed waste transporter, to an appropriately licensed site for disposal (as required).	– Liberty Industrial Construction Foreman
– Validation sampling of the base and vertical sides of the excavations by the Environmental Consultant to confirm that soil left in place conforms to allowable limits as per Section 8.5.3.	– Environmental Consultant
– Reinstate excavations (if required) with validated stockpiled material as per Section 11 of the RWP (Appendix B).	– Liberty Industrial

8.5.2 Method of excavation

Overview

It is anticipated that excavators or backhoes will be used for all excavation operations. All excavations shall be conducted in accordance with relevant management plans and under supervision of the Environmental Consultant to ensure all identified contaminated materials are removed and segregated from uncontaminated materials that will be used in the OHDSCA.

Excavation procedure

The following sequence of steps should be followed prior to commencing the excavation operations in areas of identified contamination.

The Environmental Consultant will liaise with Liberty Industrial in the field on the following:

– The boundaries of the area to be excavated.
– The expected depth of excavation.
– The manner in which materials are to be excavated.
– The area where stockpiling of material can take place.

Given the location of the works and proximity to the Inner Harbour, the Contractor shall ensure all required sediment control measures around the excavation areas are in place. Further details are provided in Section 12.4 of the RWP (Appendix B).

Excavation of contaminated materials will proceed as follows:

– Excavation of materials from the surface to the required depths in the nominated areas as detailed in Table 8.2.
– Excavations will continue in a lateral and vertical extent to remove material identified as being contaminated based on site observations (stained and/or odorous soils) and analytical results (depths to samples with contaminant results below the criteria).
– Excavated materials will be segregated as required for re-use, further management (e.g., placement within the OHDSCA) or waste classification/disposal purposes.

Liberty Industrial shall ensure that at all times the sides of the excavation are stable and that all excavation and stockpiling works are undertaken in a manner that will not contaminate clean areas of the site and will minimise any mixing of different material types or waste streams (i.e., contaminated and clean materials).

Upon completion of the excavation, Liberty Industrial shall ensure that plant and equipment is cleaned and decontaminated as per Section 8.1. Waste generated during the decontamination works is to be disposed of in accordance with Section 8.8.

8.5.3 Validation sampling

The resultant excavation shall be validated to confirm the removal of any contaminated material (so as to allow subsequent excavations to proceed without restriction), with sample results compared against nominated assessment criteria. The assessment criteria is outlined in detail in the RWP, which also includes the validation sampling protocol for the remediation works (refer to Appendix B).

8.5.4 Backfill or reinstatement requirements

On completion of excavation and subsequent validation approval, backfilling of excavations may be required (i.e., for site levelling or safety reasons). Significant backfilling at the site is not anticipated during this phase of the Early Enabling Works. If required, backfilling procedures will be as follows:

- Excavations should be backfilled with either:
  - Materials from the site, assessed as suitable for re-use under the adopted land use criteria.
  - If required, Virgin Excavated Natural Material (VENM) or Excavated Natural Material (ENM) sourced externally. Material considered to be VENM or ENM should be assessed by an appropriately qualified environmental consultant to confirm that the material meets the relevant regulatory requirements.
- Backfill material must be of suitable composition and must meet geotechnical and other material property requirements for the area of use and not present hazards to future development.
- VENM or ENM materials are not to be stockpiled in areas still undergoing remediation or come in contact with contaminated soils either through storage or from equipment/plant handling contaminated materials.
- Validation samples should be collected from the on-site or imported material (if required) to confirm its suitability for use. Further details regarding the validation schedule are presented in the RWP (Appendix B).
- It is understood that it is also intended to use fill material and concrete suitable for reuse for the wharf construction. Materials will be crushed on site and stockpiled at the East Stockyard. This material will be segregated and validated for use as per Section 8.7.

Reinstatement, compaction and further redevelopment works will be undertaken in accordance with the requirements of AIE.

8.5.5 Material tracking control

A critical aspect of the demolition for the Early Enabling Works is the manner by which materials are controlled throughout all stages of the works. The following tracking control requirements for each stage shall be implemented by Liberty Industrial to ensure all materials are accounted for:

- Excavation:
  - The area to be excavated shall be clearly delineated.
  - Qualified supervision shall be used during excavation to ensure that all contaminated materials are removed but disturbance of uncontaminated soils is minimised.
  - Materials shall be segregated to the extent practical during excavation to minimise mixing of materials with different degrees or types of contamination.
  - The final extent of excavation and location of validation sampling points shall be measured and recorded by GPS or survey, as required by AIE.
- Stockpiling/Backfilling:
  - Stockpiles shall be kept separate, to minimise mixing of materials (as above).
  - All stockpiling and backfilling operations during the remediation operation will only move material from one location to another when expressly approved by the Environmental Consultant. All such movements

shall be clearly documented by Liberty Industrial in a material tracking register equivalent. The materials tracking register shall document (at a minimum) the following information:

- Stockpile identification
- Source of material
- Volume of material
- Destination (including on-site locations for intermediate movement)
- Date of movement
- Authorisation
- Material Description.

8.6 Transport of material

Transportation of material will be undertaken in accordance with relevant management plans including:

- All material movements, including on-site movements, will be recorded on a material tracking plan documenting material source, type, description, volume, destination, reference to testing results, approval for movement and date(s) of movement. A register setting out this information shall be established as part of relevant management plans.
- Wastes will only be removed off-site after the material has been classified and written approval has been received for the disposal of the contaminated soil at the nominated treatment or disposal site, or evidence of appropriate recycling (in accordance with regulatory requirements and relevant codes of practice) has been provided.
- All asbestos debris and contaminated Personal Protective Equipment (PPE) should be doubled bagged prior to transportation to an appropriately licensed landfill that can accept asbestos waste. Management of asbestos waste is to be undertaken in accordance with the POEO (Waste) Regulation 2014.
- Waste tracking will be undertaken in accordance with EPA requirements (specifically the POEO (Waste) Regulation 2014) and include evidence of instructions, load registers/records (source, classification, volume, date and time, vehicle details etc), weigh bridge dockets.
- Any vehicles used to transport contaminated materials from the site will meet NSW EPA licensing requirements for the waste transported.
- All trucks carrying contaminated materials off-site will have the load covered, the exterior of the vehicle, including wheels, thoroughly cleaned down by Liberty Industrial after it has received its load and prior to the vehicle leaving the site. Only vehicles which have clean exterior bodywork, and which will not pollute the off-site transportation corridors will be permitted to leave the site.

8.7 Segregation of materials for re-use on-site

The discussion presented below is based on the proposed re-use of uncontaminated materials generated during excavation of materials to RL 2.5 metres PKHD across the nominated area as bunding and/or fill within the OHDSCA. Early identification and classification of the different material streams on-site will lower the costs associated with on-site treatment, transportation and/or landfill disposal during excavation works.

The selected segregation methodology will be described in detail by Liberty Industrial, and will depend on the frequency of occurrence and the nature of any contaminated materials (odorous, discoloured or ACM and other foreign materials) in excavated Fill and Unit 1 soils materials, as well as the physical characteristics of the materials themselves. The methodology may need to be varied depending on the effectiveness during the works.

One of the major components to allow re-use of excavated uncontaminated materials, will be the separation of the materials from contaminated materials and validation (visual or sampling and analysis) prior to re-use. Procedures and responsibilities will be as outlined in Table 8.4.

Table 8.4 Segregation, stockpiling and re-use responsibilities

Activity	Responsibility
– Identify the area for excavation and the uncontaminated areas of the site containing materials suitable for re-use, based on previous analytical results and site observations.	– Liberty Industrial Construction Foreman – AIE Environmental Representative –
– Removal of hard stand as appropriate	– Liberty Industrial Construction Foreman
– Excavation with segregation of different material streams if appropriate, based on previous results, visual assessment, mechanical screening or sampling and analysis i.e., materials suitable for re-use, materials for recycling, materials for disposal and materials for further management.	– Liberty Industrial Construction Foreman – AIE Environmental Representative –
– Validation of segregated materials by Environmental Consultant in accordance with the validation protocol detailed in the RWP (Appendix B) for re-use on site or within the OHDSCA bund.	– Liberty Industrial Construction Foreman – AIE Environmental Representative –
– Characterisation of unsuitable segregated materials (sampling and analysis) by Environmental Consultant, equipment by Contractor) if disposal off site is required (Waste Classification sampling as per RWP (Appendix B)).	– Liberty Industrial – AIE Environmental Representative –
– Transport of suitable materials to an appropriate portion of the site for stockpiling for future use, as directed by AIE/Environmental Consultant.	– Liberty Industrial Construction Foreman
– Transport of excess materials to the Emplacement Cell Construction site for future re-use or placement within the OHDSCA	– Liberty Industrial Construction Foreman
– If required, transport contaminated material by licensed waste transporter, to an appropriately licensed site for disposal.	– Liberty Industrial Construction Foreman
– Reinstatement as required of excavated area.	– Liberty Industrial Construction Foreman

A decision tree outlining the process for segregation and characterisation of the excavated materials for either re-use on-site, as the bund or cap in the OHDSCA, for placement in the OHDSCA or for disposal off- site is presented in Figure 8.1.

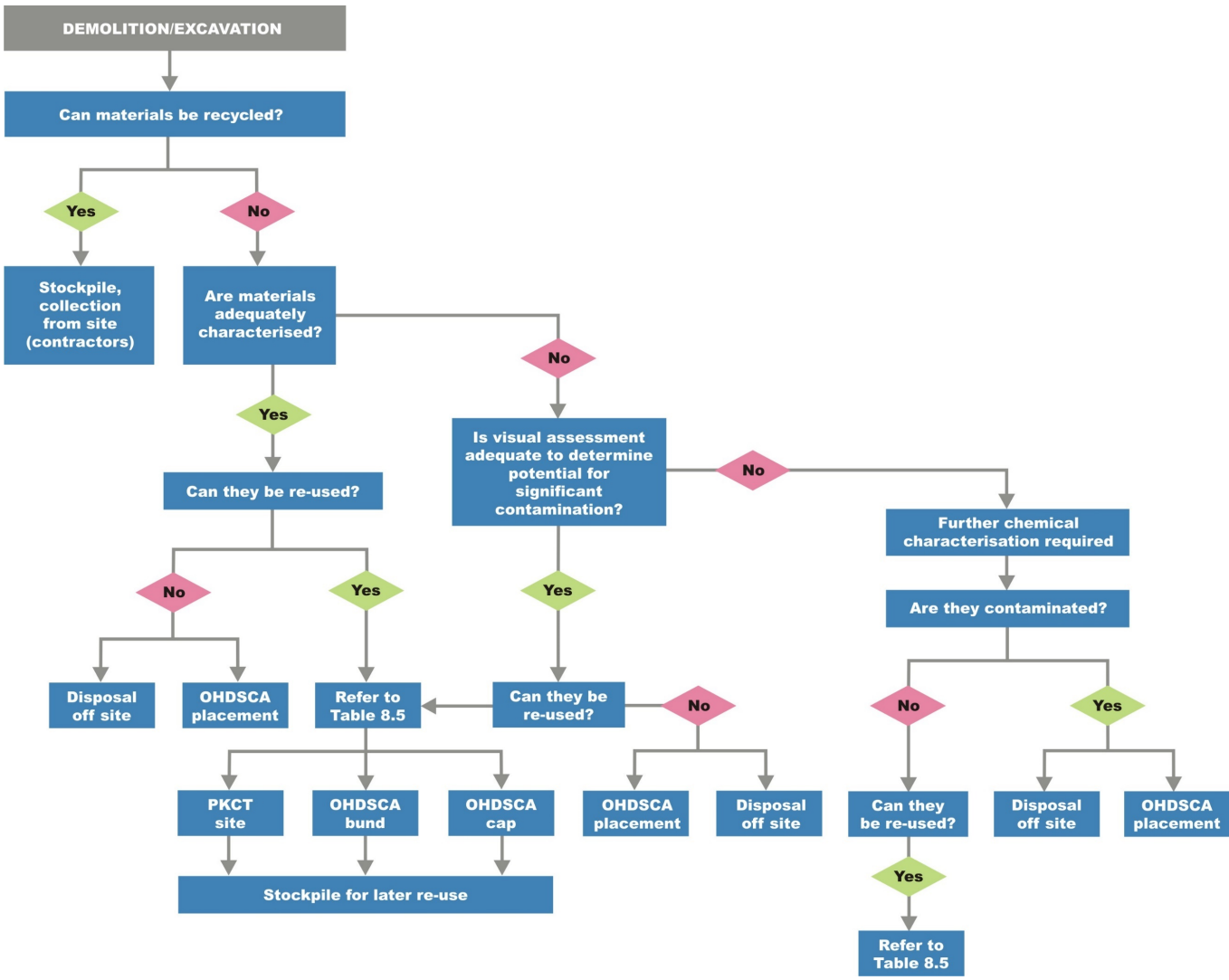

Figure 8.1: Decision tree for material segregation and characterisation

Table 8.5 details the criteria that will apply to the decision-making process with regard to the options for re-use on site.

Table 8.5 Criteria for re-use on site

Re-use on site options [1]	Decision criteria
MBD Site Compound	Less than HIL D or can be managed by capping
OHDSCA bund wall construction	Less than sediment DGV's. Where relevant, consideration of contaminant leachability will be applied, as per Section 7.5 of the RWP (Appendix B)
OHDSCA cap construction	Less than HIL D
OHDSCA placement materials	TBA
Disposal off site	Unsuitable for all of the above

1. All materials for re-use must also be deemed suitable for the geotechnical requirements

8.8 Minimising potential impacts from ACM in fill

As noted in Sections 3.10 and 4.1 of the RWP (Appendix B), ACM is present within an underground water pipe, potentially within the substation area, and two ACM fragments were previously identified on the surface and subsequently removed from near the substation. No other ACM has been observed during subsurface investigations, and it is therefore unlikely that ACM is present in the fill, although that cannot be precluded.

In order to minimise the risk of health impacts to arise from disturbance of ACM (if present) in fill and potential generation of airborne asbestos fibres, the following procedures will be adopted.

In relation to the potential presence of ACM in fill, an appropriately qualified person will be responsible to 'bucket watch' and visually monitor all fill material as it is excavated to check for potential ACM. This is part of the material management and tracking which is to be undertaken on all excavated materials at the site. If ACM is identified, unexpected finds, asbestos management procedures will be invoked. All operatives at the site will be given tool box talks the on potential for contamination at the site and instruction to stop work in the event possible contaminants are identified. The earthworks are also being undertaken by an experienced remediation contractor familiar with identifying and managing these types of potentially contaminated soils.

While there is raw slag material to be excavated, it should be noted that for approximately two thirds of the excavation zone, the slag material is a heavily bound base course which is a controlled manufactured slag road making material commonly used in road works in NSW. The heavily bound base course was installed as a replacement for the existing raw slag hard stand in 2017 to facilitate the delivery of major plant over berth 101 for installation at Coal Berth 102 to the North of the AIE site. Hence the risk of ACM being present within this material that is to be crushed is considered extremely low, given the protocols in place at this time, however the abovementioned process of visually monitoring excavation of this material will be followed, as it will be for the excavation of the raw slag hardstand elsewhere on the site that was installed in the early 1960's.

Crushing of raw slag and heavily bound base course will only be undertaken following visual inspection of the material as it is excavated and following, where necessary, appropriate segregation of material. This will involve the following:

– Different materials will be selectively excavated (eg. road building material and granulated slag will not be mixed with fill material potentially containing ACM), as indicated in Tables 8.3 and 8.4.
– Concrete will be inspected by an appropriately qualified person both during excavation and prior to crushing to confirm it doesn't contain ACM. If ACM is identified, the concrete will either be disposed of without crushing, or specific procedures will be developed for SafeWork NSW approval.
– Minimisation of dust will be undertaken for all excavation and material handling operations (including crushing) in accordance with the Air Quality Management Plan (AQMP).

If any asbestos containing materials are identified, the LAA will determine by risk assessment whether air monitoring is required. If air monitoring is considered necessary or prudent, monitoring will be undertaken in accordance with the Code of Practice *How to Safely Remove Asbestos* (SafeWork NSW 2019).

8.9 Disposal off-site

The following procedure will be undertaken for excavated materials that are required to be disposed of off-site:

– Soil to be disposed off-site must be classified for waste disposal purposes and disposed in accordance with the requirements of the *Protection of the Environment Operations (Waste) Regulation 2014* made under the POEO Act and NSW EPA (2014). The Environmental Consultant shall be responsible to oversee the classification of the waste. Liberty Industrial will ensure its transport and disposal to an appropriately licensed landfill.
– Documentation of waste classification, transport and disposal will be provided in accordance with the *Protection of the Environment Operations (Waste) Regulation 2014* and NSW EPA, 2014a and/or 2014b and provided for inclusion in the validation report. Documents required will include:
    - Materials tracking register.
    - Independent waste classification report in accordance with the requirements of NSW EPA.
    - NSW EPA online waste tracking documentation (Waste Tracker).
    - Receiving waste facility EPL (to show it can lawfully receive the waste), limit conditions and/or consent from appropriate regulatory authority.
    - Consignment authorisation/disposal receipts/tip dockets.
    - Reconciliation documents matching materials register and disposal receipts.

8.10 Remediation contingency plan

The site has been investigated for contamination as detailed in previous investigation reports. However, a degree of uncertainty is inherent in any site contamination investigation. In particular, due to the limited investigations undertaken beneath the existing infrastructure, there is a potential for contamination to be present beneath these structures. Further, due to the size of the site and nature of the fill material, there is a potential for unidentified areas of contamination across the site.

A contingency response plan for unexpected situations will be prepared by Liberty Industrial, who will be required to follow the contingency response plan if unexpected situations are encountered. Table 8.6 outlines some of the unexpected situations that may arise.

Table 8.6 Contingency procedures

Issue	Response
A greater volume of soil contamination may be encountered than is presently estimated, or other types of contamination may be encountered.	In the event that significant additional volumes of contamination or previously unidentified types of contaminants are identified, work would cease in the area of concern. An assessment of the impact of the additional contaminated materials would be undertaken by the Environmental Consultant. The presence of previously unidentified types of contaminants may be identified during remedial works. If previously unidentified types of contaminants are detected, then the validation criteria may have to be revised to incorporate those contaminants. Any potential contaminated material in addition to the type already identified will be treated in a method considered suitable for the type of contaminant. Additional testing would be undertaken to determine requirements in this respect.
Identification of friable ACM	Bonded asbestos is expected at this site and removal will be undertaken in accordance with the AMP. However, if friable asbestos is encountered, the contingency procedures in the AMP are to be implemented. An assessment of the impact of the ACM would be undertaken by the Environmental Consultant and the appropriate remediation measures implemented (usually removal).
Wastes, previously unidentified, buried in the work area may be encountered	In the event that buried wastes are encountered during remediation works, the extent of the impact from the buried wastes will be assessed. Following assessment, if required, the waste will be removed, stored, classified and disposed of in accordance with NSW EPA 2014a and/or 2014b.
Dewatering of excavations may be required.	If dewatering of excavations is required, the water will be pumped into suitable storage and either used for dust suppression or compaction (following appropriate testing), tested prior to discharge or disposed of at a licenced facility approved to accept potentially contaminated groundwater. In the event that excavations are unstable, demolition and excavation works will be reassessed in consultation with the AIE Project Manager.
Unacceptable Environmental Impacts as a result of remediation activities	The RWP (Appendix B) has considered the potential environmental impacts of side effects of the works such as noise, odour, dust and surface runoff. These will be further considered in relevant management plans prepared by the Contractor. However, in the event that unacceptable levels of such side effects are detected at the site boundaries during remedial works, the Contractor shall cease work and the Environmental Consultant will assess the situation and direct corrective action in accordance with the following: – Existing management plans. – Current EPA regulations and requirements. – In consultation with the AIE Project Manager.

9. Waste tracking and reporting

9.1 Waste minimisation strategies

Waste minimisation strategies will be implemented during the Early Enabling Works of the MBD in accordance with the waste hierarchy and the objectives of the *Waste Avoidance and Resource Recovery Act 2001* (refer to Figure 9.1*)*.

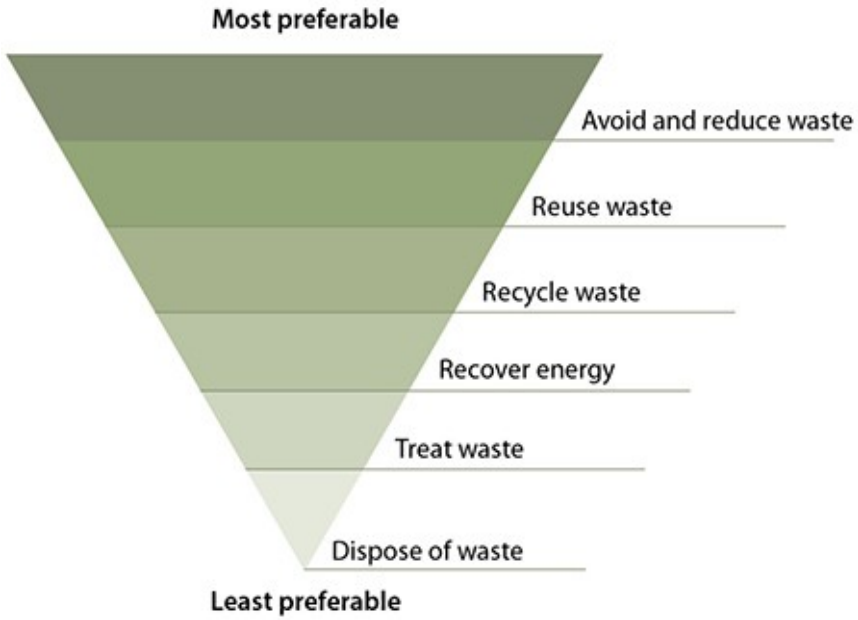

Figure 9.1 Waste hierarchy

The waste hierarchy will be applied, as outlined in Table 9.1.

Table 9.1 Waste hierarchy applicable to the Project

Item	Comment
Avoid and reduce waste	Spoil generated from the Early Enabling Works (and other phases of construction) will be placed in the Emplacement Cell Construction Site in Port Kembla Outer Harbour, avoiding waste disposal to landfill or ocean.
Reuse waste	Limited opportunity for reuse during the construction stage however the following materials may be reused on-site if practical: – Road materials (gravels, bitumen etc.), demolition concrete, rock revetment.
Recycle waste:	Demolition waste from the marine berth will be segregated into metals, bricks and concrete (if not reused) for offsite recycling. Where practicable, clean concrete and rock may be reused on site for temporary road construction.
Recover energy	Limited opportunity in the construction stage.
Treat waste	Limited opportunity in the construction stage.
Disposal of waste	If site disposal may be required for unexpected finds encountered, demolition wastes.

9.2 Onsite material movement

Materials will be transported to the stockpile areas as depicted in Figure 2.1 and Figure 2.2. Materials include:

– Green waste.
– Demolition waste.
– Spoil.
– Tie Rods Excavation.
– Revetment Rock.

Movements to the stockpile area are considered ‘on-site’. Transportation documentation will include:

– Daily load counts, noting source location and load volume estimates
– Individual Stockpile or EIS soil unit identifier (i.e., SP01 or Unit 1#A)
– Date, total number of loads, description of material

Information will be recorded on an on-site material register and stockpile register. Stockpiles will be maintained separately, surveyed for location and volume, and maintained in accordance with the relevant air, water and asbestos controls. We note that movements from the MBD Site Compound to the Emplacement Cell Construction Site are considered ‘onsite’ movements, however these will be tracked as outlined in Section 2.3.3.

Once a stockpile is removed, a visual inspection will be undertaken to confirm that all stockpiled materials have been removed and the previous surface is clear of stockpiled materials.

Stockpiled material will be relocated to either:

– The Emplacement Cell Construction Site (on-site); or
– On-site reuse (MBD Site Compound) or
– Off-site recycling; or
– Off-site disposal.

9.3 On-site reuse movements

Material moved from the stockpile area for on-site reuse in the MBD, simple truck counts will be used to track material. Volumes of trucks will be used to estimate the total movement volume and will be summarised in a material tracker.

9.4 Off-site movements

Material that is transported for off-site disposal by truck will be done so in accordance with the conditions of the Infrastructure Approval, and CTMP. The following will occur as the material is loaded from site:

– Trucks will be covered prior to exiting the MBD Site Compound and will remain covered until authorised to unload at the destination.
– Trucks carrying excavated material will be decontaminated at the wheel wash facility before exiting site.
– Trucks will be fitted with seals to ensure that the movement of potentially saturated materials is undertaken appropriately. The integrity of the seals will be inspected prior to commencement of each day’s haulage works.
– Trucks carrying construction general waste, including those listed below, will be by specialist contactors carrying appropriate licenses, spill kits, bunding and covering for each waste stream:
    - paper, glass, plastics, silt fences, survey pegs, aluminium, cans, hessian bags etc.
    - tyres, batteries, waste fuels, oils, radiator fluids, hydraulic oils and drummed chemicals.
– Trucks will not wait in the streets surrounding the site.

All off-site movements will be tracked on the waste tracking summary. Additionally, Waste Locate, a NSW EPA system, will be used track all loads of asbestos waste, restricted or hazardous waste.

Waste Locate is not required for General Solid Waste (GSW) and cell placement. Waste Locate will be used for asbestos, Restricted Solid Waste (RSW) and hazardous waste only.

9.5 Stockpiling

All stockpiles will be maintained in an orderly and safe condition for a maximum period of up to 18 months. Batters will be formed with sloped angles that are appropriate to prevent collapse or sliding of the stockpiled material. The integrity of neighbouring stockpiles of differing materials will be maintained and all measures necessary to prevent mixing of material types will be undertaken.

Stockpile controls are outlined in the Air Quality Management Plan (AQMP) and Erosion and Sediment Control Plan (ESCP), and include:

– Polymer application:
  - Vital Stonewall is a single use polymer, when applied to a completed stockpile will reduce dust generation and sediment run off for up to 6 months. Polymer will be reapplied if the stockpile life is longer than 6 months. Vital Stonewall is suitable for use adjacent to marine environments. Further details regarding Vital Stonewall are included in **Error! Reference source not found.**.
  - Additional polymer may be applied to stockpiles prior to completion in response to elevated dust measurements where dust plumes are observed to be coming from stockpiles, or if visual inspections reveal deterioration of surface sealing.
– Bucket sealing of stockpiles, as they are formed.
– Minimising active stockpiling surface area. Stockpiling will be minimised, where possible. Land based excavations will be directly loaded to trucks and transported to the Emplacement Cell Site or for offsite disposal, without stockpiling, to reduce handling and potential dust generation. Stockpiling will be required when storage of material is required prior to the Emplacement Cell being ready to receive material.
– Control of runoff from stockpiles, to prevent sedimentation of marine environments.
– Management of surface water for onsite reuse for dust suppression.

The ESCP for the MBD Site Compound is included in Appendix D and a ESCP for the Emplacement Cell Construction site will be prepared prior to transfer of spoil for stockpiling at the site.

The above controls are considered appropriate for materials identified to date; but any stockpiles of unexpected contamination with a higher potential for leaching or contaminated dust (e.g., by asbestos fibres) would be securely covered with an appropriate material (e.g., tarp or geofabric specific to the contaminant risk) prior to disposal. It is anticipated that unexpected finds of potential contamination will initially be tested in-situ to avoid stockpiling.

Stockpiles will have a maximum volume of 10,000 metres³ at the Emplacement Cell Construction Site and up to 50,000 metres^3 at the MBD Site Compound for backfill purposes. However, smaller stockpiles will be used to segregate hotspots or unexpected finds. Any stockpiles of contaminated spoil requiring offsite disposal will only be located at the MBD Site Compound.

The stockpile location fate of waste will be monitored by the Liberty Industrial Environmental Representative and the Construction Foreman.

9.6 Disposal locations

When results confirming classification of the waste have been received, these will be provided to the landfill receiving facility in order to obtain disposal approval. The destination landfill will be licensed to receive the relevant waste classification. The primary disposal locations are listed below in Table 9.2. The Environmental Manager in consultation with the Project Manager, Deputy Project Manager and Construction Foreman will make the decision.

Table 9.2 Disposal locations

Material Classification	Name and Location	EPL
Recyclable Concrete	Benedict's Recycling Wollongong	#20870
Demolition Rubble	Benedicts Recycling Wollongong	#20870
General Solid Waste,Asbestos Waste	Whyte's Gully Waste Disposal Facility	#5862
Liquid Waste	Cleanaway Unanderra	#10771
MBD and NGP Spoil	PKGT Emplacement cell	#(TBA)
Restricted Waste	Suez Kemps Creek	#4068

9.7 Incidents and non-conformance

Where the incorrect collection, storage or disposal of waste results in material environmental harm or degradation, the AIE HS&E Manager will notify the EPA in accordance with its EPL requirements.

Incidents and non-conformances 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.

All incidents and non-conformances including those involving the contractor, its subcontractors and visitors that occur during construction will be managed in accordance with the Incident Notification and Response Flow Chart (Appendix E). The incident or non-conformance will be recorded and managed according to Liberty Industrial's Safety Management Plan.

All environmental incidents , non-conformance or near misses must be as per the Infrastructure Approval and may include:

– Loss of containment incidents or releases of liquids, solids, or gas.
– Any dangerous goods or hazardous substance spills to waters and over 20 litres in volume to ground (less than 20 litres to be recorded and managed as a corrective action in the Corrective Actions Register).
– Complaints received from regulatory authorities.
– Regulatory breaches – fines, prosecutions, improvement notices, breaches of licence conditions.
– All incidents of third-party property damage or loss.
– Any loss or damage to native vegetation outside approved work areas or flora and fauna of significance.
– Incidents involving impact or potential damage to Aboriginal or Historic Heritage significant areas.
– Loss of sediment downstream in a watercourse or other sensitive areas.

In the event of a notifiable non-compliance incident arising, Liberty Industrial will notify AIE immediately to allow AIE HS&E Manager to notify DPIE in writing (to compliance@planning.nsw.gov.au) within 7 days of AIE becoming aware of the non-compliance, as per Schedule 4 Condition 6 of Infrastructure Approval SSI 9471.

All environmental incidents will be reported immediately to DPIE in writing (to compliance@planning.nsw.gov.au) immediately after AIE becomes aware of the incident, as per Schedule 4 Condition 5 of Infrastructure Approval SSI 9471.

The notification must include:

– The development (PKGT Early Enabling Works for the MBD).
– Application number.
– Condition of Infrastructure Approval that works are non-compliant with.
– The way it which it does not comply.
– Reasons for non-compliance (if known).
– What actions have/will be taken to address the non-compliance.

In accordance with EPA Guidelines, a specific Pollution Incident Response Management Plan will be developed and implemented prior to construction recommencing.

9.8 Contaminated site audit report

The RWP (Appendix B), includes a detailed procedure for validation of re-used, imported, waste, stockpile footprints and groundwater for each stage of construction. The RWP includes a Sampling Analysis Quality Plan (SAQP). The SAQP will include:

– Additional investigation of proposed bund material, to confirm suitability for use in the emplacement cell bund.
– Validation sampling plan for the site.

The outcomes of the implementation of the RWP and SAQP will be presented in a Site Validation Report at the completion of the works. The Validation Report will be reviewed by the Contaminated Site Auditor, Melissa Porter, to confirm the sites suitability for its intended land use and allow the issue of a Section A Site Audit Statement

9.9 Reporting commitments

Under the requirements of the development consent, regular reports on compliance and other matters will be provided during the construction phase. This will include reporting to the DPIE in accordance with Schedule 4, Conditions 7 and 8 of the Infrastructure Approval, 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 in accordance with Schedule 2, Condition 8 of Infrastructure Approval SSI 9471.

The Project will also be undertaken in accordance with an EPL. In general, some of the key reporting requirements include:

– The issue of fortnightly report containing; water quality monitoring results, marine ecological health data, construction works progress and appraisal of water quality controls.
– Environmental Incident Report(s) as required by DPIE and the EPA.
– Annual returns as required by the EPL.

A summary of monthly data will be published on the AIE PKGT website, noting any exceedance of EPL trigger values, the subsequent investigation and response. The contractor will also report to the relevant regulator in the event of a noncompliance with the EPL or Infrastructure Approval (Section 9.7).

10. Construction Water Quality Management Plan

The CWQMP sets out the compliance of Schedule 3 Condition 11(c) of the Infrastructure Approval. As much of the monitoring outlined in the CWQMP will be the subject of separate review by the NSW EPA for license conditions, the CQWMP has been produced as a standalone document with a summary of its scope outlined here.

The CWQMP outlines:

– Automated water quality monitoring buoys, located in the Inner and Outer Harbour, to monitoring sediment plumes at the MBD Site Compound and Emplacement Cell Construction Site.
– Background monitoring locations.
– Routine pollutant grab sampling.
– Controls and monitoring of water quality management including:
    - Silt curtains and bubble curtains.
    - Monitoring observation check lists.
    - Staged responses to changes on pollutant concentrations, observations and monitoring data.

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Appendices

Appendix A

Demolition Plan of Berth 101

Australian Industrial Energy

Port Kembla Gas Terminal

Demolition Plan for Berth 101

Document Number: PKGT-AIE-DEM-PLN-0001

Rev	Description	Date	Prepared	Checked	Approved
B	Comments from NSW Ports incorporated	03-Mar-2021	CJH	MC	ML
A	Issued for external review	22-Feb-2021	CJH	MC	ML

DEFINITIONS AND ACRONYMS

Term	Meaning
AIE	Australian Industrial Energy
EGP	Eastern Gas Pipeline
FSRU	Floating Storage & Regassification Unit
LNG	Liquified Natural Gas
PKCT	Port Kembla Coal Terminal
PKGT	Port Kembla Gas Terminal
TfNSW	Transport for NSW

CONTENTS

1 INTRODUCTION

Australian Industrial Energy (AIE) will proceed with building and operating the Port Kembla Gas Terminal (PKGT) project at Port Kembla, New South Wales. The project involves the development of a liquified natural gas (LNG) import terminal, which would be the first such import terminal in NSW and provide a simple, flexible solution to the State's gas supply challenges.

AIE's PKGT project has been granted Critical State Significant Infrastructure (CSSI) status and has been granted approval SSI 9471 from the Department of Planning, Industry and Environment in April 2019 (Approval).

AIE's project consists of:

- Floating Storage and Regasification Unit (FSRU) — a cape-class ocean-going vessel which will be moored at Berth 101 in Port Kembla. The FSRU receives LNG from LNG carriers and will gasify the LNG from transfer into the gas pipeline;
- Berth and wharf facilities – including landside offloading facilities to transfer natural gas from the FSRU into a natural gas pipeline located on shore; and
- Gas pipeline – a 13.5 kilometre, 450 millimetre diameter underground carbon steel high-pressure pipeline connection from the berth at Port Kembla to the existing gas transmission network at Kembla Grange.

The land for the project is currently leased by Port Kembla Coal Terminal (PKCT) from NSW Ports who in turn lease from Transport for NSW (TfNSW). PKCT will surrender part of their lease and new leases will be created.

The lease includes Berth 101 which will be demolished by AIE to make way for the project development. Berth 101 is the southern part of Lot 8 of DP 1154760, and the northern part of this Lot is Berth 102 which will be retained by PKCT.

This Demolition Plan provides details of the demolition of Berth 101. Under the lease agreements the berth must be demolished by 29 September 2021. AIE's contractor, Liberty Industrial Pty Ltd (Liberty) will perform the demolition work.

1.1 Berth 101

The existing Berth 101 was built in the 1960's and is a simple concrete deck on steel pile structure complete with a timber fendering system supported by concrete piles. Neither the deck or the piles were constructed using pre- or post stressed concrete. The location of AIE's project is shown in Figure 1 below and the location of Berth 101 is shown in Figure 2, with the most recent condition report of the Berth prepared by GHD in September 2017. At that time the Berth was used for discharging major equipment (coal stackers and reclaimers) for Port Kembla Coal Terminal and the Berth is currently in service.

The nearest structure to Berth 101 is PKCT's Transfer Station 8 (TS8) which services berth 102. TS8 is approximately 20 metres to the North of Berth 101. To ensure demolition methods, including vibro removal of piles, do not impact TS8, a pre works survey of TS8 will be undertaken with regular check surveys conducted as demolition works progress to confirm TS8 is not impacted.

Drawings of existing Berth 101 are in Appendix 1.

Figure 1 Location of AIE Project at Port Kembla Inner Harbour

Figure 2 Location of Berth 101to be Demolished

2 DEMOLITION OVERVIEW

2.1 General

The demolition of Berth 101 includes:

- bunker oil line running underneath Berth 101;
- timber fenders and fender piles;
- dead man anchors;
- deck of the wharf;
- approximately 457 concrete filled steel piles; and
- surveys after completion of the demolition

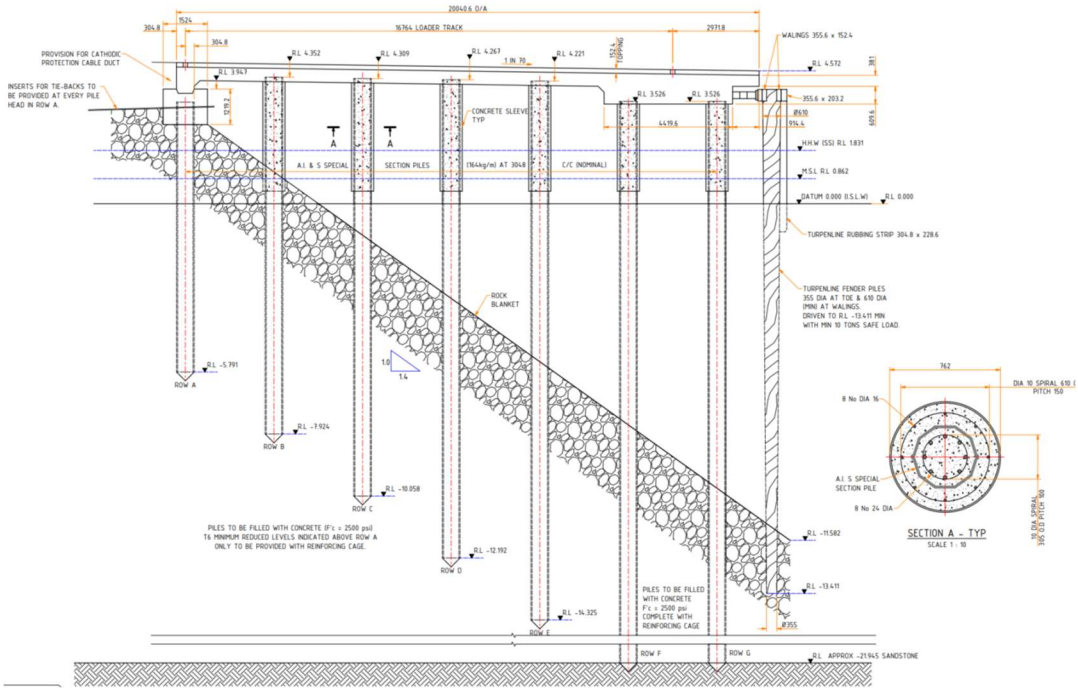


Figure 3 Cross Sectional View of Berth 101

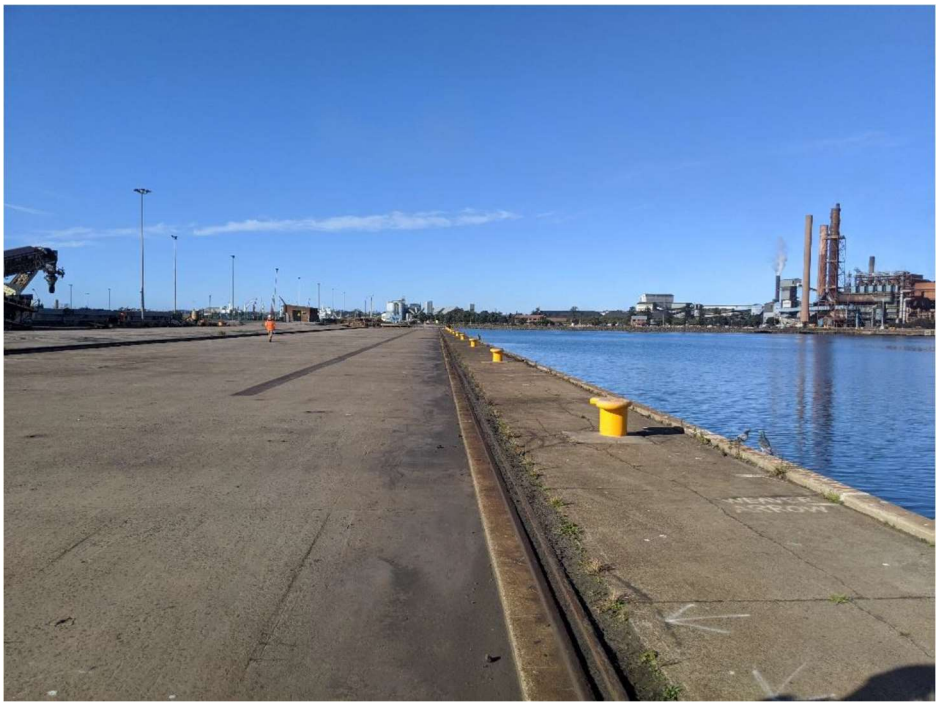


Figure 4 Berth 101 Looking South

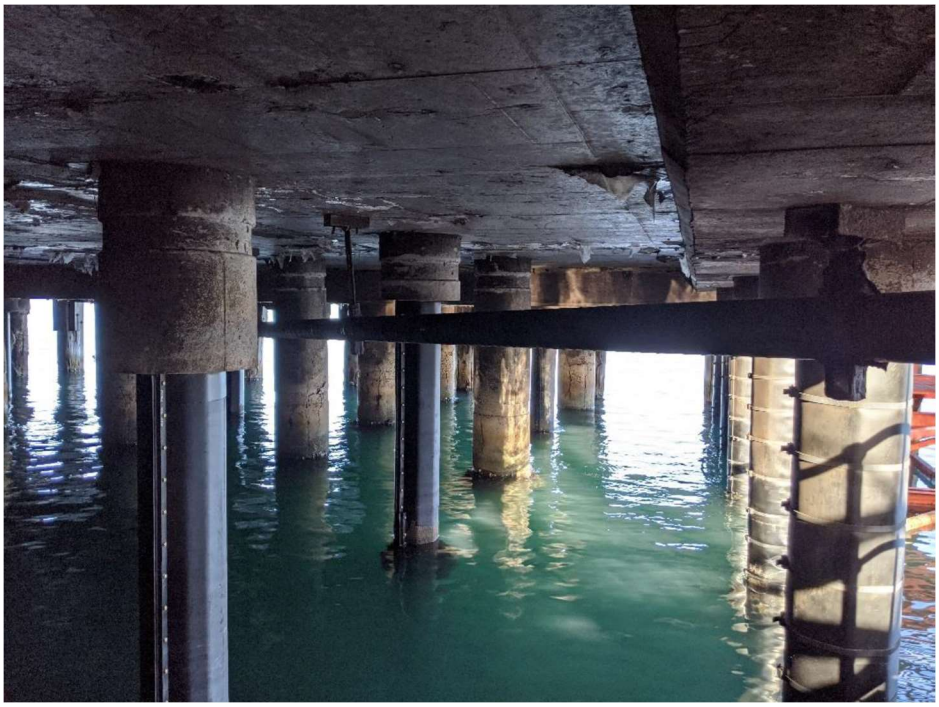


Figure 5 Piles and Bunker Oil Line Under Berth 101

2.2 Environmental Protection

Environmental protection and monitoring will be conducted by RARE Environmental for Liberty with oversight provided by GHD for AIE. RARE has been involved with AIE's project for over 18 months and have authored many of the management plans required under AIE's Development Consent.

For the berth demolition, specific environmental protection activities include:

- installation of a silt curtain prior to commencement of any work over water;
- installation of turbidity monitoring buoys as required by project Approval;
- placement of localised floating booms and provision of spill kits around work areas
- Dust control for concrete saw cutting includes vacuum collection of slurry subsequent drying prior to disposal of the slurry waste.
- atomised dust suppression will be employed to control dust generated by the concrete crushing plant;
- implementation of Water Quality Management Plan as required by project Approval;
- implementation of Air Quality Management Plan as required by project Approval,;
- implementation of Spoil and Waste Management Plan as required by project Approval;
- implementation of Construction Traffic Management Plan as required by project Approval;
- implementation of Unexpected Finds Protocol as required by project Approval;

2.3 Codes, Standards and References

In order to meet the specific requirements of AS 2601-2001 (The Demolition of Structures), job specific Work Method Statements will be created by Liberty, through detailed inspection and consultation with Liberty staff undertaking the works.

The codes, regulations, guidelines and Standards applicable to the Berth demolition are listed below.

- SafeWork NSW Demolition Licensing;
- SafeWork NSW Friable Asbestos Licensing;
- Work, Health and Safety Act 2011;
- Work, Health and Safety Regulation 2017;
- Protection of the Environment Operations Act 1997 (NSW);
- Protection of the Environment Operations (Waste) Regulation 2005 (NSW);
- Protection of the Environment Operations (Noise Control) Regulation 2008 (NSW);
- Demolition Work Code of Practice;
- AS 2601 The Demolition of Structures;
- AS 4361.2 Guide to Lead Paint Management;
- AS 3000 SAA Wiring Rules;
- AS ISO 14004 - 2004: Environmental management systems - General guidelines on principles, systems and support techniques;

- AS/NZS ISO 14001: 2004: Environmental management systems - Requirements with guidance for use;
- AS/NZS ISO 19011: 2003 Australian/New Zealand Standard Guidelines for quality and/or environmental management systems auditing;
- Environmental Protection Authority Publication Environmental Guidelines for Major Construction Sites (1996);
- AS 1885.1 – 1990: Workplace injury and disease recording standard;
- AS/NZS 4801 - 2001: Occupational Health and Safety Management Systems - Specification with Guidance for use;
- How to Safely Remove Asbestos Code of Practice;
- AS/NZS ISO 9001:2015 Quality management systems - Requirements;
- AS/NZS 4581 - 1999: Management System Integration – Guidance to Business,
- Government and Community Organisations;
- AS/NZS 4804 - 2001: Occupational Health and Safety Management Systems – General guidelines on principles, systems and supporting techniques;
- National Code of Practice for Excavation Work;
- Asbestos Blueprint for NSW;
- Fire Brigades Act 1989;
- Local Government Act 1993;
- AS 2865 – 2009 Confined Spaces;
- AS 1319 Safety Signs for the Occupational Environment
- AS/NZS ISO 45001 – 2018: Requirements with guidance for use Occupational health and safety management systems - Requirements with guidance for use

2.3.1 Relevant State Acts and Regulations

- Environmental Planning and Assessment Act 1979
- Environmental Planning and Assessment Regulation 2000;
- Biodiversity Conservation Act 2016;
- Coastal Management Act 2016;
- Contaminated Land Management Act 1997;
- Heritage Act 1977;
- Marine Safety Act 1998;
- Marine Safety Regulation 2016;
- National Parks and Wildlife Act 1974;
- Ports and Maritime Administration Act (1995)
- Ports and Maritime Administration Regulation 2012;
- Protection of the Environment Operations Act 1997;
- Protection of the Environment Operations (Clean Air) Regulation 2010;

- Roads Act 1993;
- Heavy Vehicle National Law (NSW);
- Water Management Act 2000;
- Explosives Act (2003);
- Explosives Regulations 2013;
- Marine Pollution Act 2012;
- Marine Pollution Regulation 2014;
- Waste Avoidance and Resource Recovery Act 2001;
- Fisheries Management Act 1994;
- NSW Ports' Standard Terms and Conditions for Channel Access
- NSW Ports' Standard Terms and Conditions for Berthing at Common User Wharves or Dedicated Facilities
- Port Authority of New South Wales' Harbour Master Directions Port Kembla;
- Port of Port Kembla Port Instructions;
- Australian Marine Safety Authority Navigation Act 2012; and
- Biosecurity Act 2015.

3 METHODOLOGY

3.1 Site Access

Prior to commencement of work, AIE will review Liberty's Work Health and Safety Management Plan, Emergency Response Plan and various support documents including work method statements and job hazard analyses. Method statements for high-risk activities including work over water, working at heights, lifting and working in confined spaces form part of the safety management system.

Key scenarios considered in the Emergency Response Plan include partial collapse of the Berth, personnel and equipment falling into water, hydrocarbon spills and response to medical emergencies. The safety management system will comply with Australian Standard AS45001.

Access to site and within the site will be controlled with traffic management plans which shall comply with the Project Approval. These plans shall ensure vehicles move safely and in a controlled manner using delineated transport routes.

The perimeter of the defined demolition zone will be barricaded and signposted to prevent unauthorised access. Access points will be established and only worker(s) who have been site inducted with the authority of Liberty's Project Manager may enter these zones.

The site will be secured with existing as well as temporary fencing. All entrance and exit gates will be locked or manned when truck movements are underway.

As the work progress, different work areas will be barricaded and signposted to define the area and prevent access. Any hazardous material identified will also be barricaded and signposted.

The perimeter of the defined demolition zone will be barricaded and signposted to prevent unauthorised access. Access points will be established and only worker(s) who have been site inducted with the authority of Liberty's Project Manager may enter these zones.

3.1.1 Asbestos Materials

Site will be inspected prior to demolition works and all hazmat removal works will be conducted following establishment on site. All residual ACMs and any other contaminants discovered during the demolition processes will be removed in accordance with statutory requirements and specific Work Method Statements will be developed for their removal. Disposal of these materials will occur at a licensed facility and will be tracked under the current EPA waste tracking requirements for asbestos.

3.2 Demolition Risk Assessment Workshop

A Demolition Risk Assessment Workshop (DRAW) will be undertaken prior to work commencing to identify the high-level Safety and Environmental risks that are likely to be encountered during the works. The outcome of the DRAW will be supplied to NSWPorts 7 days prior to demolition works commencing.

The DRAW will then be used by the site team as the foundation for the development of a Job Hazard Analysis (JHA) for each specific task identified within the Work Method Statement. As circumstances change, the DRAW will undergo a review.

3.3 Berth 101 Demolition

The working area for demolition of Berth 101 is represented in Figure 6 below.

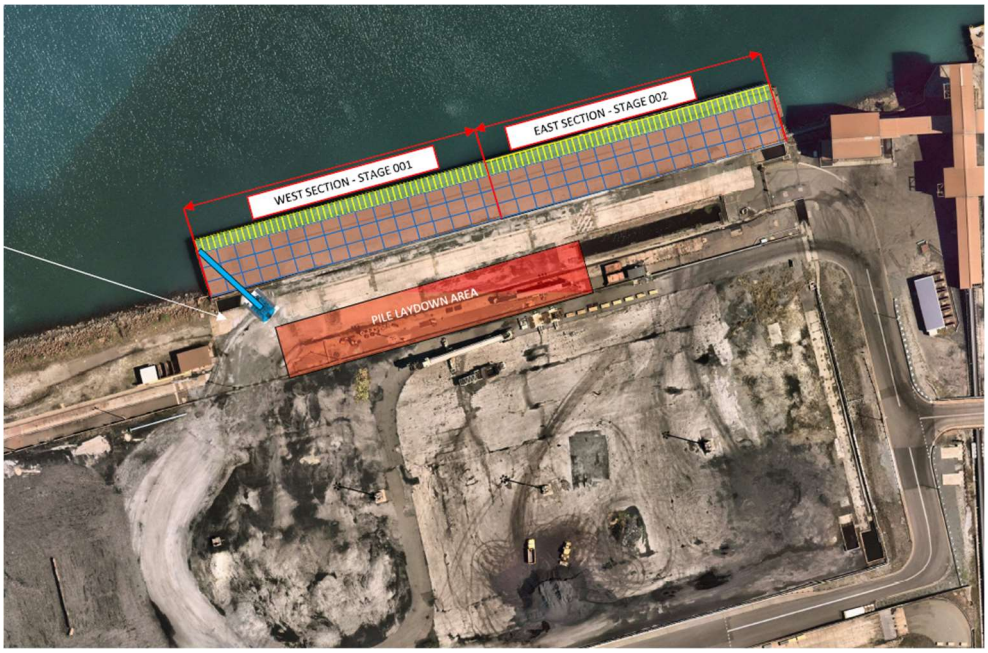


Figure 6 Working Area for Berth 101 Demolition

The following steps will be followed for demolition of Berth 101:

- Port Kembla Coal Terminal (PKCT) are responsible for disconnection and termination of all services connected to Berth 101 prior to surrendering their current Berth 101 lease. PKCT will provide objective evidence that all services have been disconnected and terminated. Liberty will be provided with the objective evidence and implement a due diligence process prior to commencing demolition works to satisfy themselves that services have been disconnected.
- install silt curtain to a depth of 6 meters with boom around Berth 101 as shown in Figure 7
- the bunker oil pipeline located underneath Berth 101 will be water washed, pigged, vented and isolated by Park Fuels prior to demolition works commencing. Isolation will be by removing a pipe spool near the northern breakwater transformer compound and cutting the pipeline (by others) near structure TS8 in PKCT;
- the bunker oil pipeline will be dismantled by unbolting flanges and cold cutting with the dismantled sections moved to the shore and then taken off site for disposal. Oil booms will be locally deployed and spill kits will be available should any fluids remain in the pipeline.
- engineering studies will be conducted by a 3rd party qualified structural engineer to plan and certify the sequence of lifting of the deck considering the stability of the Berth as it is gradually demolished. Critical crane lift studies will be conducted considering the load to be lifted, the load imposed on the Berth, the position of the crane and the reach of the crane;

Figure 7 Silt Curtain Installation

- marking out the berth deck for saw cutting and install anchor points for lifting;
- saw cutting of the berth deck;
- wire sawing of piles below the deck
- lifting sawn deck sections onto the adjacent hard stand area, see example in Figure 8;

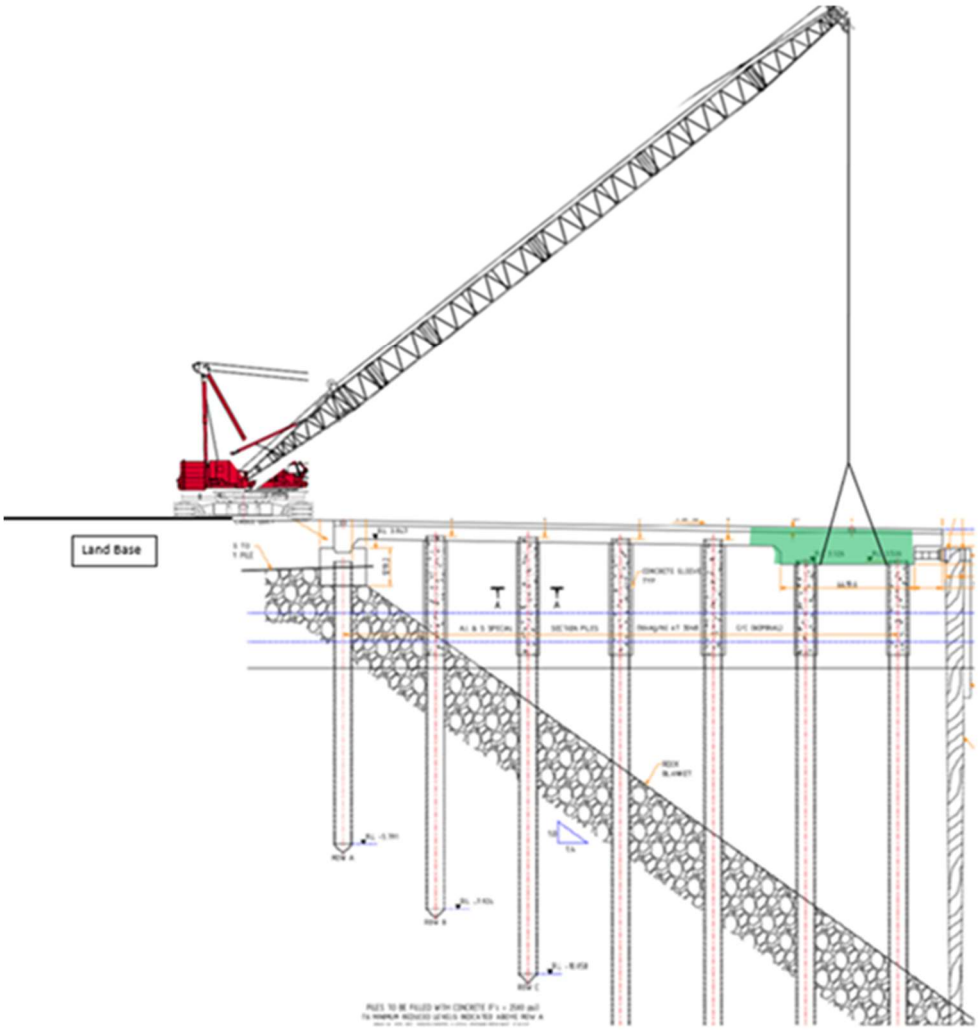


Figure 8 Example of Lifting Sawn Deck Sections

- Partial demolition of deck sections and separation of concrete from steel piles and reinforcement
- transporting partially demolished deck sections for final separation of any residual steel and crushing of concrete (for re-use) and disposal of reinforcing steel;
- fender piles are timber and will be extracted by direct pulling. There is an expectation that some piles will break and leave stumps. As AIE is dredging a new berthing box after completion of demolition, timber stumps will be removed during the dredging operation.

- extraction of steel piles by vibration and subsequent placement of piles on hard stand adjacent to the Berth using crane barge shown in Figure 9. The vibration method is low impact and does not impose any material load on adjacent structures.
- steel piles have reinforced concrete infills which will be separated using shears attached to an excavator for subsequent crushing of concrete (for re-use) on site and offsite disposal of recovered pile steel and reinforcing steel.

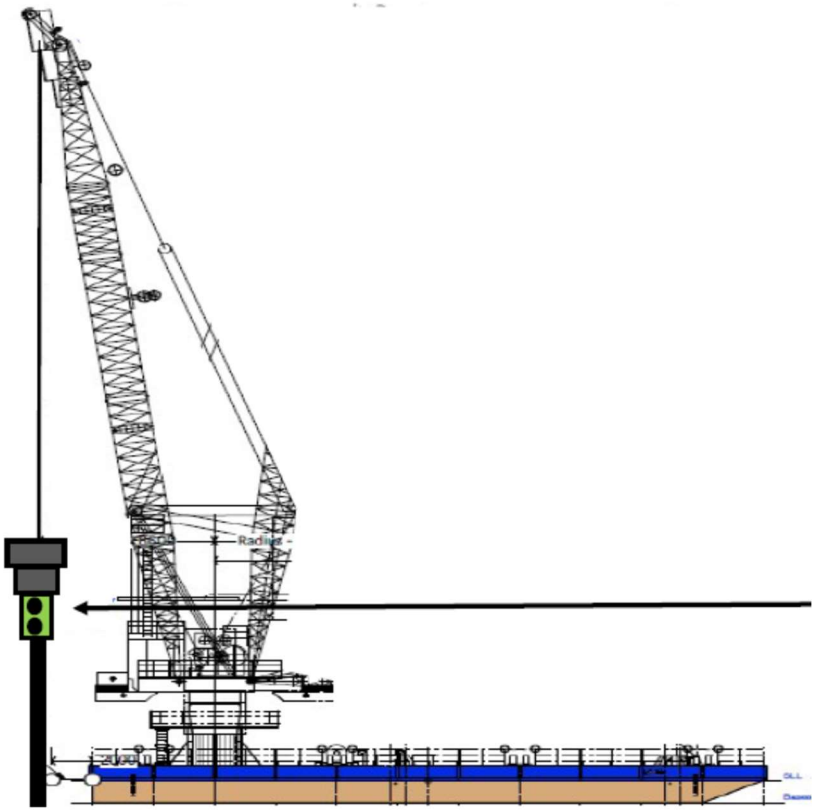


Figure 9 Crane Barge Removing Piles

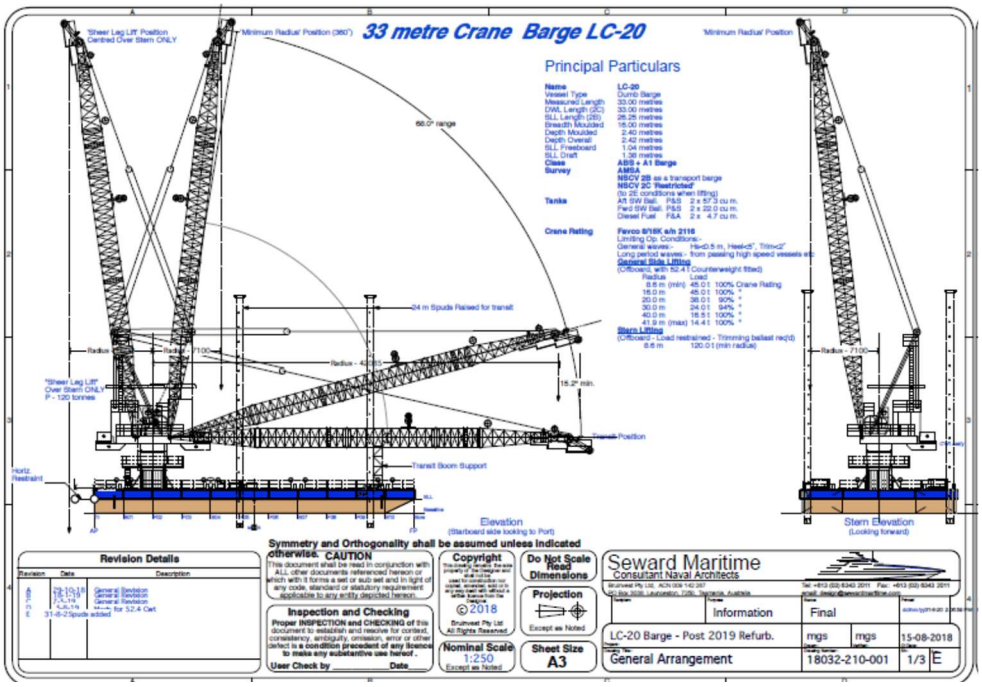


Figure 10 Crane Barge for Demolition

3.3.1 Demolished Materials

Steel (including reinforcing materials for the wharf and piles), ferrous and non-ferrous materials and green waste will be separated for offsite recycling. These materials will be transported by quad dog truck and dogs or semi-tipper trucks.

All hazardous waste including special waste (asbestos) will be transported off-site to a licensed disposal and/or recycling facility, by licensed contractors and tracked using the EPA's online tracking system.

General demolition waste will be loaded into hook bins, semi-tippers or truck & trailers, and transported to a licenced offsite disposal facility. All material types will be quantified and tracked with relevant information captured in the site Waste Register.

All concrete onsite (separated from piles, wharf structures, hardstand and retaining walls) is expected to be removed, relocated on site, crushed and then reused for the piling platform for the next stage of the project.

3.4 As Built Surveys

Upon completion of the demolition work the following surveys shall be conducted:

Certificate of Completion (Wharf);

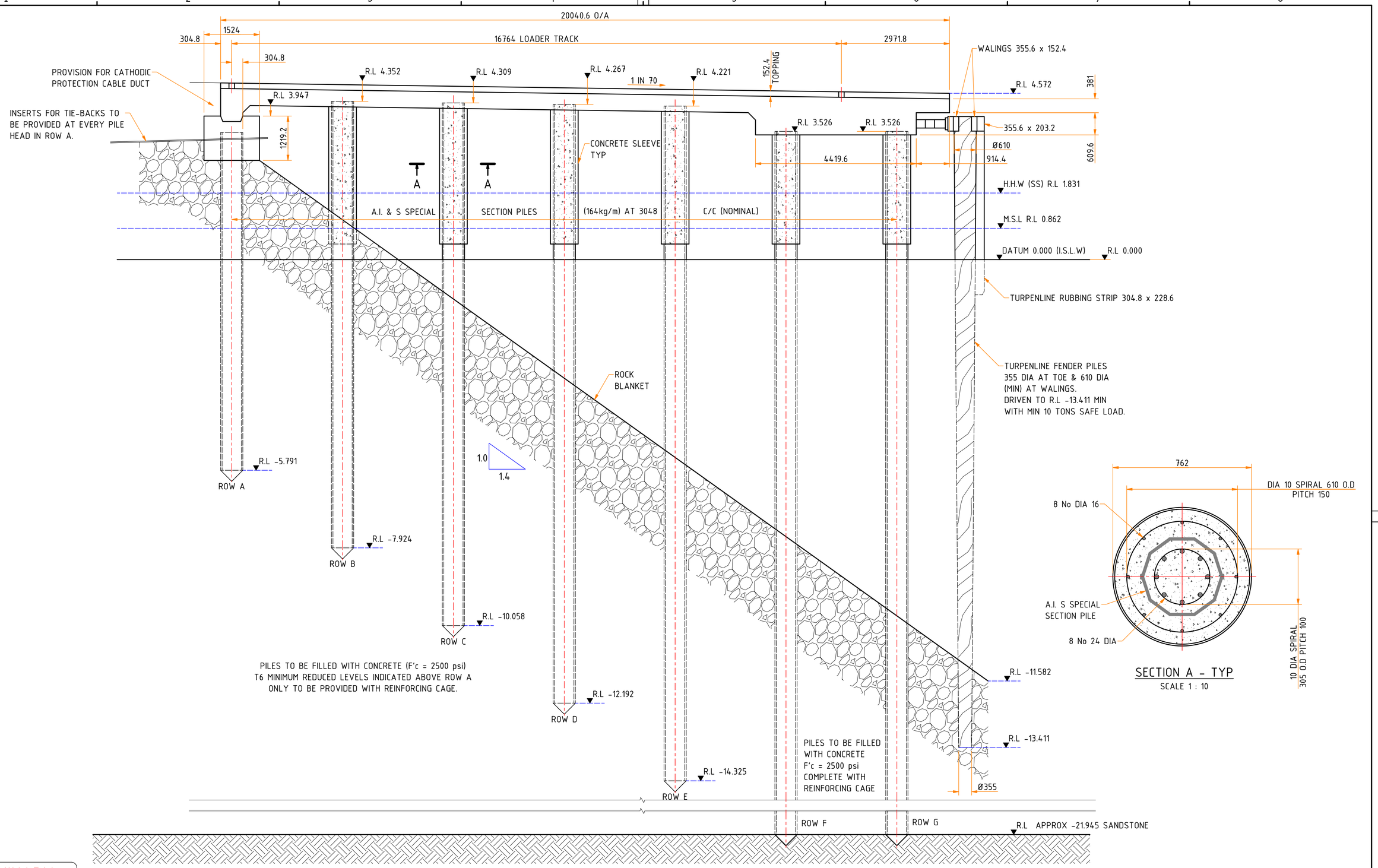
- Work-as-Executed Survey;
- Hydrographic Survey conducted by a Level 1 certified hydrographic surveyor; and
- Port Bed Clearance Report with reference to the Existing Wharf Area, which extends 10m beyond the existing wharf. The Port Bed Clearance Report is to confirm that all

structures and debris which may be considered Hazardous Substance or a hazard to navigation have been satisfactorily removed, that there is no waste material or submerged items remaining on the port bed and any other relevant matters usually included in a port bed clearance report.

Upon completion of the surveys, AIE will issue a Certificate of Completion (Wharf) to NSW Ports.

APPENDIX 1 – Berth 101 Drawings

Document Number	Revision	Title	Document Date	Document Author
CDD-PKCL-MC-C2-0001	A	Port Kembla Coal Terminal Drawing - Berth101 marine civils cross sectional view	28/08/2015	PKCT
CS-1108-SA PAGE 1	6	Construction Surveys Drawing - Port Kembla bunker oil pipeline survey		Construction Surveys
DPW-5-93	B	Dept of Public Works Drawing - Port Kembla Inner Harbour coal loading wharf no1 services details	29/10/1962	NSW Dept. of Public Works
PKCL-MC-C2-0001 and 0003 to 0007		Port Kembla Coal Terminal Drawing - coal berth		PKCT
PKNCL1-MC-C2-0018	A	Port Kembla Coal Terminal Drawing - shiploader wharves - no.1 and no.2 berths - pipe layouts including old MP berth	1/09/1992	PKCT
PKNCL1-MC-C2-0020		Port Kembla Coal Terminal Drawing - no.1 and no.2 berths - mooring layout	1/12/1993	PKCT



SECTION A – TYP

SCALE 1 : 10

MARINE CIVILS BERTH 101 – CROSS SECTIONAL VIEW

SCALE 1 : 50

PRELIMINARY
DRAWING NOT FINAL
NOT FOR CONSTRUCTION

A	DATE 28-08-15	
DRAWING STATUS: PRELIMINARY – NOT FOR CONSTRUCTION		
DRAWN: JOHNNY MANTIS (CDD)		
CHECKED: GRAHAM MASCORD (CDD)		
ENGINEER:		
CONT. NAME: COMBINED DESIGN & DRAFTING P/L		
CLIENT No.: 1667-15069		

DRAWING REVISIONS

DRAWING PRODUCED BY:

Combined Design & Drafting
PO Box 1028 WOLLONGONG, NSW 2500
Ph. 02 4229 5766 Fax. 02 4229 5733
Email: cdd@comb-design.com
A.B.N. 89 099 878 565

REFERENCE DRAWINGS

A1	DATE ORN: 21-08-2015	SCALE: AS NOTED
DRAWN: JOHNNY MANTIS (CDD)		
CHECKED: GRAHAM MASCORD (CDD)		
ENGINEER:		
REGISTRATION APPROVAL:		
CLIENT No.: 1667-15069	FUNCTION LOCATION:	
INVENTOR FOLDER:		

PORT KEMBLA COAL TERMINAL

INVENTOR FILE NAME: CDD-PKCL-MC-C2-0001.idw	INVENTOR PRINT:

MARINE CIVILS
BERTH 101
CROSS SECTIONAL VIEW

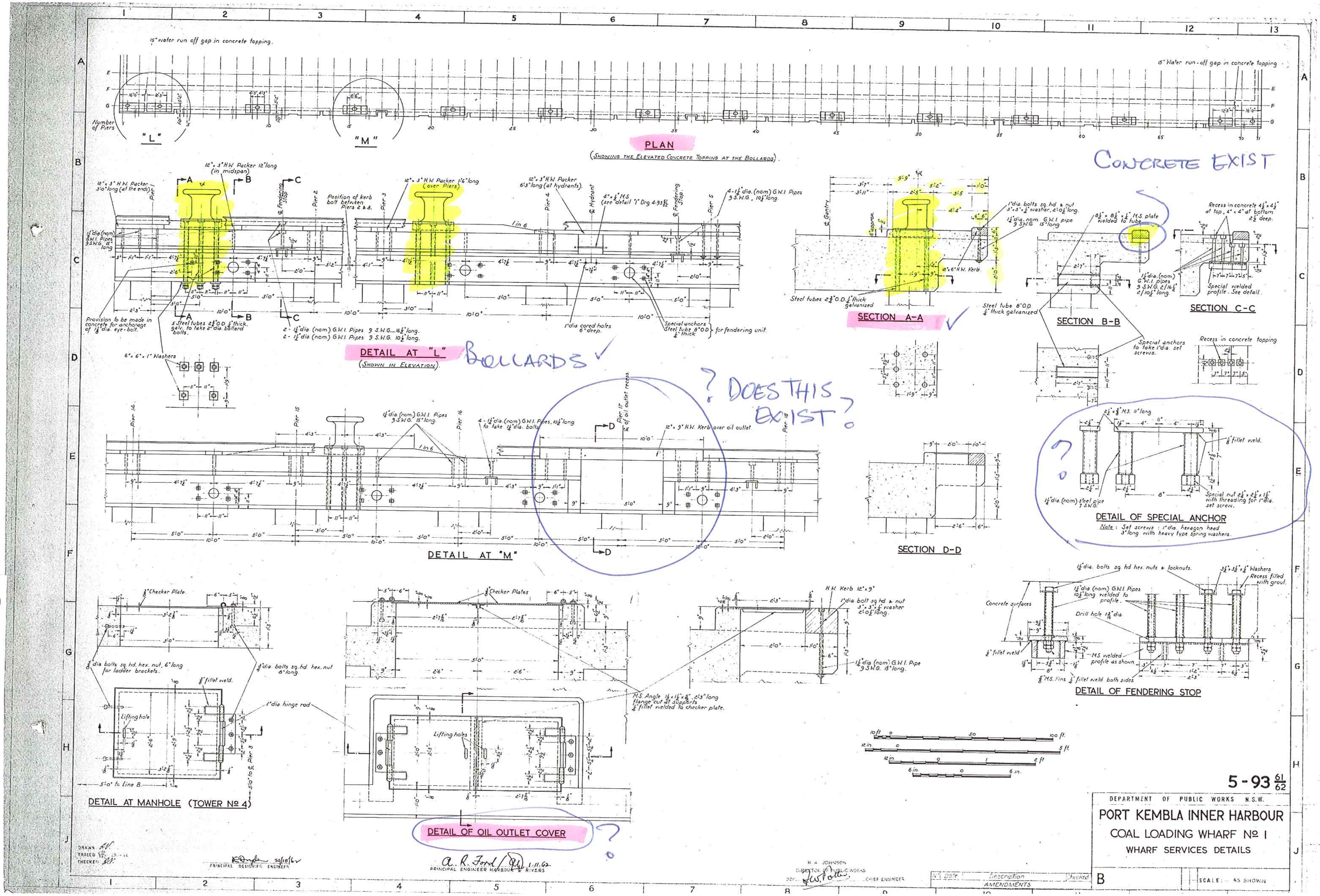
DRAWING No: **CDD-PKCL-MC-C2-0001**

REV No: A

DRAWING STATUS: PRELIMINARY – NOT FOR CONSTRUCTION

FULL SIZE 0 50 100 150 200 250 300

CB1S-3



15" water run off gap in concrete topping.
Number of Piers
"L"
"M"
PLAN
(SHOWING THE ELEVATED CONCRETE TOPPING AT THE BOLLARDS).
CONCRETE EXIST
12" x 3" H.W. Packer 12' long (in midspan)
12" x 3" H.W. Packer 5'0" long (at the ends)
12" x 3" H.W. Packer 1'6" long (over Piers)
12" x 3" H.W. Packer 6'3" long (at hydrants).
Position of kerb bolt between Piers 2 & 3.
1 in 6
Provision to be made in concrete for anchorage of 1¼" dia. eye-bolt.
5 steel tubes 2⅜" O.D. ⅛" thick galv. to take 2" dia. bollard bolts.
2 - 1½" dia (nom) G.W.I. Pipes 9 S.W.G. 16½" long.
2 - 1½" dia (nom) G.W.I. Pipes 9 S.W.G. 10½" long.
1" dia cored holes 6" deep.
Special anchors Steel tube 8" O.D. ¼" thick } for fendering unit.
DETAIL AT "L"
(SHOWN IN ELEVATION).
BOLLARDS
6" x 6" x 1" Washers
SECTION A-A
Steel tubes 2⅜" O.D. ⅛" thick galvanized
Steel tube 8" O.D. ¼" thick galvanized
12" x 6" H.W. Kerb
SECTION B-B
SECTION C-C
Recess in concrete 4½" x 4½" at top, 4" x 4" at bottom 2½" deep.
Special welded profile. See detail.
Special anchors to take 1" dia. set screws.
Recess in concrete topping
? DOES THIS EXIST ?
12" x 9" H.W. Kerb over oil outlet.
DETAIL AT "M"
SECTION D-D
DETAIL OF SPECIAL ANCHOR
Note: Set screws: 1" dia. hexagon head 3" long with heavy type spring washers.
1½" dia. (nom) steel pipe 7 S.W.G.
Special nut 2½" x 2½" x 1½" with threading for 1" dia. set screw.
⅛" fillet weld.
1½" dia. bolts sq. hd. hex. nuts & locknuts.
3½" x 3½" x ¼" Washers
Recess filled with grout.
Concrete surfaces
1½" dia (nom) G.W.I. Pipes 10½" long welded to profile.
Drill hole 1½" dia.
M.S. welded profile as shown
⅝" M.S. Fins ¼" fillet weld both sides
DETAIL OF FENDERING STOP
⅜" Checker Plate.
⅜" Checker Plates
⅝" dia. bolts sq. hd. hex. nut, 6" long for ladder brackets.
⅝" dia. bolts sq. hd. hex. nut 6" long
⅛" fillet weld.
1" dia hinge rod
Lifting hole
Lifting holes
5'0" to line B.
DETAIL AT MANHOLE (TOWER Nº 4)
DETAIL OF OIL OUTLET COVER
M.S. Angle 1½" x 1½" x ¼" 2'3" long flange cut at supports ⅛" fillet welded to checker plate.
H.W. Kerb 12" x 9"
1" dia. bolt sq. hd. & nut 3" x 3" x ⅜" washer 2'0½" long.
1½" dia (nom) G.W.I. Pipe 9 S.W.G. 15" long.
5-93 61/62
DEPARTMENT OF PUBLIC WORKS N.S.W.
PORT KEMBLA INNER HARBOUR
COAL LOADING WHARF Nº 1
WHARF SERVICES DETAILS
PRINCIPAL DESIGNING ENGINEER
PRINCIPAL ENGINEER HARBOURS & RIVERS
H. A. JOHNSON DIRECTOR OF PUBLIC WORKS
CHIEF ENGINEER
AMENDMENTS
SCALE: AS SHOWN

65'-9" overall

1'-0 1/2"

55'-0" Loader Track

9'-9"

Provision for Cathodic protection cable duct

Inserts for Tie-backs to be provided at every pile head in Row A

R.L 12.95

4'-0"

5'-0"

1 in 70

6" Topping (Future)

14.28 | 14.14 | 14.00 | 13.65 | 11.57 | 11.57

Walings 14'-6" x 3'-0"

R.L 15.00

1'-3"

14'x8" 2'-0"

2'-6" dia

Concrete Sleeves

14'-6"

3'-0"

H.H.W.(S.S.) R.L 6.01

M.S.L. R.L 2.83

Datum 0.00 (I.S.L.W.)

Turpentine rubbing strip 12"x3"

A.I.& S. Special Section piles (110.6 lb/ft.) at 16'-0" c/c (Nominal)

Turpentine fender Piles 14" dia at toe + 24" dia (min) at walings

Driven to R.L -44.00 min with min 10 tons Safe Load

140'-0"

2'-6" dia

3/8 dia spiral 2'-0" O.D pitch 6"

8 No 5/8 dia

3" dia spiral @ 2'-0" pitch

A.I.& S. Special section Pile

8 No 1" dia

SECTION THROUGH SLEEVE

Rock Blanket

1.0 : 1.4

Row A -19.0 | Row B -26.0 | Row C -33.0 | Row D -40.0 | Row E -47.0

Piles to be filled with concrete [F_c = 2500 psi] To minimum reduced levels indicated above Row A only to be provided with reinforcing cage.

Row F | Row G

Piles to be filled with concrete F_c = 2,500 p.s.i complete with reinforcing cage

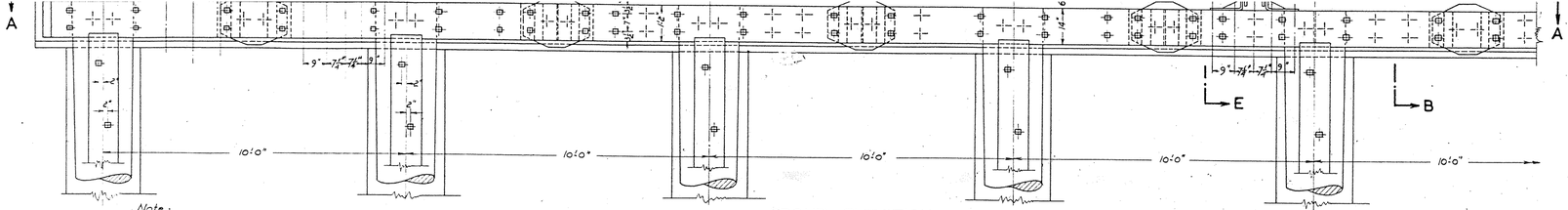
R.L -38.00

R.L -7.20 approx Sandstone

CORAL BERTH PILES

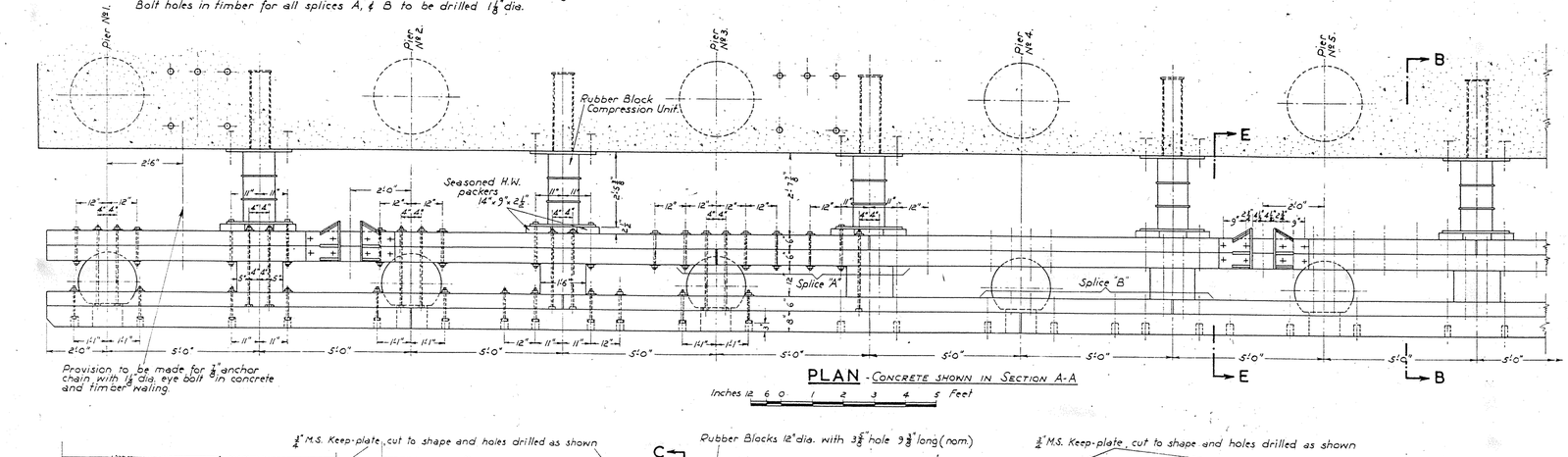
PKCB 128

Q9/5193



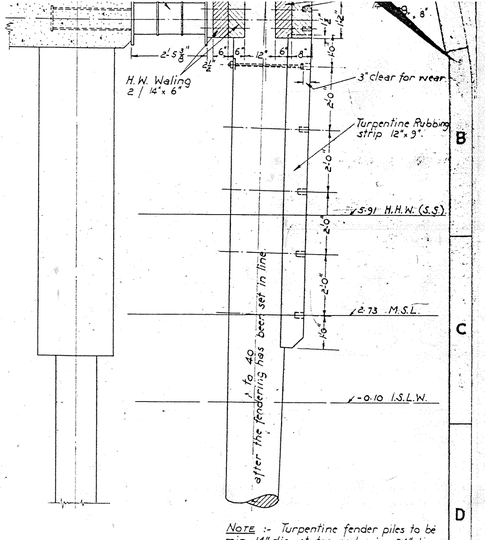
Note :
All bolts, if not otherwise stated, to be 1" dia. sq. hd. & nut with 3½" x 3½" x ¼" washers
All steel surfaces if not galvanized to have an approved paint coating.
Bolt holes in timber for all splices A, & B to be drilled 1⅛" dia.

FRONT ELEVATION

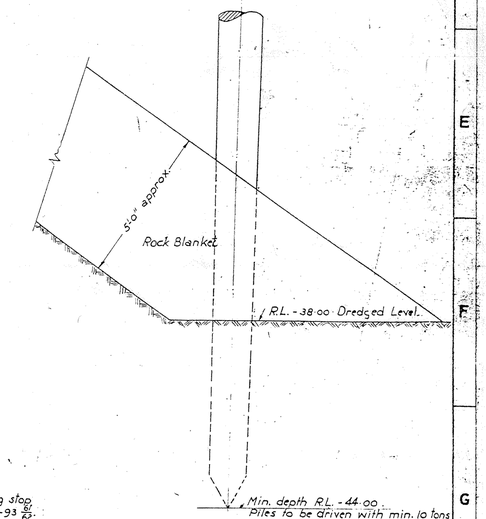


PLAN - CONCRETE SHOWN IN SECTION A-A

Inches 12 6 0 1 2 3 4 5 Feet

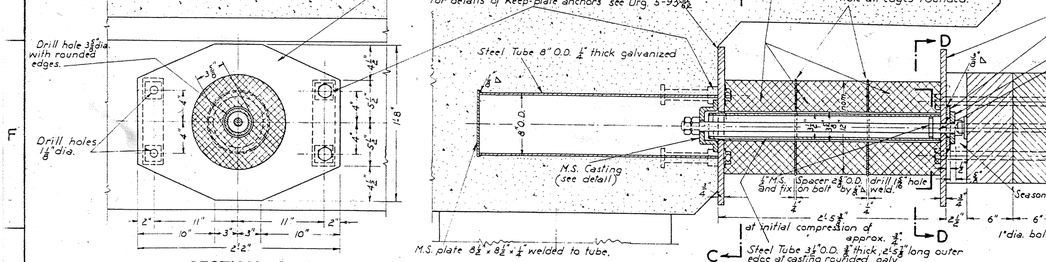


Note :- Turpentine fender piles to be min. 14" dia. at toe and min. 24" dia. at waling.



SECTION B-B

Inches 12 6 0 1 2 3 4 5 Feet

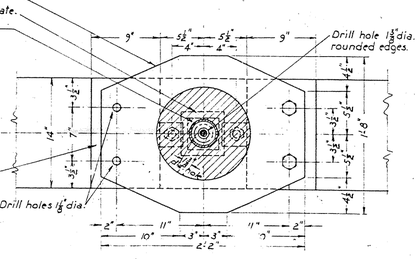


SECTION C-C

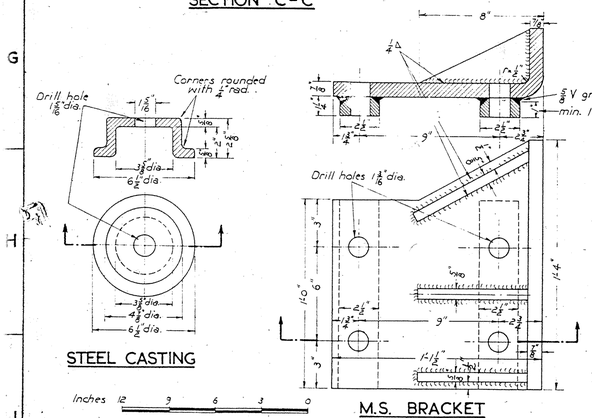
LONGITUDINAL SECTION

RUBBER BLOCK COMPRESSION UNIT DETAIL

Inches 12 9 6 3 0 1 2 Feet



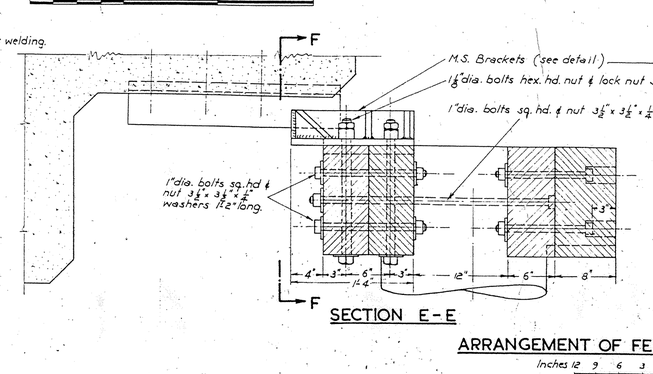
SECTION D-



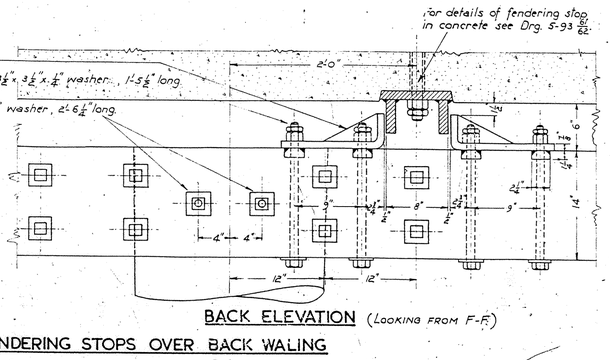
STEEL CASTING

M.S. BRACKET

Inches 12 3 6 3 0



SECTION E-E



BACK ELEVATION (LOOKING FROM F-F)

ARRANGEMENT OF FENDERING STOPS OVER BACK WALING

Inches 12 9 6 3 0 1 2 Feet

DRAWN
TRACED
CHECKED

J.E. Bruden 23/10/62
PRINCIPAL DESIGNING ENGINEER

D.R. Ford / 1.11.62.
PRINCIPAL ENGINEER HARBOURS & RIVERS

R.A. JOHNSON
DIRECTOR OF PUBLIC WORKS
per ... CHIEF ENGINEER

PKCL-MC-C2-0003
6-93 61/62

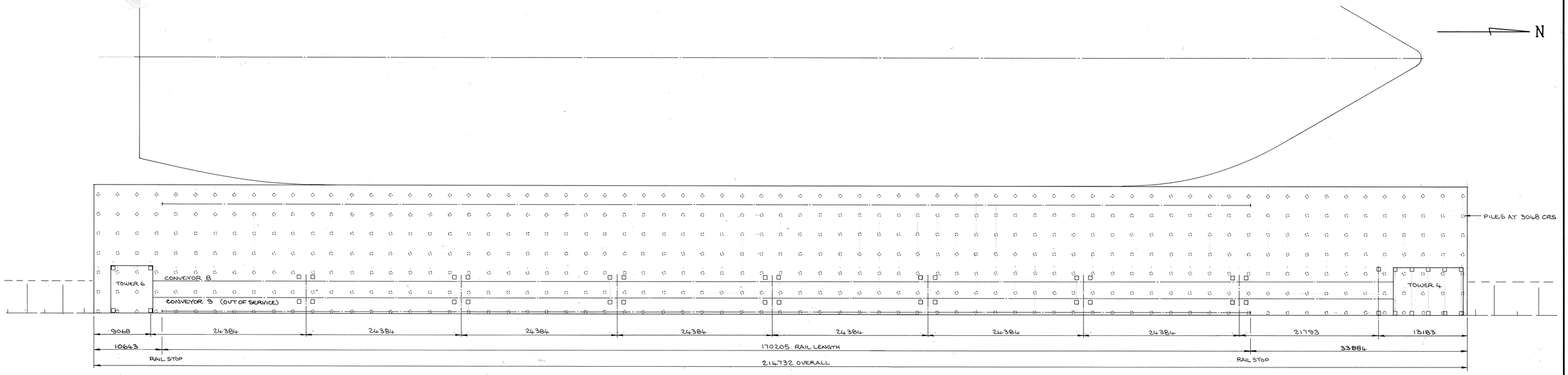
DEPARTMENT OF PUBLIC WORKS N.S.W.

PORT KEMBLA INNER HARBOUR
COAL LOADING WHARF No 1
FENDERING AND DETAILS

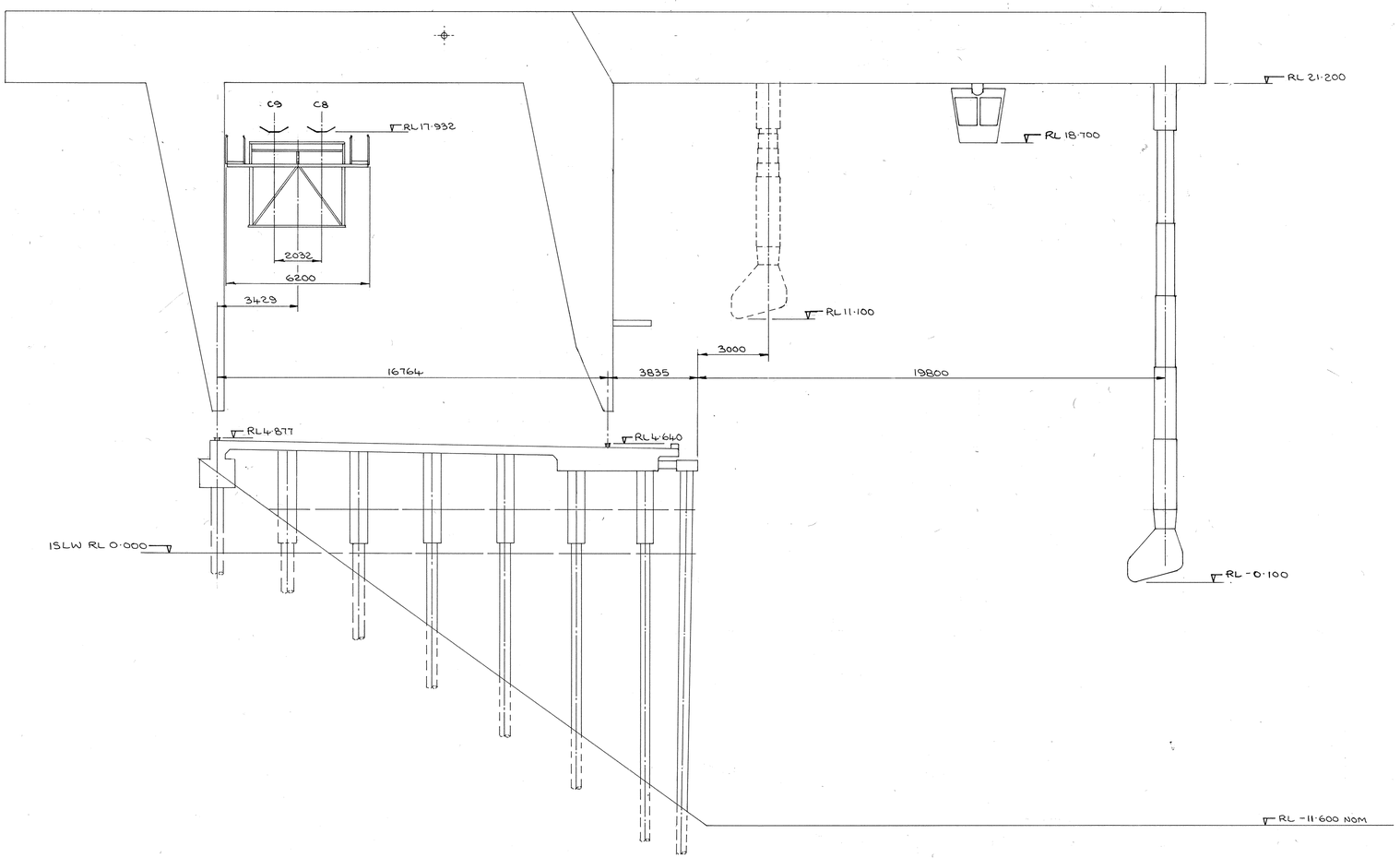
No	Date	Description	Checked
		AMENDMENTS	

B

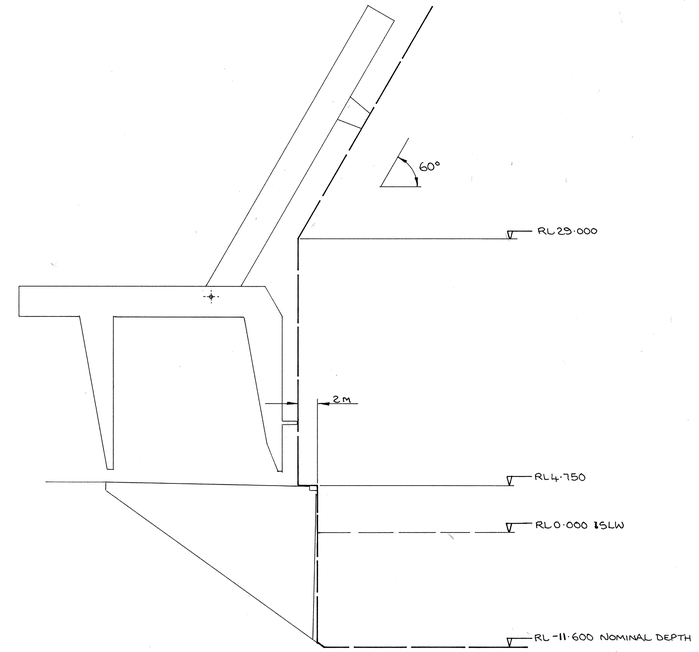
SCALE:- AS SHOWN



PLAN OF WHARF 1:250



SECTION THROUGH WHARF & SHIPLOADER 1:10



SHIPLOADER CLEARANCE BOOM RAISED

REFERENCE DRGS

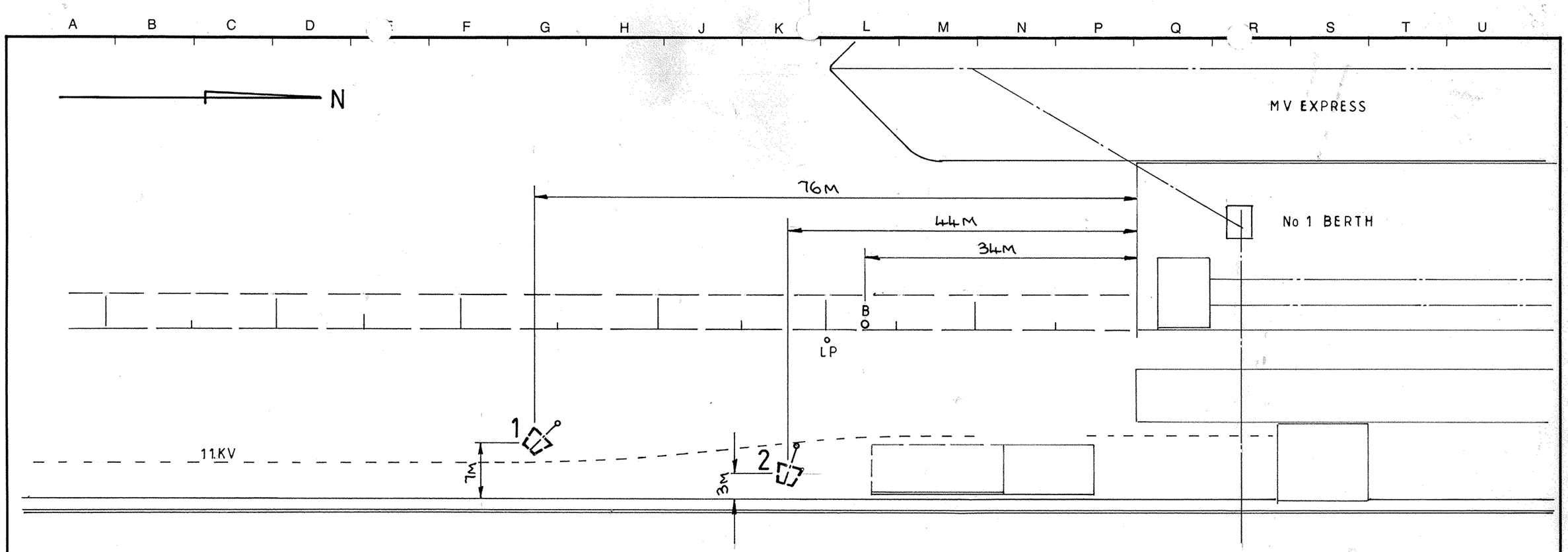
DRG No.	TITLE
PKNCL1-MC-C2-0018	No.1 & 2 BERTHS PILE LAYOUT
PKCL-MC-C2-0001	No.1 BERTH PILE DETAILS
PKCL-MC-C2-0002	No.1 BERTH CLEARANCE & LOADING DIAGRAM
PKCL-MC-C2-0003	No.1 BERTH FENDERING DETAILS

PORT KEMBLA COAL TERMINAL LIMITED
Port Kembla Road, Inner Harbour
PO Box 823
WOLLONGONG EAST NSW 2520
AUSTRALIA
Tel (042) 280288
Fax (042) 287605
A.C.N. 003 942 774

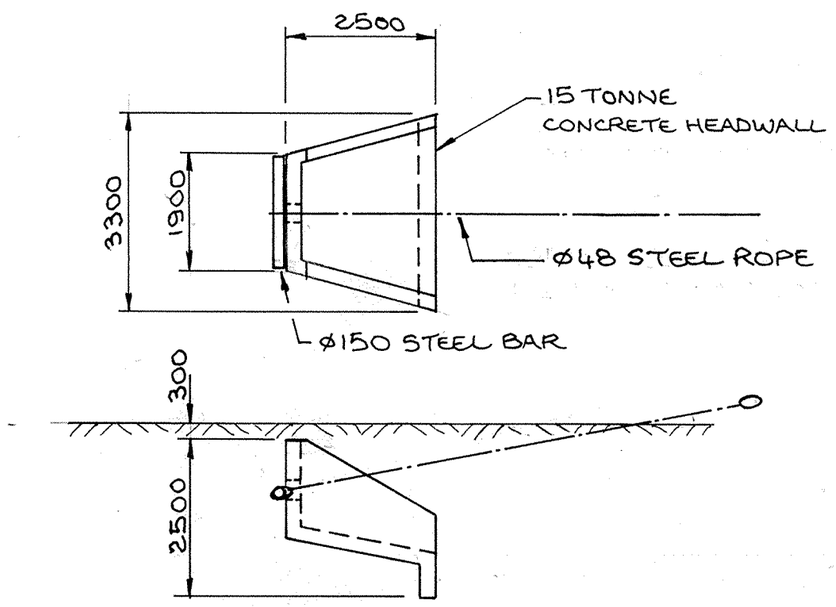
SCALE 1:250 1:10	DRAWN	R.GEORGE	SEPT. 93
	CHECKED		
	ENG		

OLD LOADER
No. 1 BERTH
WHARF LAYOUT & SHIPLOADER CLEARANCES

DRG No. PKCL-MC-C2-0004 REV.



PLAN



MOORING BLOCK

SAFE WORKING LOAD 20 TONNE EACH

PORT KEMBLA COAL TERMINAL LTD

Port Kembla Road Inner Harbour
P.O. Box 823
WOLLONGONG EAST NSW 2520
AUSTRALIA

Tel (042) 280288
Fax (042) 287605
A.C.N. 003 942 774

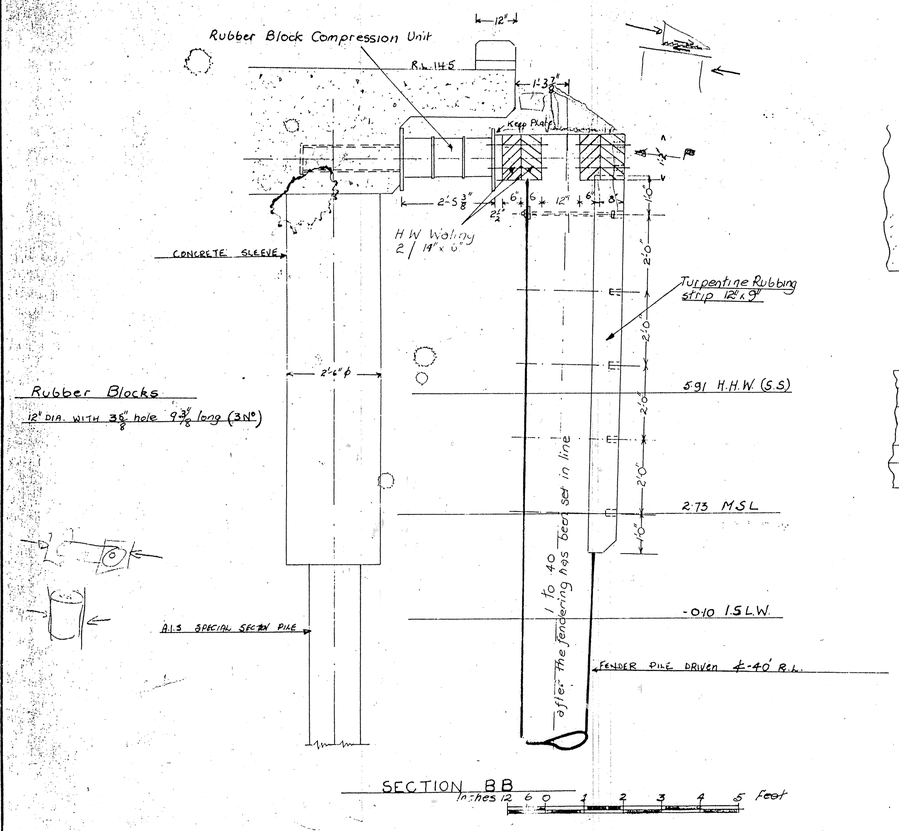
SCALE	1:500 1:100
DRAWN	R.GEORGE 3-93
CHECK'D	
ENG	G.MARSH

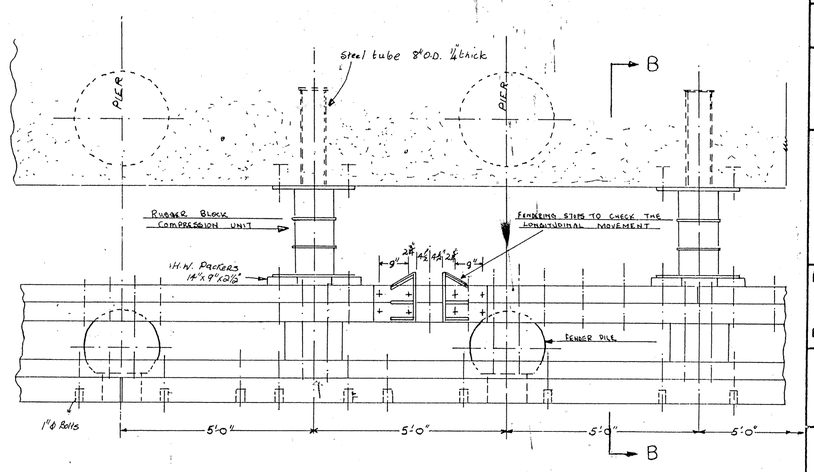
No.1 BERTH
AUXILIARY MOORING POINTS

DRG No. PKCL-MC-C2-0005

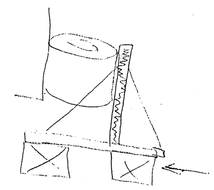
SHEET
OF

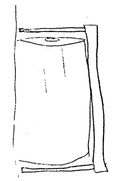
REV.



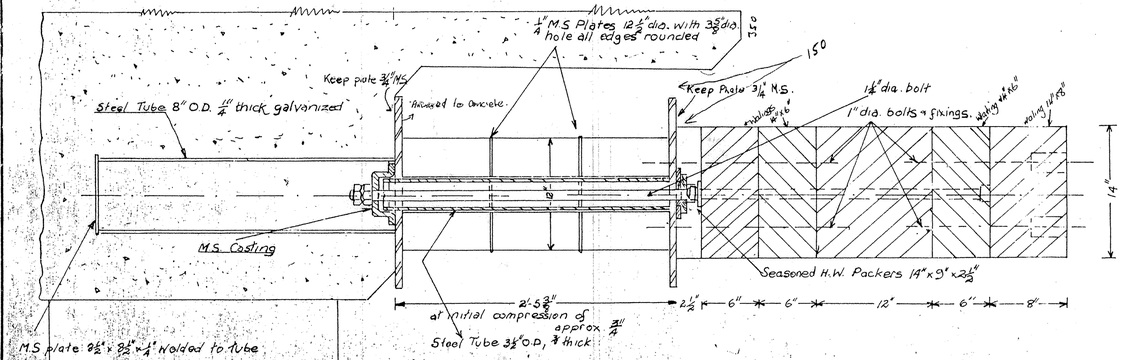


PLAN OF FENDERING SYSTEM





Rubber Blocks 12" dia. with 3⅜" hole 9⅞" long (nom)



LONGITUDINAL SECTION

RUBBER BLOCK COMPRESSION UNIT DETAIL

Inches 12 9 6 3 0 1 2 Feet

PORT KEMBLA INNER HARBOUR
COAL LOADING WHARF
FENDERING AND DETAILS
EXISTING SYSTEM

PKCL-MC-C2-0006

P74 185CB

B3 23.9.71

NOTES

DEPARTMENT OF PUBLIC WORKS
NEW SOUTH WALES
J.C. HUMPHREY, DIRECTOR

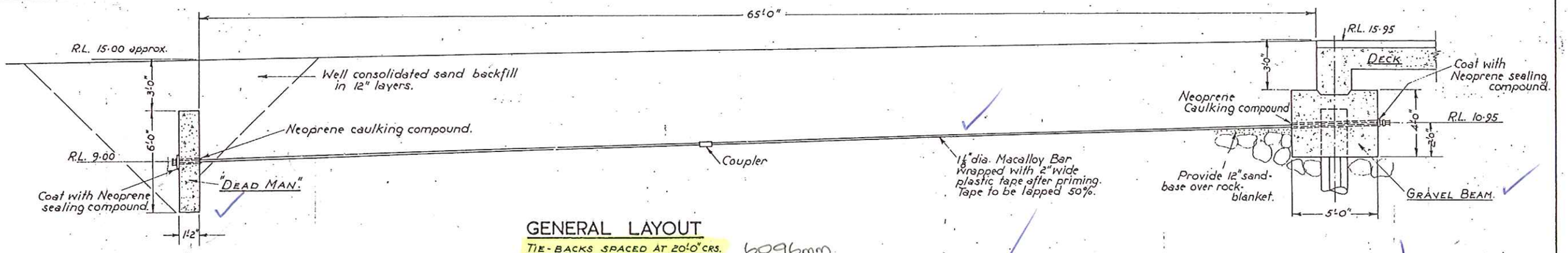
E.H. FARMER GOVERNMENT ARCHITECT

PRINCIPAL ENGINEER

SCALE:

SHEET NUMBER
IN SET NUMBER

PLAN NO.

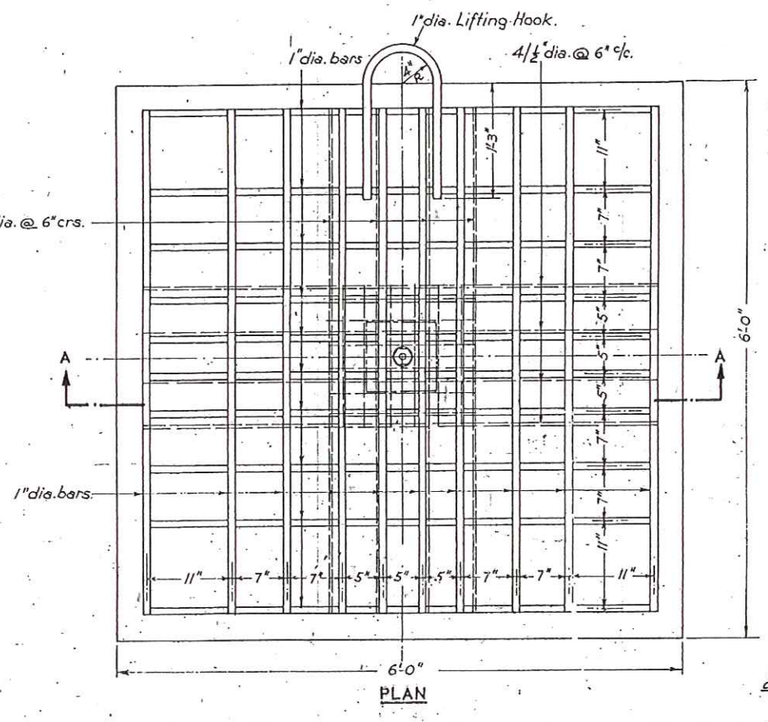


GENERAL LAYOUT

TIE-BACKS SPACED AT 20'-0" CRS.
36 No. REQUIRED

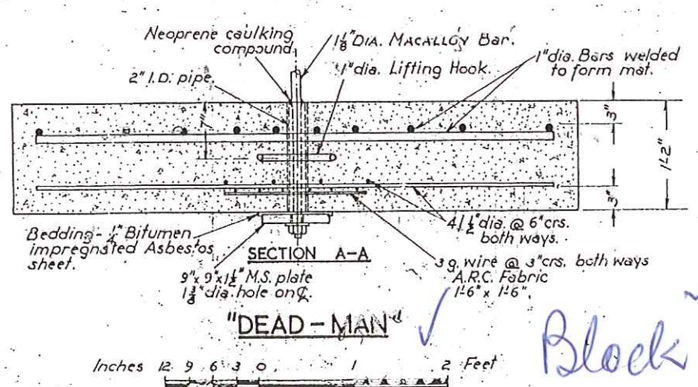
Feet: 0 1 2 3 4 5 6 7 8 9 10

6096mm (Every second pile) ✓



PLAN

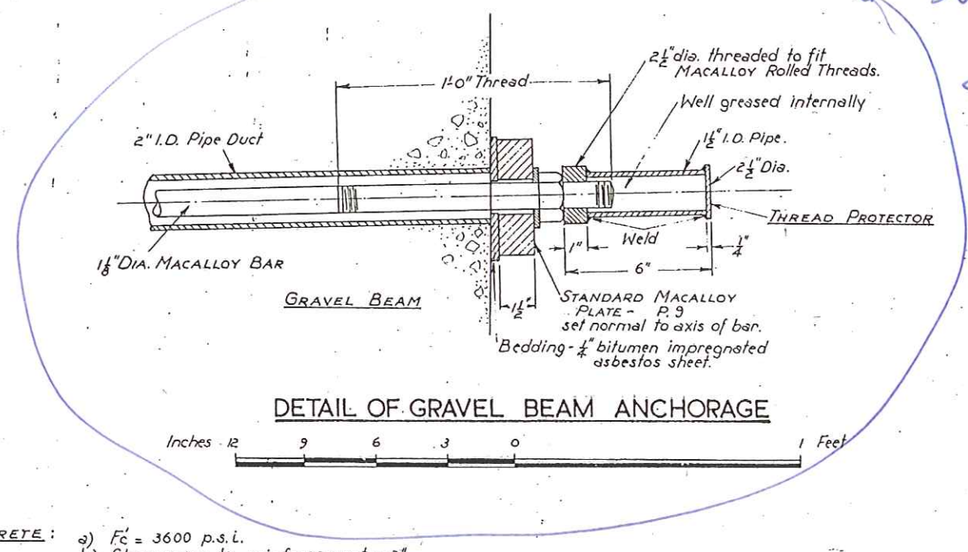
WEIGHT - 2·8 TONS (APPROX.)



"DEAD-MAN" ✓

Inches 12 9 6 3 0 1 2 Feet

Block without Reo.



DETAIL OF GRAVEL BEAM ANCHORAGE

Inches 12 9 6 3 0 1 Feet

max. Do you need this in full detail?

NOTES

1. CONCRETE:
   a) F'c = 3600 p.s.i.
   b) Clear cover to reinforcement = 3".
   c) "Dead-Man" to be cast with 1"dia. bars near bottom face of form.
2. MACALLOY BARS:
   a) All bars 1⅛"dia. with rolled threads.
   b) Length of complete bar over plates:- 69'-11½".
   c) When ordering specify the following thread lengths:-
      At "Dead-man" - 4".
      At Gravel beam - 12".
   d) End plates, washers & nuts to be coated with Neoprene sealing compound.
   e) STRESSING PROCEDURE
      Initial Tension = 5 Tons (approx.).
      Screw nut up finger tight. Stress bar with spanner to give an extension of ¾". After 24 hours relax the tension and measure the recovery. Restress the bar ⅜" from the new initial position. Keep repeating the procedure until the relaxation is eliminated. Check the stress in the bar by the procedure outlined above 4 weeks later.

PKCL-MC-C2-0007 9-93 61/62

DEPARTMENT OF PUBLIC WORKS, N. S. W.

PORT KEMBLA INNER HARBOUR
COAL WHARF No 1
DETAILS OF TIE-BACKS

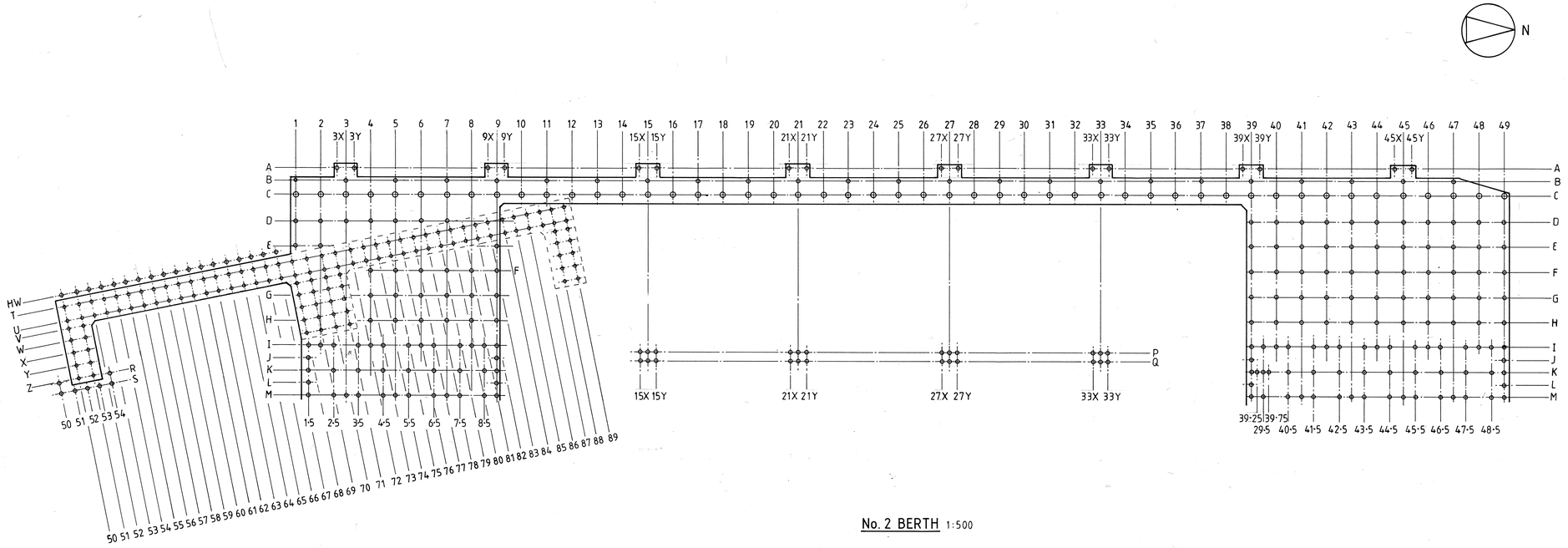
C | SCALE :- AS SHOWN

DRAWN N.F.B.
TRACED
CHECKED

J.E. Dyden 16.7.62
PRINCIPAL DESIGNING ENGINEER

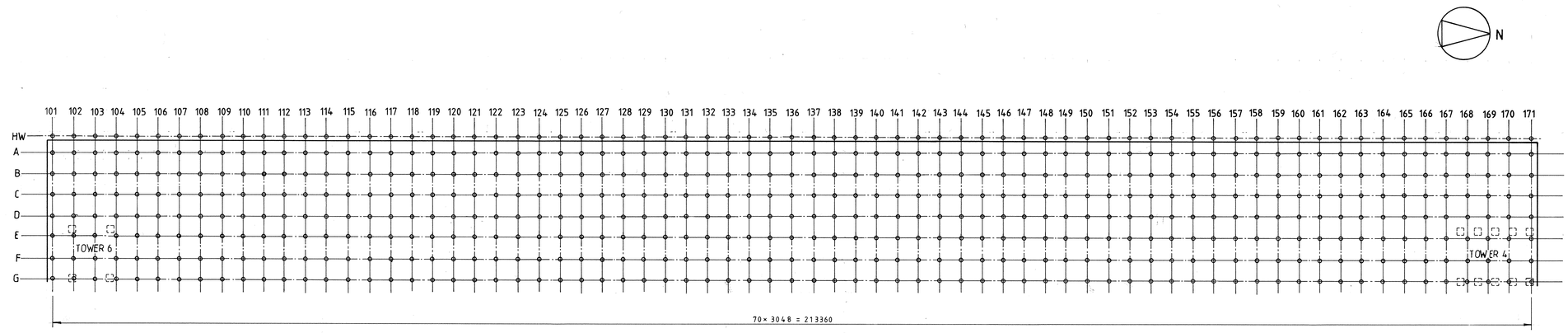
A.R. Ford 20.7.62
PRINCIPAL ENGINEER HARBOURS & RIVERS

R. A. JOHNSON
DIRECTOR OF PUBLIC WORKS
per ..... CHIEF ENGINEER



No. 2 BERTH 1:500

ROW	NUMBER	TYPE
A	16	BHP 2 PART HOLLOW STEEL 16MM WALL
B	24	
C	49	1200 OD x 20 WALL STEEL TUBE
D	18	BHP 2 PART HOLLOW STEEL 16MM WALL
E	14	
F	17	
G	17	
H	17	
I	30	
J	4	
K	20	
K	3	450 OD x 10 WALL STEEL TUBE
L	4	BHP 2 PART HOLLOW STEEL 16MM WALL
M	28	
N	6	
P	12	
Q	12	850 OD x 16 WALL STEEL TUBE
R	2	
S	5	
T	40	BHP 2 PART HOLLOW STEEL 16MM WALL
U	40	
V	8	
W	8	
X	8	
Y	8	
Z	8	
HW	18	355 TO 700 DIA. TURPENTINE TIMBER



No. 1 BERTH 1:300

ROW	NUMBER	TYPE
A	72	BHP 2 PART HOLLOW STEEL 16MM WALL
B	72	
C	72	
D	72	
E	72	
F	72	
G	72	
HW	72	355 TO 700 DIA. TURPENTINE TIMBER

REFERENCE DRGS

PKNCL1-MC-C2-0012	SHIPLOADER WHARF (No.2) PILING PLAN
DRG No.	TITLE

A	RG	26-10-92
TIMBER PILES ADDED		

PORT KEMBLA COAL TERMINAL LIMITED
Port Kembla Road, Inner Harbour
PO Box 823
WOLLONGONG EAST NSW 2520
AUSTRALIA
Tel (042) 280288
Fax (042) 287605
A.C.N. 003 942 774

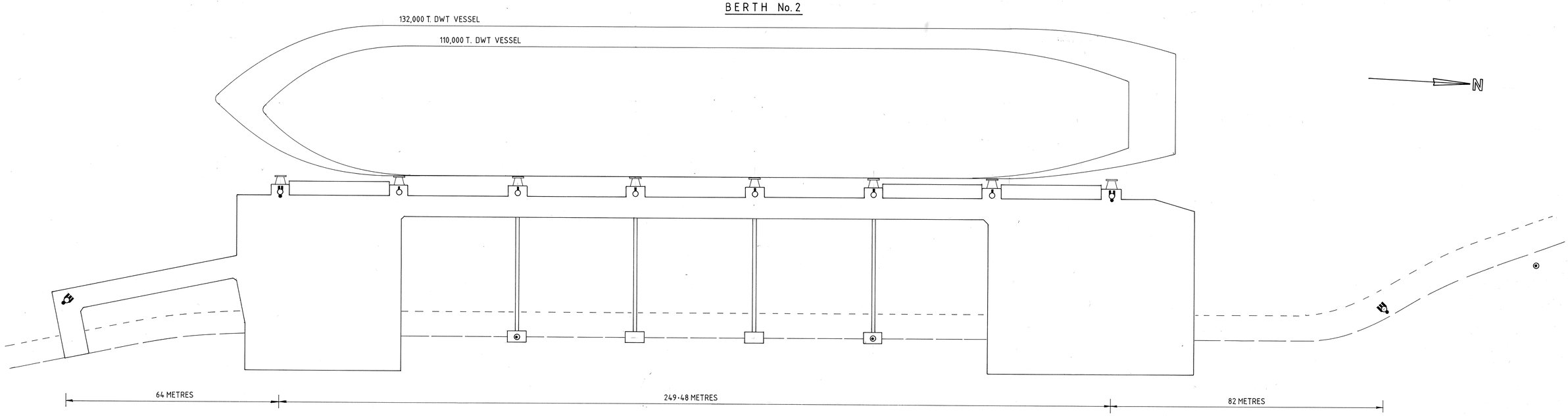
SCALE 1:500 1:300	DRAWN	R. George.	Sept. 92
	CHECKED		
	ENG		

SHIPLOADER WHARVES
No. 1 & No. 2 BERTHS
PILE LAYOUTS (INCLUDING OLD M P BERTH)

DRG No. PKNCL1-MC-C2-0018

REV. A

BERTH No. 2



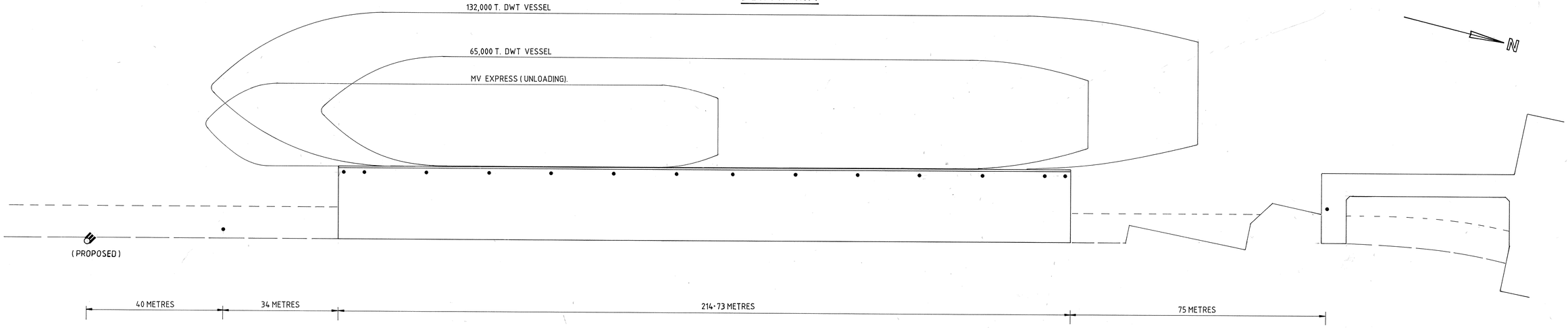
FENDERS

BERTHING ANGLE	0 °	15 °
DEFLECTION	55 %	55 %
ENERGY ABSORBTION (T - M)	201·6	116
REACTION (TONNES)	233·68	210·31

MOORINGS

- 1 x 100 TONNE QUICK-RELEASE HOOK
- 2 x 100 TONNE QUICK-RELEASE HOOKS & 10 T CAPSTAN
- 3 x 100 TONNE QUICK-RELEASE HOOKS & 10 T CAPSTAN
- 100 TONNE BOLLARD

BERTH No. 1



MOORINGS

- 3 x 60 TONNE QUICK-RELEASE HOOKS
- 60 TONNE BOLLARD

REFERENCE DRGS

DRG No.	TITLE

PORT KEMBLA COAL TERMINAL LIMITED
Port Kembla Road, Inner Harbour
PO Box 823
WOLLONGONG EAST NSW 2520
AUSTRALIA
Tel (042) 280288
Fax (042) 287605
A.C.N. 003 942 774

SCALE 1: 500	DRAWN	R.George	Dec. 93
	CHECKED		
	ENG		

No. 1 & No. 2 BERTHS MOORINGS LAYOUT

DRG No. PKNCL1-MC-C2-0020

REV.

Appendix B

Remediation Works Plan

Australian Industrial Energy

Port Kembla Gas Terminal

Remediation Work Plan (Terminal Site)

March 2021

Abbreviations and definitions

Abbreviation	Definition
AEC	Area of environmental concern
AIE	Australian Industrial Energy
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Guideline
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASLP	Australian Standard Leaching Procedure
ASS	Acid sulfate soils
BaP	Benzo(a)Pyrene
BTEXN	Benzene, toluene, ethyl benzene and xylenes plus naphthalene
CEMP	Construction Environmental Management Plan
CD	Chart Datum
CLM Act	Contaminated Land Management Act 1997(incorporating amendments made by the Contaminated Land Management Amendment Act 2003)
COPC	Contaminant of potential concern
CSM	Conceptual Site Model
CT1 etc	Contaminant Threshold (waste classification criteria)
DGV	Default guideline values
DP	Deposited Plan
DQI	Data quality indicators
DQO	Data quality objectives
EIL	Ecological Investigation Level
ERL	environmental risk limits
ESL	Ecological Screening Level
FSRU	Floating Storage and Regasification Unit
<	Less than (laboratory reporting limit)
Ha	Hectare
HAT	Highest Astronomical Tide
HIL	Health Investigation Level (relating to defined land use scenario)
HSL	Health Screening Levels
ISQG	Interim Sediment Quality Guideline
LAA	Licenced Asbestos Assessor
LAT	Lowest Astronomical Tide
LNG	Liquified natural gas
LOR	Limit of reporting
mAHD	Elevation in metres from Australian Height Datum
MHW	Mean High Water
MLW	Mean Low Water
mbgl	Metres below ground level
mg/kg	Milligrams per kilogram
NATA	National Association of Testing Authorities of Australia
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NOHSC	National Occupational Health and Safety Commission
NSW EPA	New South Wales Environmental Protection Authority
OEH	Office of Environment and Heritage

Abbreviation	Definition
OHDSCA	Outer Harbour Dredged Spoil Containment Area
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated Biphenyl
pH	-log[H]
PID	Photo-ionisation detector
PKCD	Port Kembla Chart Datum
PKHD	Port Kembla Height Datum
ppm	Parts per million
QA/QC	Quality assurance/quality control
RPD	Relative percentage difference
RWP	Remediation Work Plan
SAQP	Sampling and Analysis Quality Plan
SCC	Specific contaminant concentration (waste classification criteria)
SCr	Chromium reducible sulfur
SRC	Serious Risk Concentrations
SWL	Standing water level
TCLP	Toxicity Characteristics Leaching Procedure
TEQ	Toxicity Equivalence Quotient
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
UCL	Upper Confidence Limit
ug/L	Micrograms per litre
WHS	Work Health and Safety

Table of contents

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Figure index

Appendices

1. Introduction

1.1 Overview

Australian Industrial Energy (AIE) commissioned GHD Pty Ltd (GHD) to prepare a Remediation Works Plan (RWP) for the demolition and remediation works at Berth 101 at the Port Kembla Gas Terminal (the project) in Port Kembla, New South Wales (NSW). The project involves the development of a liquified natural gas (LNG) import terminal at Berth 101 in the Inner Harbour and the installation of new pipeline to connect to the existing gas transmission network. The area in which these works will be undertaken ("the site") is shown on Figure 1 in Appendix A.

1.2 Background

The project involves the development of an LNG import terminal including a Floating Storage and Regasification Unit (FSRU) semi-permanently moored at Berth 101, and the installation of new pipeline to connect to the existing gas transmission network. The existing Berth 101 infrastructure will be demolished and then excavated and dredged to accommodate the new berth pocket to accommodate the FSRU and an adjoining LNG Carrier. Material excavated / dredged from Berth 101, will be placed into a barge which will then transport the material to the Outer Harbour Dredged Spoil Containment Area (OHDSCA).

The development has progressed to the early works stage at Berth 101 (the site), which includes the demolition and removal of all existing surface infrastructure, and disconnection and removal of all underground services. For the purposes of this RWP, these works are referred to as the "Berth 101 demolition works". AIE has indicated that excavation to 2.5 m Port Kembla Height Datum (PKHD) will be required to facilitate the demolition process. This equates to approximately 1.6 m to 4.2 metres below ground level (m bgl). At this stage, material excavated as part of the demolition / remediation process will be segregated into contaminated and uncontaminated materials, with contaminated materials either disposed off-site or segregated for further management and uncontaminated materials stockpiled and managed at the southern end of the eastern stockyard or at the Outer Harbour stockpiling area until the next stage of construction.

GHD previously carried out a contamination assessment of Berth 101 in 2018 as part of the Environmental Impact Statement (EIS) prepared for the proposed development. The contamination assessment identified two benzo(a)byrene (BaP) toxicity equivalence quotient (TEQ) hotspots at depths at 4.20 m and 4.75 m below ground level (bgl) (1.74 m and 0.13 m PKHD) within fill/reclaimed sands with concentrations above the criteria for human health (commercial/industrial land use). These hotspots were further investigated by GHD as part of an additional targeted investigation (GHD, 2021b) to refine the lateral and vertical extent of the hotspots and assess the significance of the contamination identified and potential risks it may pose to marine ecosystems in the Outer Harbour. In addition to the hotspots, GHD (2021b) also provided further assessment of leachability of fill materials (Fill, Unit 1 and Unit 2) present on site and limited investigation of the extent of PCB contamination in the vicinity of the substation that remains on site. Data gaps remain beneath the substation.

The following investigations have been prepared for the site since 2018 and have been used in preparation of this RWP:

- GHD (2018a), *Contamination Assessment report for Berth 101.* GHD, October 2018) (GHD, 2018a)
- GHD (2021a), *Baseline Contamination Assessment. Southern Part of Lot 22 DP 1128396, Port Kembla*. GHD, February 2021. (GHD, 2021a)
- GHD (GHD, 2021b), *DRAFT - Port Kembla Gas Terminal. Additional Targeted Investigation – Berth 101*. *Yet to be issued.*
- AIE (2021), *Port Kembla Gas Terminal - Demolition Scope of Work. PKGT-DEM-SOW-0001*. Australian Industrial Energy, January 2021. (AIE, 2021)

The above reports/specifications may be part of review being undertaken by NSW EPA accredited site auditor, Melissa Porter, who has been appointed by AIE to review various documentation associated with the contaminated land aspects of the project, and in particular to verify compliance with the following Infrastructure Approval Conditions from the approval for SSI 9471 (dated 24 April 2019):

Condition 8 - Emplacement Cell Design Objectives

- Emplacement cells must be designed and constructed to:

  e) Ensure that contaminated materials are not used for cell bunding and that the potential for acute and chronic toxicity impacts to marine life that might colonise the outer bunds is minimised.

Condition 11 - Spoil Management Plan

- 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, DoI Lands & 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:

  a) A Contaminated Spoil Protocol that includes:

  – procedures for identifying and managing unexpected finds of contaminated or asbestos containing materials along the pipeline route and at Berth 101;
  – a strategy for addressing any contamination that has been encountered, if required (including the remediation and/or removal of contaminated soil or groundwater); and
  – details on how environmental and health risks will be mitigated and managed;

Condition 13 – Site Audit Statement

- 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. [GHD notes that “the site” is not defined, but assumes in the context of preceding conditions that this is likely to be the emplacement cell site].

These reports should be read in conjunction with the summary of previous investigations (described in Section 2), as the basis for preparation of this RWP.

1.3 Purpose of the RWP

The purpose of this RWP is to manage contamination issues during the Berth 101 demolition works, to support subsequent excavation and dredging of material and transfer to the off-site areas of the project. The RWP provides a description of the remediation program, and the procedures and standards to be followed during the course of the project, to ensure the successful management of contamination at the site and consequently the protection of the environment and human health.

This RWP is intended to be read in conjunction with the Spoil Management Plan required by Condition 11 of the Approval. Where there is any inconsistency between this RWP and any approved management plans, the more stringent requirements will apply.

It is understood that this RWP is subject to review by the Site Auditor.

1.4 Objectives

The objectives of the RWP are to:

- Set remediation goals relevant to subsequent removal and off-site emplacement of material, so that material can be appropriately managed and will pose no unacceptable risk to human health or the environment under those designated end uses.
- Document the selected remediation techniques and procedures selected to address the identified site contamination issues.
- Document a sampling and analysis plan to validate or characterise material exposed or excavated as part of the demolition works, including to address data gaps remaining from existing investigations.
- Document procedures to enable appropriate management of material prior to removal from site as part of subsequent stages of work. This RWP is not intended to provide procedures for the subsequent stages of material movement or off-site emplacement.
- Establish the various safeguards required to complete aspects of the demolition and materials handling work relating to contamination in a safe and environmentally acceptable manner.
- Identify the necessary approvals and licences required by regulatory authorities in order to enable the demolition works to proceed (in relation to contamination issues only).

1.5 Scope of work

The scope of works to meet the stated objectives comprised the following:

- A summary of site details and information including results of previous investigations
- A description of the proposed site use or development
- A summary of the site contamination status
- Document measures to address any recommendations from the previous investigations including additional sampling as required (during demolition/remediation)
- Provide remediation goals and objectives relevant to subsequent removal and off-site emplacement of material, so that material can be appropriately managed and will pose no unacceptable risk to human health or to the environment
- Summarise remediation / management options and the rationale behind the selection of the preferred remediation strategy

- Details of the preferred remediation strategy and any required monitoring during and after the implementation of the preferred remediation method
- Document procedures and plans to be implemented to reduce risks to acceptable levels for the proposed site works and management of material, including an Unexpected Finds Protocol (UFP)
- Describe validation and characterisation sampling methodologies for areas subject to disturbance as part of the demolition works, including an analytical schedule
- Specify clean up and validation criteria required
- Establish the environmental safeguards required to complete the demolition works (in relation to contamination issues) in an environmentally acceptable manner, including protocols for excavated materials
- Identify the necessary approvals and licences required by regulatory authorities to complete demolition works (in relation to contamination issues only).

1.6 Roles and responsibilities

The roles and responsibilities of the various parties involved in the Berth 101 Demolition Works are outlined in Table 1-1 below.

Table 1-1: Roles and responsibilities

Role	Responsibilities
AIE Project Manager (to be confirmed)	Responsible for overall funding and direction of civil and environmental work associated with the demolition works. Responsible for the overall control of the site.
Demolition / Remediation Contractor (Contractor) (to be confirmed)	Responsible for required civil works (i.e. demolition and any associated works), including all measures required to protect worker and public health and the environment during the works. * It should be noted that the remediation contactor may engage their own environmental consultant, who may take on some of those responsibilities listed for the Environmental Consultant below.
Environmental Consultant (to be confirmed)	Responsible for providing technical guidance to the Contractor in appropriately implementing the requirements of the RWP, monitoring of work areas for environmental purposes, collection and analysis of validation and characterisation samples, and advising AIE of appropriate actions on the basis of observations, sampling and analysis. Responsible for preparing the Remediation and Validation Report (RVR) at the completion of remediation.
NSW EPA Accredited Site Auditor (Melissa Porter)	Responsible for reviewing work of Environmental Consultant to verify compliance with relevant Infrastructure Approval Conditions from the approval for SSI 9471 (dated 24 April 2019).

1.7 Limitations

This RWP is limited to management of contamination issues during the demolition works stage of the project and is not intended to:

- Address demolition activities, nor HSE or regulatory requirements except in relation to management of site contamination
- Provide procedures for the subsequent stages of material movement or off-site emplacement
- Provide procedures to be followed during subsequent bulk excavations and dredging works to remove Berth 101 and create the new berth.

This RWP is not intended to replace approved management plans, but to be read in conjunction with them – as referenced in Section 10.1.

2. Proposed development

As noted in Section 1.1, the project involves the development of an LNG import terminal including a FSRU semi-permanently moored at Berth 101, and the installation of new pipeline to connect to the existing gas transmission network.

AIE has indicated that the material from Berth 101 will be excavated / dredged, placed into a barge which will transport the material to the OHDSCA where it will either be reused in the perimeter bund or placed within the OHDSCA itself (Refer to Figure 2-1: Location of dredge area and disposal area (OHDSCA) (provided by AIE)

).

Materials previously identified as fill (Fill), reclaimed sands and alluvium (Unit 1A/1B) will be used to form a perimeter bund, within which will be contained remaining excavated / dredged materials (i.e. estuarine soils, residual soils, weathered rock, harbour sediments and muds). A portion of this material will be retained for use in capping layer of the containment area. AIE has estimated in-situ material volumes to be excavated / dredged of 462,360 m^3, where 70% of this volume will comprise Fill (78,111 m^3) and Unit 1 (246,737 m^3). The material to be reused in construction of the perimeter bund and capping layer will be sourced from the upper 13 m to 14 m of the berth excavation. The layout of the perimeter bund in the OHDSCA is shown in Figure 2-2.

As noted in Section 1.7, this RWP is not intended to provide details of methodology for the bulk excavation and dredging works, as this information will be provided in separate documentation.

Figure 2-1: Location of dredge area and disposal area (OHDSCA) (provided by AIE)

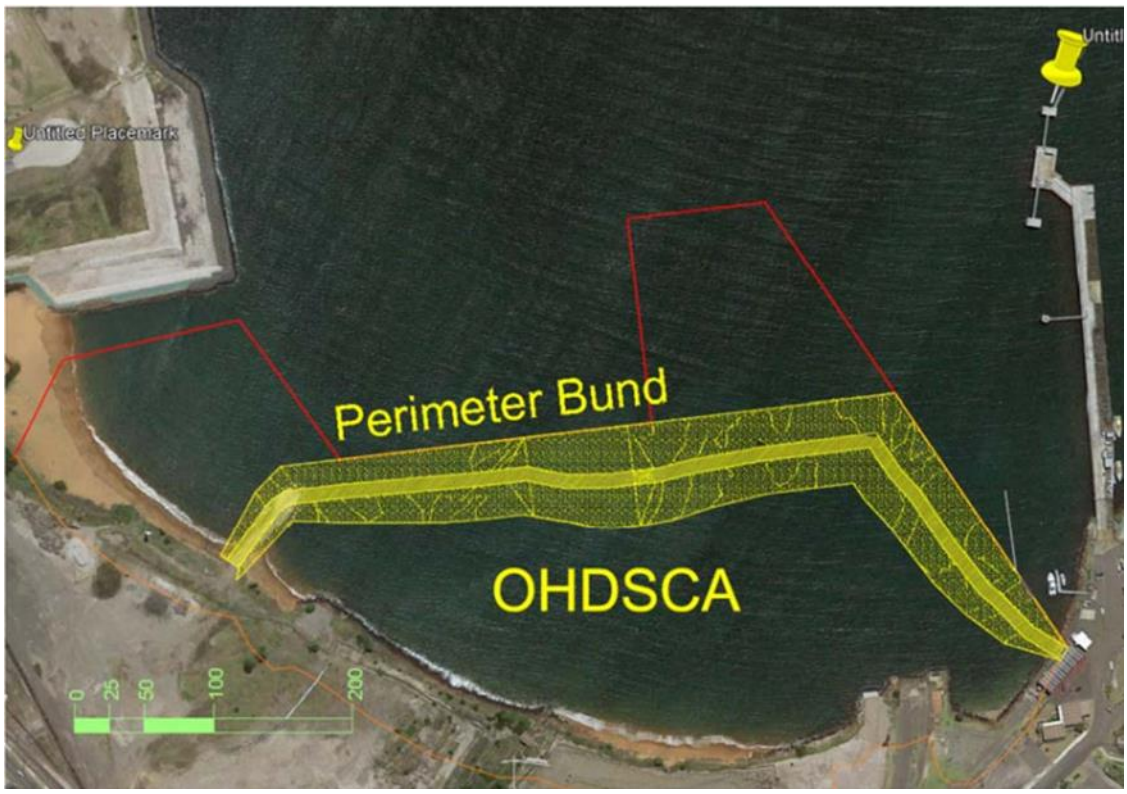

Figure 2-2: Outer Harbour Dredged Spoil Containment Area (OHDSCA) (provided by AIE)

3. Summary of site conditions

The following summary is based on information from the previous GHD investigations (GHD, 2018a), (GHD, 2021a) and (GHD, 2021b). Reference should be made to these reports for more detailed information including aerial photographs and site photographs.

3.1 Site identification

The site for the demolition / remediation work is shown in Figure 1 and Figure 2, Appendix A and is bounded by PKCT to the north and the shoreline and breakwater to the south. Existing Berth 101 is on the western side of the site. Seawall Road along the eastern shore currently allows public access.

Site identification details and surrounding land uses are summarised in Table 3-1.

Table 3-1: Site identification details

Address:	Berth 101 and Bulk Product Area, Port Kembla, NSW
Site co-ordinates:	307013 m E; 6184616 m N (southern point of excavation area)
Title identification:	Part Lot 22 DP 1128396
Approximate area:	3 ha (excavation area)
Current owner	NSW Ports
Zoning:	SP1 – Special Activities SEPP (Three Ports) 2013
Local government area:	Wollongong
County / Parish :	Camden / Wollongong
Current land use:	Industrial – Ports
Adjoining land uses:	Industrial including coal terminal

3.2 Port Kembla Chart Datum and tidal fluctuations

The Australian Tides Manual Special Publication No 9 Version 5 (ICSM, 2018) summarises the various datums used around Australia to predict tidal behaviour. An understanding of the tidal terminology is required when comparing chart datums, tidal effects on ASS and the potential for acid production. Table 3-2 below provides a definition of the relevant terminology and gives the average limits observed at Port Kembla, and Figure 3-1 shows the tidal variation at Port Kembla from 1957 to 2020 (Fox Environmental Consulting, 2020).

Table 3-2: Explanation of terms and datums used in Australian ports

Term	Purpose	Definition[1]	Port Kembla
Highest Astronomical Tide (HAT)	Landward limit of the tidal interface.	The highest level of water which can be predicted to occur under any combination of astronomical conditions.	2.33m CD (+1.458m AHD)[2]
Lowest Astronomical Tide (LAT)	Baseline for the purposes of defining Australia's maritime boundaries.	The lowest tide level which can be predicted to occur under average meteorological conditions and under any combination of astronomical conditions.	-0.0217m CD (-0.655 m AHD)

Term	Purpose	Definition[1]	Port Kembla
Mean High Water (MHW)	Common datum for cadastral mapping and common limit for topographic mapping.	The average of all high waters observed	~1.80m CD (+1.458m AHD)[2]
Mean Sea Level	Average limit of tides	Arithmetic mean of hourly heights of sea over a sufficient period of time	~0.910m CD (0.0m AHD)[3,4]
Mean Low Water (MLW)	Used as the limit of Australian States As definition of 'low water'	Arithmetic mean of all low water heights of sea over a sufficient period of time	~0.20m CD (-0.655m AHD)[2]
Australian Height Datum (AHD)	National vertical Datum of Australia and refers to Australian Height Datum 71 for Australian Mainland	AHD71 is a surface that passes through approximate MSL measured between 1966 and 1968 at 30 tide gauges around the Australian mainland	0.0mAHD (0.872m CD)[3,4]
Chart Datum (CD)	Local Port Kembla Sea Level Datum	In use since at least 1957	0.0m CD (-0.872m AHD)[3,4]

Table notes:

[1] Definitions taken from Australian Tides manual v5 (ICSM, 2018)

[2] Mean High Water and Mean Low Water taken from monthly recorded sea levels for Port Kembla - 1957 to 2020 http://www.bom.gov.au/ntc/IDO70000/IDO70000_60420_SLD.shtml

[3] Chart Datum from http://www.bom.gov.au/oceanography/projects/abslmp/data/data.shtml

[4] MSL at Port Kembla also given as 0.910m CD on http://www.bom.gov.au/ntc/IDO70000/IDO70000_60420_SLD.shtml

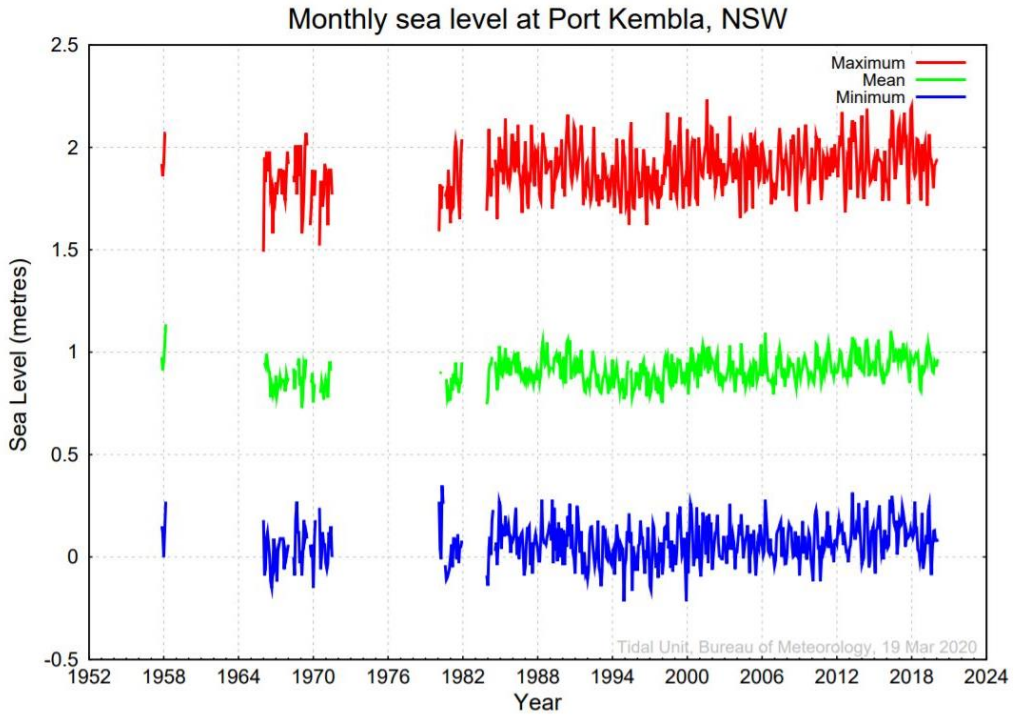

Figure 3-1: Monthly Tidal Range in LAT Port Kembla Harbour (source: BOM website)

3.3 Sensitive environments

Port Kembla Inner Harbour is located immediately west of the site. Port Kembla Outer Harbour is located immediately south-east of the site.

The Inner and Outer Harbours are highly modified and industrial settings receiving stormwater runoff and waste discharge from neighbouring industries. Prior to 1955, the Inner Harbour was previously Tom Thumbs Lagoon, a remnant saline coastal lagoon, which has been progressively reclaimed by the Port Kembla Steelworks. Originally 500 ha in area, the lagoon is now 50 ha (GHD, 2018a).

The Tasman Sea is located approximately 250 m east of the site.

3.4 Topography and drainage

Google Earth Pro indicates the site lies at an elevation between 3 m and 5 m AHD. The elevation of previous investigation locations was surveyed by a registered survey and was recorded between 4.073 m and 6.708 m AHD (GHD, 2018a).

Information obtained from Google Earth Pro indicates that the berth gently slopes down towards the south and west.

Surface water is generally directed to the PKCT stormwater system, which includes a number of settlement ponds; one of which is located immediately south-east of Berth 101 (Southern Pond). It is expected in high rainfall events that surface water will flow directly into the harbour.

3.5 Soil landscape

The Wollongong-Port Hacking 1:100 000 Soil Landscape Series Sheet 9029-9129 (Soil Conservation Service of NSW, 1990) indicates the site is situated within a disturbed terrain soil landscape, which is described as:

- Disturbed terrain:
  - The topography varies from level plains to undulating terrain and has been disturbed by human activity to a depth of at least 100 cm. The original soil has been removed, greatly disturbed or buried. Most of these areas have been levelled to slopes of<5%. Landfill includes soil, rock, building and waste material. The original vegetation has been completely cleared.
  - Limitations are dependent on nature of fill material and include subsidence resulting in a mass movement hazard, soil impermeability leading to poor drainage, and low fertility. Care must be taken when these sites are developed. A survey at a suitable scale as well as geotechnical analysis should be undertaken because of variability of materials throughout the sites. Seek advice from local councils concerning localised areas of disturbed terrain.

3.6 Acid sulfate soils

The Acid Sulfate Soil (ASS) Risk Map (DLWC, 1997) indicates that the Berth (in red outline) is situated in an area mapped as disturbed terrain at an elevation >4 m (shown in grey shading) in Figure 3-2 below. Estuarine sediments exist within the harbour and are mapped as high probability of ASS.

Low risk ASS was identified in probable reclaimed sands and alluvial / tidal sands encountered at depths between 0 m and 25 m below ground surface. The probable reclaimed sands had pockets and lenses of high risk ASS. Estuarine material encountered at depths between 0.4 m and 25 m bgl, typically below the alluvium, was assessed as high risk ASS.

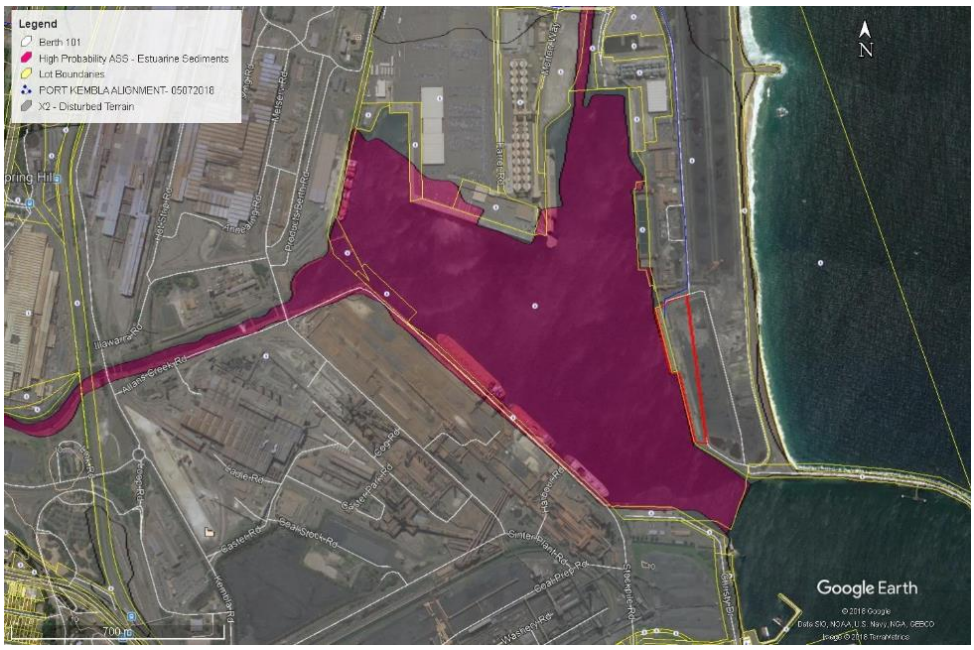

Figure 3-2: Acid sulfate soil risk map (DLWC, 1997)

3.7 Geology

3.7.1 Regional geology

The 1:100,000 Geological Series Sheet of Wollongong-Port Hacking (Geological Survey of NSW, 1985) indicates that the regional underlying geology is Quaternary sediments described as quartz and lithic fluvial sand, silt, and clay. The Quaternary sediments are likely to be underlain by the Budgong Sandstone which is described as red, brown, and grey lithic sandstone.

3.7.2 Site specific geology

Fill was encountered at all previous investigation locations up to 5.5 m depth, typically comprising gravelly sand and sandy gravel (Fill) overlying sand (probable reclaimed sand –Unit 1A/1B). Natural sands, assumed to be likely alluvium, were encountered from 3.2 m, graduating to finer alluvial deposits (silts and clays) to the maximum depth of investigation. (GHD, 2018a)

The Worley Parsons geotechnical investigation extended below GHD's target investigation depths and encountered residual deposits of sandy clay and clay which were logged from 12 m to 29.7 m bgl. Bedrock is understood to have been encountered at the geotechnical boreholes from a depth of 17.6 m to 29.5 m.

The Fill and Unit 1A/1B materials encountered during the GHD 2018 investigation are summarised in Table 3-3. Some variability was observed in the fill unit however the material encountered in Unit 1 was reasonably consistent across the site.

Table 3-3: Generalised material descriptions for Fill and Unit 1

Stratigraphic Unit	Generalised Description	Corresponding Stratigraphic Unit
Fill	Gravelly sand, sand, silt, black, dark brown, grey, some to trace, silts and cobbles. Foreign materials, coalwash, coal, slag, steel, wood, concrete.	Fill
Probable Reclaimed Sands	SAND, brown, pale brown, yellow, orange, fine to coarse grained, trace amounts of shell fragments, fine to coarse gravel, silt bands and layers, clayey sand layers, trace iron stained sand, fine black sand layers (probable heavy mineral sands), rounded to sub-rounded gravel, clay lenses and layers. Foreign materials: charcoal, wood and coal.	1A / 1B This was categorised as 'Fill Unit 2' in the GHD 2018 investigation but has since been reassigned as Unit 1
	Clayey SAND, black, dark grey, grey, fine to coarse grained sand, medium to high plasticity clay, trace silt, shell fragments, gravel.	1B
	Gravelly CLAY, black, dark grey, grey, low to medium plasticity, fine to coarse grained angular to sub-angular gravel, trace of fine to coarse grained sand.	1B
Possible Alluvium / Tidal Sands	SAND, brown, pale brown, yellow, orange, fine to coarse grained, trace amounts of shell fragments, fine to coarse gravel, silt bands and layers, clayey sand layers, trace iron stained sand, fine black sand layers (probable heavy mineral sands), rounded to sub-rounded gravel, clay lenses and layers.	1A

3.8 Hydrogeology

3.8.1 WaterNSW database

Lotsearch report (Lotsearch, 2020) indicates there are six registered groundwater bores east of the site, five of which are in Part Lot 22 as shown in Figure 3-3. The bores were registered for monitoring purposes and installed in 2011 and 2012 to depths between 6 m and 7.5 m bgl. No information on salinity, standing water level, or yield was recorded. The locations of these monitoring bores are generally consistent with those installed by Douglas Partners, except for GW112710 and Douglas Partners monitoring well 205 (Douglas Partners, 2014). Monitoring well 205 is located south-west of GW1127709 but does not appear to be registered.

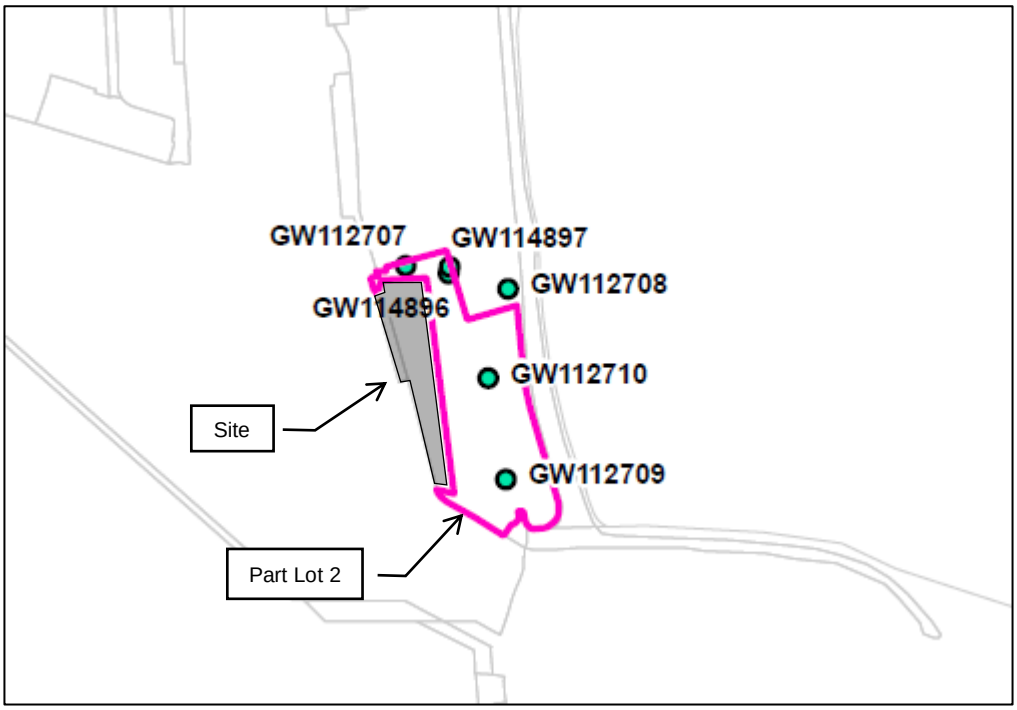

Figure 3-3: Registered groundwater bores (Lotsearch, 2020)

3.8.2 Site specific

Groundwater inflows were encountered in all boreholes, except GBH34 and GBH36, at depths between about 3.7 m and 5.0 m bgl. GBH36 refused at 0.15 m bgl. Six groundwater monitoring wells (MW2, MW3, MW6, 201, 204, 205) were installed on-site as part of previous investigations undertaken by Douglas Partners in 2011 and more recently by GHD in 2018. Groundwater was measured at depths between 4.01 m and 4.90 m bgl on 18 October 2018.

No hydrocarbon odours were noted in groundwater during drilling or sampling at any of the wells. No evidence of non-aqueous phase liquid (NAPL) was observed during groundwater sampling. No odours or sheens were noted on the surface of the groundwater from monitoring wells during purging and sampling for the remaining locations.

DP (2014) stated that groundwater flow direction was towards the south-west, that is, towards the Inner Harbour. However, it was further stated that groundwater flow direction was unlikely to be homogeneous across the site due to water bodies along three sides, various filling material and tidal influences. These factors were considered to form localised flow patterns.

3.9 Climate information

The closest weather stations to the site are:

- Port Kembla (BSL Central Lab) (Station No. 68131, Lat: 34.47° S, Lon: 150.88° E, Elevation: 9 m) for rainfall.
- Bellambi AWS (Station No. 68228, Lat: 34.37° S, Lon: 150.93° E, Elevation: 10 m) for temperature.

The Port Kembla station is approximately 1.9 km south-west of the site, whilst Bellambi station is approximately 10.5 km north-east of the site.

Table 3-4 provides a summary of annual mean for temperature and rainfall. No information was available on evaporation and wind.

Table 3-4: Summary of annual climate statistics

Climate data	Data range	Minimum	Maximum	Mean	Median
Rainfall (mm)	1963 to 2020	406.1	1847.1	1096.9	1057.9
Average daily temperature (°C)	1997 to 2020	20.8	22.1	21.4	21.4
Wind speed (km/h)	1997 to 2020	-	141	13	-

3.10 Site conditions

Site conditions were described in GHD (2021a) and were based on observations during fieldworks conducted between October and December 2020.

The area was previously investigated by GHD in 2018 (GHD, 2018a) and is approximately 3.3 ha in area. The area incorporates Berth 101 and the area immediately to the south, and a section of the Western Bulk Stockyard, as shown on Figure 2 (Appendix A). The site is not currently in use. There is no permanent vegetation or trees in the investigation area, only small patches of grasses and weeds. The area does not appear to have substantially changed since the 2018 investigation (GHD, 2018a).

An electrical substation was seen on the western side of the site, at the southern end of the berth. This area was largely fenced off with brick structures built around some areas. The substation was in relatively good condition with no leaks or damage observed. Anthropogenic material was observed generally scattered across the whole site, including slag, steel, plastic and wood.

Several services are present within the site including an above ground water pipe which was observed on the western side, positioned in a north-south direction. A buried low pressure oil pipeline was also present along a similar alignment running to the west of the water pipe. An asbestos water pipe is located east of the substation and shown as a green line on Figure 2 (Appendix A). In 2018, two fragments of suspected asbestos containing material (ACM) were identified on the surface near the substation, and removed for assessment. No suspected ACM was observed, here or elsewhere on the site during the 2020 investigation.

Two large stockpiles, approximately 700 m^3 to 800 m^3 of mixed sandy gravel material were observed in the south-western section of the site. Slag gravel, cobbles, concrete and boulders were seen mixed with this stockpiled material. The stockpiles were partially covered with vegetation.

In 2018, coal stockpiling was occurring in the southern end of the investigation area, during the GHD (2021b) investigation, no remnant coal stockpiles or evidence of ongoing stockpiling activities were observed.

Large industrial equipment and plant including coal loaders were observed on paved areas in the east of the site, on the western side of the Western Bulk Stockyard.

4. Review of previous investigations

Several investigations have been undertaken at the site. The key findings of the investigation reports reviewed are summarised below. Reference should be made to the specific documents for more detailed information.

4.1 Contamination assessment for Berth 101 (GHD, 2018a)

A contamination assessment for Berth 101 was carried out as part of the EIS for the proposed LNG import terminal and FSRU, visiting LNG carriers, wharf offloading facilities and the installation of a new pipeline to connect to the existing gas transmission network.

The relevant objectives of the contamination assessment were to:

- Assess the likelihood for contamination to exist on the site from past or present activities.
- Provide recommendations for further investigation and/or options management in relation to the proposed development (if applicable).

The scope of work developed to meet this objective included a review of site history information, site walkover, soil sampling from 39 environmental boreholes, opportunistic observations and soil sampling from the ten geotechnical boreholes, installation of three groundwater monitoring wells, sampling and analysis of groundwater from the newly installed wells and three existing monitoring wells. Selected samples were tested for key contaminants of potential concern to inform the assessment. The results of the historical review, site walkover, field and laboratory testing were interpreted and assessed with respect to the above objectives.

Based on site history information, Berth 101 (also known as the Bulk Products Berth) was constructed in 1964 and commissioned for the loading of coal, coke and slag. Dredge material from the Inner Harbour and steelworks slag may have been used in the berth's construction, although the source of fill could not be confirmed. The berth had an array of surface infrastructure including substation, conveyors and diesel underground storage tank (UST). The majority of the surface infrastructure was removed c2011 and the UST was removed in the early 1990's. No evidence of contamination was observed at the time of UST removal. Previous investigations at the site were undertaken by Douglas Partners (DP) in 2014, which assessed the former UST location, substation, fill and groundwater. DP concluded that the site was suitable for continued industrial land use. GHD notes that the assessment of the former UST was limited due to shallow refusal and collapsing ground conditions, thus limiting the depth of investigation to the upper 2.6 m of the soil profile. The base of the UST was 5 m bgl.

Contamination in the fill material within the area to be excavated within Berth 101 is relatively minor, and generally consistent, as indicated in the results summary table (Table LR1) in Appendix B. Only two soil samples exceeded adopted criteria; these were at GBH09 and GBH26 and were for BaP TEQ (health criterion) and for heavy end petroleum hydrocarbons (TRH F3, >C_{16}-C_{34}) (Management Limits) near the inferred base of fill material between 4 m to 5 m bgl. Review of potential source-pathway-linkages for this contamination indicates that it is unlikely to pose any significant constraints to the proposal, subject to further assessment of the extent of BaP TEQ hotspots and mitigation measures developed to manage potential health impacts during construction works. Potential risks to marine environmental receptors from relocation of the berth material are considered low and acceptable based on measured concentrations of contaminants.

Asbestos was identified on-site in the form of fragments of asbestos containing material (ACM) on the ground surface. These are assumed to be associated with historical demolition on site.

No asbestos was identified in samples below the ground surface, and it is therefore unlikely that asbestos containing materials are present in the fill, although this cannot be precluded.

Some relatively minor impacts from heavy metals and ammonia were identified in a perched fresh to brackish groundwater lens within Berth 101. The size of the lens is not well understood, however, the proposed piling and excavation works will limit the amount of perched water discharging into the marine environment, which will in any event significantly attenuate the concentrations of contaminants observed in this investigation.

4.2 Data review and gap analysis for Fill and Unit 1 Material (GHD, 2020)

GHD carried out data review and gap analysis for Fill and Unit 1 material in response to a request by the appointed site auditor. The auditor requested an evaluation of the existing data to consider potential implications of any identified contamination with respect to the planned reuse of fill and alluvium as a perimeter bund in the OHDSCA.

The objectives of the data review and gap analysis were to:

- Summarise the chemical characteristics of the Fill and Unit 1A/1B material to be used in the emplacement bund; and
- Provide recommendations for additional investigation to close identified data gaps (if any).

To meet the above objectives the following scope of work was carried out:

- Review draft Excavation and Dredging Plan and Waste and Spoil Management Plan provided by AIE.
- Review laboratory results from the contamination assessment (GHD, 2018a) and summarise the number of samples, analytes, and results for Fill and Unit 1 per depth interview.
- Provide conclusions and recommendations in relation to the above objectives.

Based on the available information, the majority of Fill and Unit 1A/1B are considered to pose a low risk to the marine aquatic environment based on the characterisation carried out, however some limited supplementary assessment would be beneficial to confirm this.

Based on this data analysis, the following was concluded and recommended:

- Fill:
  - There is considered to be sufficient data to chemically characterise the fill material for the majority of contaminants of potential concern (COPC). However, PCBs exceeded default guideline value (DGV) and upper guideline value (GV-high) in the vicinity of the substation and therefore may present a risk to marine aquatic ecosystem. Soils from around the substation should be separated from materials intended for construction of perimeter bund. The resulting excavation within the vicinity of the substation will require validation to confirm no residual PCBs remain for the purposes of constructing the bund.
- Unit 1A/1B:
  - Unit 1 was relatively homogeneous in respect of material type and it is expected that the available data is representative of material quality. However, the two TRH and PAH hotspots suggest some variability does exist within Unit 1 materials. [Note, the GBH09 hotspot sample was logged within fill near the inferred base of fill material between 4 m to 5 m bgl, with the GBH26 hotspot sample within possible alluvium at a similar depth].

- The TRH and PAH hotspots are driving exceedances of DGV and GV-high. A preliminary review of Toxicity Characteristic Leaching Procedure (TCLP) suggests that leachability of these CoPC is low and would be expected to be much lower in less aggressive marine conditions.
- Some limited supplementary assessment would be beneficial to further confirm the likely low risks posed by TRH, PAH and PCB to marine aquatic ecosystems from the material in Fill and Unit 1 which will form part of the perimeter bund.

The gap analysis also identified potential toxicity problems associated with chromium, lead, nickel and zinc as some concentrations exceeded DGV and/or GV-high. However, lead and chromium concentrations in groundwater did not exceed 95% species protection for groundwater. Conversely, copper and zinc concentration did exceed 95% species protection for groundwater.

4.3 Baseline contamination assessment (GHD, 2021a)

This baseline contamination assessment investigated the proposed lease area of 12.3 ha associated with the planned Port Kembla Gas Terminal. Results from previous and concurrent investigations were used to inform the baseline conditions of the site being assessed.

The objectives of the baseline contamination assessment were to:

- Assess the likelihood for contamination to exist on the site from past or present activities.
- Establish baseline conditions of the lease area with respect to contamination.
- Assess whether soil or groundwater contamination at the site presents a potential risk to human health, and whether any risk is posed to ecological receptors from groundwater contamination, associated with the proposed redevelopment of the site.
- Provide recommendations for further investigation and/or contamination management for areas considered to pose an unacceptable risk to human health and/or the environment in the context of the proposed development (if applicable).

The scope of work included a review of site history information, site walkover, soil sampling from 127 locations (boreholes and shallow hand augers), two sediment samples, installation of five groundwater monitoring wells, sampling and analysis of groundwater from the newly installed wells and five existing monitoring wells. Selected soil and sediment samples were tested for key contaminants of potential concern to inform the assessment. Leachability testing was also carried out using sea water reagent for selected samples.

Summary of previous investigations

As above, GHD (2021a) included a summary of the investigation findings from GHD (2018a) as described above in Section 4.1. This investigation identified two hotspots of contamination (GBH09 and GBH26) with BaP TEQ and heavy end petroleum hydrocarbons. Review of potential source-pathway-linkages for this contamination indicated that it is unlikely to pose any significant constraints to the proposal, subject to further assessment of the extent of the contamination and mitigation measures developed to manage potential health impacts during construction works.

Potential contamination and risks to receptors

For the site and proposed works therein, the primary receptors are considered to be workers involved in construction and excavation on the site. This exposure scenario provides an increased likelihood that workers will be in direct contact with soil and exposed via inhalation to dust and vapours generated during excavation, or by dermal contact and ingestion during construction works and excavation. Therefore, the source-pathway-receptor (SPR) linkages are possibly complete if contamination exists. The site and surrounding areas have been used for heavy industrial purposes for 50 to 100 years, and use of chemicals in settlement ponds is unlikely to encourage terrestrial ecological receptors to inhabit the site. Therefore, the SPR linkages are likely to be incomplete. For marine ecological receptors, SPR linkages could be complete if contamination exists.

Based on investigation results, for the majority of AEC's the SPR linkages have been reassessed as incomplete, due to absence of contamination. Although contamination, buried waste, demolition waste, ACM and former infrastructure were not identified, boreholes only provide a one dimensional view of the soil profile and are between 20 m and 30 m apart, therefore it cannot be precluded that contamination, waste, ACM, and former infrastructure may exist in areas between borehole locations. For AEC 1, contamination was present and therefore the SPR linkages were still potentially complete. For AEC 2, the assessment is incomplete due to the energised status of the substation, therefore SPR linkages could still exist. The risk posed by the respective contaminants at AEC 1 and AEC 2 is being assessed as part of the targeted investigation. For AEC 10, the low pressure oil pipeline and ACM water pipe in their current undisturbed state do not pose an unacceptable risk to receptors. However, during removal inadvertent release of oil or liberation of asbestos fibres could occur, thus significantly increasing the exposure risk to receptors. A summary of potential risk to receptors and associated recommendations for each AEC is provided in Table 4-1 below.

For groundwater, minor exceedances of arsenic were reported at each monitoring well location, and at two locations for mercury. Copper concentrations exceeded assessment criterion at one location.

Table 4-1: Summary of contamination and potential risks to receptors

AEC	Description	Contamination identified in excess of assessment criteria	Likelihood of contamination posing an unacceptable risk*		Conclusions/ Recommendation
			Human Health	Ecological	
1	TRH and BaP TEQ hotspots in western portion of the site (Area A)	Yes	Moderate	High	Further assessment is still required of SPR linkages and risk to receptors
2	Substation in western portion of the site (Area A)	No	Moderate	Moderate	Further investigation at depth is still required to assess SPR linkages and risk to receptors
3	UST in the central northern portion of the site	No	Low	Low	CEMP including UFP
4	Buried waste (south-east corner, west side of Conveyor No. 7)	No	Low	Low	CEMP including UFP

AEC	Description	Contamination identified in excess of assessment criteria	Likelihood of contamination posing an unacceptable risk*		Conclusions/ Recommendation
			Human Health	Ecological	
5	Fill of unknown quality and origin (entire site)	No	Low	Low	CEMP including UFP
6	Former railway line in eastern portion of the site (Area B)	No	Low	Low	CEMP including UFP
7	Sediment in retention ponds (Southern Ponds and T3 Pond)	No	Low	Low	None
8	Chemical, hydrocarbon and ammonia odours (north-eastern portion of the site)	No	Low	Low	CEMP including UFP
9	Former structure (south-east corner of the site)	No	Low	Low	CEMP including UFP
10	Hazardous building materials (western portion of the site near former infrastructure), ACM water pipe and other underground services	Yes (ACM fragments at the surface in 2018) Otherwise, no.	Low (current state) High (during removal)	Low (current state) High (during removal)	CEMP including AMP Licenced asbestos removalist to supervise ACM water pipe removal
11	Truck wash located north-east of the site	No	Low	Low	CEMP including UFP
12	Migration of coal dust and fallout from the steelworks	No	Negligible	Negligible	None

Notes: *Likelihood is the probability of an unacceptable risk being present, categorised on a scale from high (near 100% probability of being present) to very low (near 0% probability of being present).

CEMP = Construction Environmental Management Plan; UFP = Unexpected Finds Protocol; AMP = Asbestos Management Plan.

Preliminary waste classification

The preliminary waste classification identified that fill across the site can be classified as General Solid Waste. Whilst total chromium exceeded the hexavalent chromium CT1 and CT2 criteria in a number of locations, with isolated exceedances of the CT1 criteria for lead and BaP, TCLP results were below the TCLP1 thresholds in all samples analysed, and were considered representative of leachability of fill materials across the site, therefore, the SCC with TCLP can be applied. The 95% UCL of all contaminants that reported exceedances of the CT1 criteria were less than the SCC1.

Results from Berth 101 (GHD, 2018a) indicate that materials may contain some ASS and may need to be managed in accordance with the requirements of (NSW EPA, 2014b) *Classifying Waste:* Part 4.

Recommendations

Based on the results of the baseline assessment with respect to contamination and waste classification matters, the following was recommended:

- Preparation of a Construction Environmental Management Plan (CEMP) to manage the occurrence of potential contamination, buried waste, demolition waste, ACM, and former infrastructure in all parts of the site. The CEMP should also include an Unexpected Finds Protocol (UFP).
- For AEC 1 and AEC 2, further assessment is still required of SPR linkages and risk to receptors.
- For AEC 10, preparation of an asbestos management plan (AMP) prior to decommissioning of these particular services. An appropriately licenced asbestos removalist contractor will need to be engaged to supervise the removal of the ACM water pipe.
- For groundwater, further assessment is recommended of the potential risk arsenic, mercury and copper concentrations pose to ecological receptors.
- Supplementary waste classification assessment of any surplus materials requiring disposal, following excavation.

4.4 Targeted assessment – Berth 101 (GHD, 2021b)

This report is in preliminary DRAFT form and has not been issued so only the objectives and soil analytical results are discussed in this section.

GHD completed a targeted investigation of locations where hotspots of contamination were previous identified (GHD, 2018a). The objectives of the targeted assessment included:

Fill:

- Obtain additional samples to assess the leachability of total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbon (PAH) and/or heavy metals in a marine environment.
- Based on the leachability results, refine the risks of TRH, PAH and heavy metals leaching from the bund to the marine aquatic environment.

Unit 1:

- Refine the lateral and vertical extent of the potential PAH and TRH hotspots at borehole locations GBH09 and GBH26 and leachability of TRH and PAH in the marine environment.
- Based on the leachability results, refine the risks of TRH and PAH concentrations leaching from the bund to the marine aquatic environment.
- Increase the dataset in respect of material quality between 5 m and 14 m (excavation level for reuse of material) within the southern half of the site.

Electrical substation:

- Assess lateral and vertical extent of polychlorinated biphenyls (PCB) associated with electrical substation number 1 and leachability of PCBs in a marine environment.
- Based on the leachability results, refine the risks of PCB leaching to the marine aquatic environment from bund materials.

4.4.1 Scope of work

The scope of works included:

- Hotspot GBH09 – Four locations (GBH09A – GBH09D) to a maximum depth of 6 mbgl and analysed for TRH, PAH, TOC and Australian Standard Leaching Procedure (ASLP).
- Hotspot GBH26 - Four locations (GBH26A – GBH26D) with GBH26A to 14 mbgl and GBH26b to GBH26d drilled to 6 mbgl and analysed for analysed for TRH, PAH, TOC and ASLP.
- Substation – Seven locations GBH141 to GHB143, GBH145 to GBH148 and re-sampling of four previous locations (DP, 2014) 216 – 219, sampled as 216A to 219A. Due to the presence of underground services, locations were hand augered to a maximum depth of 0.3 mbgl. Samples were analysed for PCBs and TOC.
- Fill – GBH13A drilled to 3.0 mbgl, GBH22A drilled to 14 mbgl, GBH24A drilled to maximum depth 0.5 mbgl and GBH39 (A/B) drilled to a maximum depth of 2.5 mbgl. Selected samples were analysed for heavy metals, TRH, BTEXN, PAHs, TOC, selected ASLP.

4.4.2 Results

Subsurface conditions

Observations of subsurface material, were, in general, consistent with the observations made in the previous investigation (GHD, 2018a). Fill was encountered at all locations, with the exception of GBH22A, where reclaimed sands were observed to 8 m depth. Fill typically comprised gravelly sand and/or sandy gravel (Fill Unit 1) overlying sand (probable reclaimed sand – Fill Unit 2) with varying proportions of clay and silt. Fill Unit 1 was typically black to dark brown in colour comprising sandy gravel or gravelly sand with varying quantities of silt, and contained foreign materials including coal and slag at a number of locations.

Fill Unit 2 primarily comprised fine to coarse sand, which was encountered in the majority of boreholes. Varying quantities of clay were present as either lenses or within the unit as clayey sand. Thinner distinct units of clay or gravelly material were also present in some boreholes.

Natural sands, interpreted to be likely alluvium, graduating to finer alluvial and/or estuarine deposits (silts and clays) to the maximum depth of investigation. In GBH22A, a unit of clay with extremely weathered sandstone was encountered from 13 to 14 m, which was interpreted to be estuarine clays overlying extremely weathered bedrock. In GBH132, highly weathered was encountered at 8.3 m bgl, which was the shallowest occurrence of weathered rock at the site.

TRH and BaP hotspots

Based on previous investigation results, the likelihood for contamination within these areas was assessed as high. Additional targeted investigations were completed to further assess the vertical and lateral extents, and leachability potential of TRH and BaP TEQ impacts specifically at GBH09/4.2-4.4 m and GBH26/4.75-4.9 m (1.74 m and 0.13 m PKHD). Based on the excavation plan, hotspots are below planned excavation levels of 2.5 m PKHD for demolition works

TRH and BaP TEQ concentrations at GBH026C/4.7-4.8m were lower than those reported in the 2018 investigation but elevated with respect to other samples outside of the identified hotspot area. Concentrations at GBH09A to 09D were low and/or below LOR, inconsistent with the 2018 results.

The impacts appear to be associated with Fill Unit 2 (reclaimed sands) and possible alluvium soil units. However, the soil types differ for each sample where TRH and BaP TEQ impacts have been identified. The laboratory results indicate that the vertical extent of TRH and BaP TEQ at GBH26 is approximately 4.8 m bgl. The lateral extent for GBH26 is unknown in the eastern and western directions. TRH and BaP TEQ impacts were not identified at GBH09 radial step outs indicating the hotspot is relatively localised.

Leachability testing, using seawater sampled from the Inner Harbour, indicated TRH and BaP TEQ is leachable and exceeds water quality assessment criteria. The risk posed by leachable concentrations to marine ecology is currently being assessed, however groundwater monitoring results indicate soil is not having an impact on groundwater.

Based on the results of GHD (2021a), it is likely that the TRH and BaP TEQ impacts are relatively localised and more likely to be associated with the western portion of the site, that is, Berth 101.

Substation

For the substation area, previous investigations detected PCBs, however concentrations were below the human health assessment criteria (HIL-D). However, because material from this area is to be excavated/dredged and then placed in the OHDSC, these concentrations were also compared to sediment DGV (ANZG, 2018a) and exceeded the DGV for PCBs.

The additional targeted investigation was carried out to further assess the vertical and lateral extents, and leachability potential of PCBs. Sampling was limited to the upper 0.2 m of the soil profile due to the presence of underground services with ten surface samples collected. Detectable concentrations of PCBs, all below HIL-D, were reported at locations 217A, 219A and GBH143. PCB concentrations reported at 217A, 219A and GBH143 exceeded sediment DGV and DGV high (ANZG, 2018a) but were not leachable.

Detectable concentrations of PCBs were reported in samples closer to the substation, suggesting the lateral extent of PCBs is not widespread and relatively localised to the immediate vicinity of the substation. The vertical extent will be assessed during demolition and remediation of the site once the substation and underground services have been decommissioned and disconnected. The risk posed by detectable PCB concentrations to marine ecology is currently being assessed.

General Fill

Site history and previous investigation results have identified fill of unknown quality and origin, which affects the entire site. The Berth 101 area was constructed using dredged sediments (reclaimed sands) from the adjoining Inner Harbour. Overlying the reclaimed sands (Fill unit 2), was fill material described as gravelly sand, sands and silts, and coalwash (Fill unit 1). This fill material was identified west of the No. 7 conveyor and contained trace amounts of slag, coal, concrete and/or wood. Fill was encountered in all boreholes and the type of fill was generally consistent across the site; however, its thickness was variable.

Evidence of potential contamination was identified during sampling and included a pale green-grey fill layer at GBH09A at depths between 0.2 m and 0.7 m bgl.

The above evidence of contamination was targeted with soil samples analysed for TRH, BTEXN, PAH and/or heavy metals. The majority of these COPCs were reported at concentrations below the LOR. Detectable concentrations of ammonia, heavy metals, BTEX, TRH and PAH were reported but again well below the guideline values.

Sample GBH13A/2.8-3.0m (western fill area) reported elevated TRH and BaP TEQ concentrations, relative to other samples outside the hotspot areas. Concentrations of BaP TEQ in sample GBH13A/2.8-3.0m were below HIL-D, but above DGV (ANZG, 2018a). Concentrations of BaP TEQ in deeper sample GBH13A/3.4-3.5 m, were above both HIL D and the DGV (ANZG, 2018a). The vertical extent on contamination GBH13A has not been delineated.

As material from Berth 101 is scheduled to be excavated and material to be reused within the OHDSCA, analytical results from this area were also compared to the sediment criteria. The following is noted:

- Where concentrations were reported above the laboratory limit of reporting, hydrophobic organic contaminants were normalised to 1% organic carbon to account for preferential partitioning at higher organic carbon concentrations.
- Concentrations of TRH (sum total) potentially exceeded the normalised hydrophobic organic contaminants (1% organic carbon) for GBH09A_5-5.3, GBH09D_4.7-5.0, GBH022A_8.0-8.5, GBH026B_5.7-6.0, and GBH039B_1.9-2.1, as the normalised LOR of <500 mg/kg exceeded the guideline of 280 mg/kg.
- Copper, lead and zinc exceeded the DGV (ANZG, 2018a) in GBH024A_0.0-0.3.
- PAH concentrations were above the DGV (ANZG, 2018a) at GBH13A_2.8-3.0, GBH13A_3.4-3.5, GBH026B_5.7-6.0, and GBH026C 4.7-4.8.
- TRH C_{10}-C_{36} concentrations exceeded the DGV (ANZG, 2018a) at GBH13A_3.4-3.5. The normalised concentration was 1,162 mg/kg.

No asbestos or other forms of potential contamination were observed. While asbestos was previously identified on-site in the form of fragments of ACM on the ground surface near the substation (GHD, 2018a), no asbestos was identified in samples below the ground surface in the entire lease area at the test locations, and it is therefore unlikely that ACM is present in the fill, although this cannot be precluded.

Based on laboratory results from the previous and current investigations, and with the exception of TRH and BaP impacts in the western portion of the site, the likelihood for contamination within fill was assessed as low.

This assessment excluded stockpiles currently stored in the south-western corner of the site as described in Section 3.10.

5. Proposed demolition/remediation works

The scope and technical requirements for the demolition/remediation works are provided in the AIE Port Kembla Gas Terminal – Demolition Scope of Work (SOW) (AIE, 2021).

The SOW generally involves excavating the top material from the western area of the site to allow construction of the quay wall to commence and also includes removing redundant site services and demolishing and removing above and below ground structures, foundations and piles, equipment, conduits, cabling and pipework. The proposed work area is presented in Figure 2, Appendix A. The scope of works includes:

- Site establishment, including fencing and security
- Demolition of onshore concrete items above RL 2.5 m PKHD on the PKGT site
- Demolition / removal of buried services and structures
- Demolition of existing Berth 101 and removal of piles
- Demolition / excavation of hard stand to RL 2.5 m PKHD
- Processing demolished materials (for use by others) and stockpiling on-site or stockpiling at the southern end of the eastern stockyard and the Outer Harbour for later use by others
- Disposal of waste and unsuitable materials to an approved facility.

Although not directly referred to in the AIE SOW, the two large stockpiles of mixed sandy gravel material in the south-western section of the site will also be characterised and removed from site. The location of the stockpiles is presented in Figure 2 in Appendix A.

Relevant parts from the SOW are summarised in the following sections.

5.1 Excavation zone

The proposed excavation zone generally extends from Road No. 7 at the northern end of the West Stockyard to the South Ponds and across to Road No. 9 as shown by the yellow shaded area below in Figure 5-1 (as extracted from SOW (AIE, 2021)).

Figure 5-1: Proposed excavation zone (AIE, 2021)

As stated in the SOW, it is proposed to segregate, manage, stockpile and transport excavated materials into the following categories:

- Fill materials and concrete suitable for re-use for wharf construction will be crushed on-site (70 mm minus) and stockpiled at the southern end of the Eastern Stockyard area
- Excess materials suitable for placement in the Outer Harbour will be transported to the Disposal Area
- Revetment rock armour will be stockpiled for reuse if removed
- Recyclable material such as steel, cables, etc. will be transported off site for recycling
- Waste materials that are unsuitable as fill or for recycling will be disposed off-site at an approved landfill facility.

5.2 Removal of above ground and underground structures / services

The SOW indicates that numerous above and below ground structures and site services are currently located in the excavation zone and will be demolished and removed generally down to RL +1.5 m PKHD as part of the excavation process.

5.2.1 Bunker oil pipeline

The existing bunker oil pipeline extends from storage facilities on the southern shore of Port Kembla, under The Cut to the oil berth at the northern breakwater. A 300 mm carbon steel pipeline extends underground (approximately 600 mm clear cover) along the western shore of the site to Berth 101. An above ground section then passes under Berth 101 and on to Berth 102 to the north.

The pipeline sections, both underground and running under Berth 101 require removal with management and disposal of any residual hydrocarbons. It is proposed to cut the pipeline into transportable lengths and removed from site to an appropriate and approved location. Beyond the excavation zone, the pipeline will remain in-situ and be capped at both ends with suitable identification.

5.2.2 Domestic water pipeline

An underground potable water supply pipeline currently runs underground on the eastern side of Tower TS8 to supply Berth 101 and a ductile iron cement lined (DICL) pipeline continues along the western shore of Berth 101 supplying the Port Authority of NSW (PANSW) meter compound at the south of the site.

An abandoned pipeline formed from asbestos containing material (ACM) runs parallel to the DICL pipeline. A licenced removal company shall be engaged by the Contractor to remove and transport the asbestos material in a safe manner to an approved disposal site. An asbestos clearance certificate shall be provided following removal. Asbestos removal works including independent supervision and validation are further described in Section 10.3.1.

All abandoned domestic water piping is to be removed within the excavation zone. Beyond the excavation zone, the pipeline shall remain in the ground and be capped at both ends.

5.2.3 Electricity supply

Electricity is supplied from the PKCT 11 kV South Substation and distributed in Substation B (south of Berth 101). These supplies include:

- An underground 11 kV electricity cable (approximately 900 mm cover) from Substation B to the PANSW pad-mounted transformer at the southern end of the site.
- Several 415 V cables from Substation B to Pumps 01 at the South Ponds, to Pumps 09 and 17 at drain pit sumps and to light poles across the site
- Control cabling for pumps, lights and water spray nozzles.

The substation building is to be demolished (see Section 5.3 below) with all cables in the excavation zone removed.

5.2.4 Telecommunications

The telecommunications cable extends from a pit near PKCT South Substation to a pit near the PANSW meter compound. The route of the cable is uncertain however it is understood to follow the western shore. During demolition works, the cable is required to be removed and disposed of. Any cable beyond the excavation zone, is to remain in-situ.

5.2.5 Tertiary treated effluent

Tertiary Treated Effluent (TTE) is supplied to PKCT for firefighting and dust suppression sprays. An interconnected ring main circles around both the East and West Stockyards supplying dust suppression sprays and fire hydrants.

The pipelines and sprays serving the West Stockyard will be demolished and removed. The western incoming supply shall be capped near Tower TS7 and at the branch from West Stockyard to the PKCT truck wash.

The spray system for the East Stockyard is not required and will be demolished. The TTE pipeline along the eastern side (Seawall Road) is to remain in-service. The TTE pipeline along Road No. 9 shall be capped on western side of PANSW meter compound.

5.2.6 Stormwater

During demolition, stormwater from the site will be directed to settling ponds or gross pollutant traps or oil separators before being discharged to the harbour. The overflow pipes at the Southern Pond is AIE's licensed discharge point into Port Kembla Harbour.

As the demolition work proceeds, the Contractor must ensure stormwater runoff always flows to the Southern Pond in accordance with AIE's Environment Protection Licence conditions.

5.3 Demolition works

The West Stockyard and western shore of the site contain remnants of the coal terminal infrastructure and site services. All structures, foundations, piling, paving, site services, etc. within the excavation zone require demolition and removal. The proposed structures for demolition are summarised in Table 5-1 below.

Table 5-1: Above ground structures to be demolished

Structure	Works required	Validation required (yes / no)
Tower T1	Remove any remaining miscellaneous steel work as necessary (e.g. handrails and guardrails)	No
Tower T2 and T3	Demolish headstock and cut-off any piles at RL+1.5 m PKHD.	No
Tower T1, T3, T4 and T6 Clean Out Pits/ Drains	Demolish any remaining miscellaneous steel work, the Clean Out Pit and associated drains.	Yes – beneath the pits
Conveyor C3	Demolish any pavement/gutter and cut-off any piling in the excavation zone	No
T3 Pond	Demolish any remaining miscellaneous steel work, the pit and associated drain.	Yes – beneath pit / pond and drain
Tower T5 gantries	Demolish the remaining footings and headstock and cut-off piles at RL +1.5m PKHD. The two southern gantries require complete removal of the headstock and piles.	No
Conveyor C5 Gantry Walls	Demolish the remaining West Stockyard walls (inverted precast concrete T sections).	No
Reclaim conveyors C6 and C7	Demolish all remaining parts including the reclaim hopper, paving and any foundations/piling/footings.	No
West shore clean out pit	Demolish any remaining miscellaneous steel work, the pit and associated drain.	Yes – beneath the pit
West Stockyard Hardstand Area	Demolish and excavate the hardstand to RL + 2.5 m PKHD. The excavation of the hardstand shall extend to 3 m beyond the tie rod anchors. (the hardstand area is constructed of 300 mm heavily bound base course (road building material), 340 mm lightly bound base course (80% blast furnace slag and 20% granulated blast furnace slag) and 200 mm of engineered fill.	Yes – material segregation, stockpiling and visual or chemical characterisation prior to either re-use on-site or removal off-site.

Structure	Works required	Validation required (yes / no)
Light Towers	Demolish the foundations and remove associated cabling. Demolish and remove all other light towers from the site.	No
Berth 101	Berth 101 comprises a concrete deck supported by 568 concrete and timber piles, tie rods and dead man blocks. There is also a fendering system comprising timber piling, timber waling and rubber fenders, various utilities and a sheet pile cut-off wall (approximately 175 m long) along the landside of the berth. Works required include cut and remove the concrete deck, remove tie rods and anchor blocks and cut off piles one metre below design dredge level or extracted.	Yes - material segregation and visual characterisation prior to either recycling, re-use on-site or removal off-site.
Substation	Undertake ACM inspections and testing of materials prior to demolition (as required). Where ACM is confirmed, remove and dispose off-site by licensed contractor with clearance certificate. Demolish building and transformer bays including underground foundations and conduits. Remove and dispose of any remaining cables from Substation within the site.	Yes – within footprint beneath substation building and transformer bays. May also be required at base of trenches resulting from any ACM conduit removal outside of building footprint.
Mooring lines	Remove lines and blocks.	No
Sewer tanks	Two underground concrete sewer tanks are located on the south side of Tower TS8. Demolish the tanks following pump out and flushing.	Yes – beneath septic tanks.

5.4 Stockpiles

Two large stockpiles, approximately 700 m^3 to 800 m^3 of mixed sandy gravel material are present in the south-western section of the site. The stockpiles also contain inclusions of slag gravel, cobbles, concrete and boulders. Both stockpiles will be removed as part of the demolition / excavation works and will be characterised (visual and sampling as required) for re-use.

5.5 Other works

A number of other works are required to be undertaken in conjunction with or prior to the site preparation/early works phase and include the following:

- Soil transport from site to Outer Harbour - Transport of approximately 33,000 m^3 of material from the site and stockpiling at the Port Kembla Outer Harbour. This will involve loading, transportation to the Outer Harbour laydown area and unloading, stockpiling and management of the stockpiles. These materials will be characterised prior to transport based on the source location, the availability of any existing data and additional sampling and analysis as required.

- Platform Excavation and Stockpiling - Excavation of platform, load, haulage and stockpiling at the Eastern Stockyard approximately 70,000 m^3 of materials.

5.6 Demolished materials

5.6.1 Materials for recycling

Materials suitable for recycling will be preserved during the demolition works and removed and stored on-site in the eastern stockyard as directed by AIE until collected or removed from site by appropriate contractors.

5.6.2 Materials for re-use

Demolished materials which are sound, suitable and approved by AIE and the auditor may be re-used in the works, subject to approval. Materials for re-use may include:

- Uncontaminated excavated material as fill
- Crushed concrete as fill

Materials for re-use are to be stockpiled and stored in the southern end of the eastern stockyard until further stages of the works proceed.

5.7 Categories of land use

Remediation during the above site works would be protective of on-going commercial/industrial (port facility) land use.

The selection of assessment/validation criteria for the remediation works in any particular area of the site would be based on the proposed land use of that area (commercial/industrial).

Where material is proposed to be reused in areas subject to exposure by environmental receptors (e.g. in the OHDSCA), assessment would also be undertaken of potential ecological impacts.

6. Relevant guidelines and legislation

6.1 Guidelines for contamination assessment and management

National Environmental Protection (Assessment of site Contamination) Measure 1999 (as amended 2013) (NEPC, 2013)

The *National Environment Protection (Assessment of Site Contamination) Measure 1999* (referred to here as the NEPM) was produced by the federal National Environmental Protection Council (NEPC) in 1999 and was revised and updated in 2013 by way of the National Environmental Protection (Assessment of site Contamination) Amendment Measure 2013 (NEPC, 2013). The amended NEPM is still referred to as the NEPM 1999. The NEPM provides a national framework for conducting assessments of contaminated sites in Australia.

The purpose of the NEPM is to "*establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, environmental auditors, landowners, developers and industry."*

The desired environmental outcome for this NEPM is "*to provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination."*

The NEPM addresses assessment of contamination, and does not provide specific guidance for remediation or management of risk, although principles for remediation and management of contaminated sites are presented in Volume 1 of the NEPM, as discussed in Section 9.2 of this RWP.

The NEPM includes two Schedules: Schedule A comprises a flowchart of the recommended general process for the assessment of site contamination and its relationship to the management of site contamination and Schedule B consists of technical guidelines about site assessment criteria, site investigation procedures, laboratory analyses, human health risk assessment, ecological risk assessment, derivation of investigation levels, groundwater risk assessment, community engagement and risk consultation and competencies and acceptance of environmental auditors and related professionals.

In broad terms, the assessment process can be described as:

- Tier 1 Preliminary investigation, laboratory analysis and interpretation, development of a conceptual site model (CSM) and assessment of results with reference to investigations or screening levels. The need for risk-based remediation assessment to derive response levels and/or the need for remediation is evaluated.
- Where required, Tier 1, Tier 2 or 3 Detailed investigation/Site specific risk assessment, laboratory analysis and interpretation are completed, and the requirement for remediation is evaluated.

6.2 State legislation and guidelines

NSW has a comprehensive suite of guidelines relating to assessment and management of contamination, administered by the EPA under the *Contaminated Land Management Act* (CLM Act) 1997 and the *Protection of the Environment Operations Act* (POEO Act) 1997. These include the following:

- NSW EPA (1995), *Contaminated Sites: Sampling Design Guidelines*. (NSW EPA, 1995)
- NSW EPA (2020), *Consultants reporting on contaminated land – Contaminated land guidelines.* (NSW EPA, 2020)
- NSW EPA (2017), *Contaminated Sites: Guidelines for NSW Site Auditor Scheme (3rd ed.).* (NSW EPA, 2017)
- NSW EPA (2014a). *Waste Classification Guidelines Part 1: Classification of Waste.* (NSW EPA, 2014a)
- NSW EPA (2014b). *Waste Classification Guidelines Part 4: Acid sulfate soils* (NSW EPA, 2014b)

Guidelines approved under the CLM Act (CLM Act, 1997) also include:

- *National Environment Protection* (Assessment of Site Contamination) Measure 1999 as amended 2013 (NEPC, 2013).
- *Australian and New Zealand - Toxicant Default Guideline Values for Sediment Quality* (ANZG, 2018a)
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Canberra ACT, Australia and New Zealand Governments and Australian state and territory governments* (ANZG, 2018b)
- Friebel, E and Nadebaum, P (2011). *Health screening levels for petroleum hydrocarbons in soil and Groundwater*. CRC CARE Technical Report no. 10. CRC for Contamination Assessment and Remediation of the Environment, Adelaide, Australia, 2011. (Friebel & Nadebaum, 2011)

Other guidelines used in the framework for assessment of asbestos contamination include:

- Western Australian Department of Health (WA DoH) *Guidelines for Remediation and Management of Asbestos Contaminated Sites in Western Australia* (WA DoH, 2009).

Relevant state and local environmental planning instruments

State and local environmental planning instruments relevant to the site include:

- State Environmental Planning Policy (State and Regional Development) 2011;
- State Environmental Planning Policy (Three Ports) 2013;
- State Environmental Planning Policy (Infrastructure) 2007;
- State Environmental Planning Policy (Coastal Management) 2018;
- State Environmental Planning Policy No 33 – Hazardous and Offensive Development;
- State Environmental Planning Policy No 55 – Remediation of Land; and
- Wollongong Local Environmental Plan 2009.

State Environmental Planning Policy 55 – Remediation of Land

SEPP55 introduces state wide planning controls for the remediation of contaminated land. Under the provisions of SEPP55, "*land must not be developed if it is unsuitable for a proposed use owing to contamination and must be remediated prior to development"*.

The dredging and reclamation are being undertaken as part of Port Kembla Gas Terminal Approved as part of SSI9471. On that basis SEPP55 does not apply.

This remedial works plan is being prepared to assist in meeting the obligations for management of contaminated material within the construction program.

Protection of the Environment Operations Act 1997 (POEO, 1997)

The objectives of the *Protection of the Environment Operations Act 1997* (POEO Act) are to protect, restore and enhance the quality of the environment, in recognition of the need to maintain ecologically sustainable development.

The POEO Act provides for an integrated system of licensing and contains a core list of activities requiring an environment protection licence (EPL) from the NSW Environmental Protection Authority (NSW EPA). These activities are called 'scheduled activities' and are listed in Schedule 1 of the POEO Act.

Clause 9 of Schedule 1 applies to chemical storage facilities and includes developments with capacity to store more than 200 tonnes of liquefied gases. The FSRU will be permanently moored at Berth 101 and will therefore likely constitute a scheduled activity requiring an EPL.

Clause 15 of Schedule 1 applies to contaminated soils treatment which includes treatment or storage of more than 30,000 m^3 of contaminated soils.

In accordance with Section 5.24 of the EP&A Act, an EPL cannot be refused if it is necessary for carrying out an approved SSI project and is consistent with the Infrastructure Approval.

An application for an EPL to guide construction and operation of the project is being processed by the EPA.

Work Health and Safety Act and asbestos removal regulations and code of practice

AIE and its appointed Contractor have a legal obligation under the Work Health and Safety (National Uniform Legislation) Act 2011, (the WHS Act) and prescribed in the Work Health and Safety (National Uniform Legislation) Regulations 2017, to ensure the work health and safety of its workers, subcontractors and visitors.

As there is a potential for asbestos to be encountered within fill or as subsurface structures at the site, the primary legislative requirements detailing AIE's obligations regarding the presence of asbestos (if it is encountered) on the site are listed as follows:

- *Work Health and Safety Act 2011*(NSW)
- *Work Health and Safety Regulations 2017* (NSW)
- *How to Manage and Control Asbestos in the Workplace*, 2019 SafeWork NSW (SafeWork NSW, 2019a)
- *How to Safely Remove Asbestos*, 2019 SafeWork NSW. (SafeWork NSW, 2019b)

6.3 Commonwealth legislation

Relevant Commonwealth Acts and Regulations include:

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environment Protection (Sea Dumping) Act 1981*
- *Work Health and Safety Act 2011* (Federal)

The principal Commonwealth environmental legislation for consideration in implementation of the remediation and validation works is the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC Act provides that the Commonwealth is to be involved in matters of "National Environmental Significance" (NES). Under the environmental assessment provisions of the EPBC Act, actions that are likely to have a significant impact on a matter of NES are subject to an assessment and approval process. The EPBC Act identifies seven matters of NES:

- World Heritage properties
- National Heritage places
- Ramsar Wetlands of international significance
- Nationally listed threatened species and ecological communities
- Listed migratory species
- Commonwealth marine areas
- Nuclear actions (including uranium mining)

When there are habitats or species of national significance (as listed under the schedules of the *Environment Protection and Biodiversity Conservation Regulation 2000*) within the project area likely to be impacted negatively upon by the proposed remediation works, then preparation and lodgement of an EPBC Act referral to the Commonwealth for the assessment would need to be considered and addressed accordingly. Potential impacts upon matters of NES were considered as part of the EIS and Infrastructure Approval and a referral was not deemed to be required.

7. Assessment criteria

7.1 Relevant guidelines

The framework for the contamination assessment was developed with reference to relevant guidelines relating to assessment and management of contamination as detailed in Section 6.

In the first instance, the most sensitive assessment criteria will be compared with the concentrations of any contamination identified at the site. If these are exceeded, the specific land use and exposure scenarios relevant to the area and depth at which the subject material is located will be examined, and the concentrations compared with the appropriate criteria for those circumstances. If the relevant criteria are exceeded, the material will be managed or remediated in accordance with this RWP.

7.2 Assessment/validation criteria - soil

7.2.1 Health investigation and screening levels

The assessment criteria proposed for the RWP were sourced from the following references:

- *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended 2013) (NEPC, 2013)
- CRC CARE *Technical Report No. 10 – Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater* (Friebel & Nadebaum, 2011)

NEPC (2013) presents health based investigation levels for different land uses (e.g. industrial / commercial, residential, recreational, etc.) as well as ecological investigation levels.

The site is situated within a heavy industrial area of Port Kembla. The site land use has been and will continue to be industrial. If any material is transported off-site for reuse as capping material in the OHDSCA, the land use would be similar.

The potential secondary receptors are site workers in a commercial/industrial land use setting. It is expected during remediation, site workers may be in direct contact with soil for short periods.

Based on the likely receptors identified for this site, the following assessment criteria will be adopted for soil assessment purposes:

- Health investigation level (HIL) for remaining contaminants of potential concern (Table 1A(1) HIL D (NEPC, 2013))
- Direct contact screening values for petroleum hydrocarbons listed in Tables B3 and B4 (Friebel & Nadebaum, 2011)

The assessment criteria selected for the key COPCs are listed in Table 7-1.

Table 7-1: Human Health assessment criteria

COPC	Health Investigation Level (HIL) (mg/kg)	Direct contact screening values (HSL-D) (mg/kg)
Heavy Metals		
Arsenic	3,000	-
Cadmium	900	-
Chromium (III+VI)	3,600	-

COPC	Health Investigation Level (HIL) (mg/kg)	Direct contact screening values (HSL-D) (mg/kg)
Copper	240,000	-
Lead	1,500	-
Mercury	730	-
Nickel	6,000	-
Zinc	400,000	-
TRH		
F1 (C6-C10)	-	-
F1 (C6-C10 less BTEX)	-	26,000
F2 (>C10-C16)	-	-
F2 (>C10-C16 less naphthalene)	-	20,000
F3 (>C16-C34		27,000
F4 (>C34-C40)		38,000
PAH		
Carcinogenic PAHs (as BaP) TEQ	40	-
Total PAH	4,000	-
PCB	7	-

Table notes: "-" No guideline value

In addition to human health risks, ecological risks also need consideration for the above land uses. The ecological risks consider contaminant impacts to vegetation and transitory wildlife. The risk to those receptors is dependent on the exposure pathway and site activities, which may degrade ecological values. The site and surrounding areas have been used for heavy industrial activities for over 50 years, which has significantly reduced the potential habitat value for ecological receptors. Therefore, terrestrial ecological values are considered to be significantly degraded and are not considered to be required for further site assessment or validation in relation to land-based use of materials.

7.2.2 Asbestos

The NEPM provides guidance relating to the assessment of known and suspected asbestos contamination in soil and addresses both friable and non-friable forms of asbestos. The health screening levels for asbestos in soil have been adopted from the Western Australian Department of Health (WA DoH) *Guidelines for Remediation and Management of Asbestos Contaminated Sites in Western Australia* (WA DoH, 2009).

The NEPM guidance emphasises that the assessment and management of asbestos contamination should take into account the condition of the asbestos materials and the potential for damage and resulting release of asbestos fibres. Therefore, for the purposes of assessing the significance of asbestos in soil contamination, three terms are used as summarised below:

- Bonded asbestos containing material (Bonded ACM) – sound condition although possibly broken or fragments and the asbestos is bound in a matrix
- Fibrous asbestos (FA) – friable asbestos materials such as severely weathered ACM and asbestos in the form of loose fibrous materials such as insulation
- Asbestos fines (AF) – including free fibres of asbestos, small fibre bundles and also fragmented ACM that passes through a 7 mm x 7 mm sieve

From a risk to human health perspective, FA and AF are considered by the NEPM to be equivalent to “friable” asbestos in Safe Work NSW Codes of Practice (2019). Bonded ACM in sound condition represents a low human health risk. However, both FA and AF materials have the potential to generate, or be associated with, free asbestos fibres and may represent a significant human health risk if disturbed and fibres are made airborne.

As per Section 7.2.1, the commercial / industrial (D) health screening levels were adopted as the most appropriate to the site:

Table 7-2: Asbestos assessment criteria

Form of Asbestos	Health Screening Level (w/w)
	Commercial/industrial D
Bonded ACM	0.05%
FA and AF[a] (friable asbestos)	0.001%
All forms of asbestos	No visible asbestos for surface soil

a. The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres.

A tiered approach to risk assessment of asbestos contamination is recommended, including the development of an appropriate Conceptual Site Model (CSM). A weight of evidence approach is recommended with consideration given to factors such as the distribution of different fill types, the heterogeneity of the contamination and the uncertainty associated with the sampling methodology.

The NEPM states that if the Tier 1 screening levels are not exceeded, and an appropriate level of investigation has been carried out, then no contamination management actions are required except for ensuring the surface soil is free of visual asbestos. Final visual inspection of the assessment and remediated areas should not detect any visible asbestos.

GHD notes that these HSLs do not necessarily equate to requirements under the WHS Regulation or Codes of Practice, which may impose requirements regardless of the concentration or proportion of asbestos in soil.

7.3 Assessment criteria – sediment

For soils that may be re-used in an aquatic environment, the assessment criteria selected for this assessment were sourced from the following references:

- *Australian and New Zealand - Toxicant Default Guideline Values for Sediment Quality* (ANZG, 2018a)

ANZG (2018a) provides criteria that allow for the assessment of toxicant effects on sediment biota. Toxicant concentrations reported below the DGV are considered to present a low risk of unacceptable effects to aquatic ecosystems. However, toxicant concentrations exceeding the GV-high are an indicator of potential high-level toxicity problems, and therefore not a guideline value that will ensure protection of ecosystems without further lines of evidence with respect to toxicity affects. Based on the aquatic receptors identified in Section 8.4 below, these guidelines are considered appropriate for the purposes of this assessment.

In addition to the assessment criteria, the guideline also recommends that "the <2 mm sediment particle size fraction should be used for chemical analyses for comparison with sediment quality guideline values so that the potential risk posed by contaminants is not diluted by a large mass of larger materials (gravel and other debris). The <63 µm sediment particle size fraction (clay and silt) is considered a suitable representation of the sediment materials that are mostly readily resuspended or potentially ingested by organisms" (ANZG, 2018a).

Because the bioavailability and toxicity of contaminants is influenced by sediment grain size and organic carbon content, particle size distribution and total organic carbon (TOC) testing will also be carried out on selected samples representing a particular sediment unit. TRH, PAH and PCB concentrations will be normalised to 1% OC based on the TOC result.

The sediment assessment criteria selected for the COPC identified on site in GHD (2021a) and (2021b) are listed in Table 7-3.

Table 7-3: Sediment assessment criteria

COPC	DGV (mg/kg)	GV-high (mg/kg)
Chromium (III+VI)	80	370
Copper	65	270
Lead	50	220
Nickel	21	52
Zinc	200	410
Total TRH	280	550
Total PAH	10	50
PCB	0.034	0.28

7.4 Assessment criteria – water

7.4.1 Published guidelines

For soils that may be re-used in an aquatic environment, further consideration was given to leachable concentrations of potential contaminants in comparison with water quality criteria. The water assessment criteria selected for this assessment were sourced from the following references:

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Canberra ACT, Australia and New Zealand Governments and Australian state and territory governments (ANZG, 2018b)
- *Environmental Risk Limits for Mineral Oil (Total Petroleum Hydrocarbons) for the National Institute for Public Health and the Environment, Netherlands* (Verbruggen, 2004).

ANZG (2018b) provides default guideline values (DGV) for the protection of aquatic ecosystems which afford 80% to 99% species protection depending on the environmental setting. The DGV's applicability to a given site depends on current or desired condition of the ecosystem and the associated level of protection that is assigned. The levels of protection include:

- High ecological/conservation value system: apply 99% species protection DGV
- Slightly to moderately disturbed system: apply 95% species protection DGV
- Highly disturbed system: apply 90% or 80% species protection DGV.

The Inner and Outer Harbours are highly modified industrial settings receiving stormwater runoff and waste discharge from neighbouring industries and therefore considered to be a highly disturbed system. Based on current site conditions, applying 80% to 90% species protection DGV could be appropriate. However, it is anticipated that some stakeholders (e.g. NSW EPA) may consider the application of a lower species protection level could result in further degradation of water quality in the Harbour and therefore prefer to use more stringent DGVs. Therefore, leachability results will be compared to 80%, 90% and 95% species protection DGVs (or 99% protection DGVs where recommended for particular COPC based on bioaccumulation).

ANZECC/ARMCANZ (2000) states that there was insufficient data to derive a high reliability trigger value for TPH. This has remained unchanged since the revision of these guidelines in 2018 (ANZG, 2018b). The ANZECC/ARMCANZ (2000) provided a low reliability trigger value for Total Petroleum Hydrocarbons (TPH) of 7 µg/L. This guideline is generally considered by industry to be overly conservative and is also well below the TPH detection limit which most laboratories can achieve. The National Institute for Public Health and the Environment, Netherlands commissioned a report to determine the Serious Risk Concentrations for ecosystems (SRCseco) for Mineral Oil (Total Petroleum Hydrocarbons) (Verbruggen, 2004). The Serious Risk Concentrations (SRC) are based on environmental risk limits (ERLs) derived using data on ecotoxicology and environmental chemistry and represent the levels of a substance that present a risk to the ecosystem. The SRCs are considered to provide a reasonable indication of impact to aquatic ecosystem and, in the absence of locally derived trigger values for TRH; the relevant values listed in Table 3, Column 6 in this document have been adopted.

The Verbruggen (2004) value is derived for specific TRH fractions from the Dutch Target and Intervention Values (Rijkswaterstatt, 2000) with a value for mineral oil of 600 µg/L. This guideline was re-released in 2013 (Rijkswaterstatt, 2013) and the value for mineral oil remained the same, therefore the values derived in Verbruggen (2004) are still considered relevant.

7.4.2 TPH Screening levels for protection of aquatic organisms

Further to the TRH criteria discussed above, GHD has compiled a set of TPH screening levels for protection of aquatic organisms, as presented below.

7.4.2.1 Overview

TPH is a complex mixture of compounds that can change over time via physical weathering and/or biological transformation processes. As a result of these factors, it is difficult to predict the concentration of TPH in the environment that may adversely affect aquatic organisms.

Due to this complexity and uncertainty, ANZG (2018b) has not published water quality guidelines (WQG) for TPH in aquatic environments and very few relevant WQG have been published internationally. ANZG (2018b) has however published WQG for individual TPH compounds, including BTEXN and a number of individual polycyclic aromatic hydrocarbon compounds and these should be the primary focus of a tier 1 assessment of TPH analytical data.

7.4.2.2 Solubility and bioavailability

Higher molecular weight TPH compounds have low aqueous solubilities, with the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG, 1997) reporting that the solubility of TPH is inversely related to carbon chain length, ranging from approximately 0.01 mg/L to 10 mg/L for $TPHC_{15}$ compounds to <0.001 mg/L for $TPH>C_{35}$ compounds. High molecular weight TPH also demonstrate high affinities for adsorption to organic matter, as demonstrated by log organic carbon-water partition co-efficient (Koc) values typically >4 mg/L (TPHCWG, 1997).

The composition of the dissolved phase TPH in a water sample is also controlled by the effective solubility of each compound in the mixture, which is a function of the solubility of each compound and its mole fraction in the TPH mixture. The effective solubilities of TPH compounds in a hydrocarbon mixture are typically much lower than their individual solubilities. The estimated solubility of the various TPH fractions, when present in their pure form and in mixtures, as presented by Friebel and Nadebaum (2011), is summarised in Table 7-4. A review of this data indicates that the TPH fractions with effective solubilities > 1 mg/L is limited to the $>C_6$ -C_8 aliphatic fraction and the C_6-C_{16} aromatic fractions.

Table 7-4: Summary of TPH solubility data (as presented by Friebel and Nadebaum, 2011)

TPHCWG Fractions	Estimated Pure Solubility (mg/L)	Estimated Mixture Solubility Limit (mg/L)
Aliphatic hydrocarbons		
$>C_6–C_8$	16	1.5
$>C_8–C_{10}$	0.69	0.14
$>C_{10}–C_{12}$	0.05	0.0078
$>C_{12}–C_{16}$	0.00035	0.0001
$>C_{16}–C_{21}$	0.000002	0.0000003
$>C_{21}$-C_{35}	0.000002	0.00000001
Aromatic hydrocarbons		
Benzene (C_6)	1750	42
Toluene (C_7)	526	43
Ethylbenzene (C_8)	169	3
Xylene (C_8)	198	15
Naphthalene (C_{10})	31	0.12
$>C_8–C_{10}$	110	4.76
$>C_{10}–C_{12}$	30	1.08
$>C_{12}–C_{16}$	9.3	1.07
$>C_{16}–C_{21}$	0.56	0.05

TPHCWG Fractions	Estimated Pure Solubility (mg/L)	Estimated Mixture Solubility Limit (mg/L)
>C_{21}–C_{35}	0.03	0.00028

When insoluble or sediment-associated TPH comes into direct contact with the epithelia of aquatic organisms (e.g. gut, gills), there may be some dissolution in the thin film of water between the TPH and membrane surfaces and partition into the membrane (Di Toro, et al., 1991). Aquatic organisms primarily absorb the water soluble fraction of TPH however, rather than insoluble compounds or TPH associated with sediment particulates. The aquatic toxicity of TPH is therefore more closely related to measurements of the water-soluble fraction of hydrocarbons than total hydrocarbon concentrations (ANZG, 2018b).

The potential exists for physical impacts (e.g. smothering) to occur at TPH concentrations higher than the solubility limit, due to the presence of light non-aqueous phase liquids (LNAPL). Limited ecotoxicity data is available for high molecular weight hydrocarbons (>C_{16}), but the data that is available suggests that the direct chemical toxicity of these compounds is however limited by their low solubility and bioavailability (Batelle, 2007) (CONCAWE, 2001) (ITRC, 2018) (Atlantic PIRI, 2012).

TPH concentrations in water samples are typically measured using gas chromatography-flame ionization detection (GC-FID). This method may not provide an accurate representation of dissolved TPH concentrations, as a non-soluble TPH (either insoluble sheen or particulate-associated), when present in the water sample will be extracted (Zemo & Foote, 2003). Ideally, the endpoints reported for TPH ecotoxicity tests should therefore be reported on the basis of the water accommodated fraction (WAF) for TPH mixtures, rather than total measured TPH concentrations.

7.4.2.3 Published TPH guidelines

Due to the uncertainties inherent is estimating TPH ecotoxicity, as outlined in Section 7.4.2.1, there are very few screening levels published internationally for TPH. A summary of a selection of the available aquatic protection values and guidelines published internationally for TPH is presented in Table 7-5.

Table 7-5: Summary of a selection of published TPH guidelines

TPH	Reported relevant carbon fraction	Freshwater (µg/L)	Marine (µg/L)	Source	Derivation
TPH (diesel)	C10-C19 (Total)	500	500	British Columbia, Canada: MoE (1996)	Not detailed
TPH (gasoline)	WAF* of gasoline C5-C8 Aliphatic: 100% C9-C16 Aromatic: Trace	440	3700	California, United States: CASWB-SFBR (2016) Hawaii, United States: HIDOH (2017)	Aquatic toxicity testing of gasoline-contaminated groundwater using the freshwater water flea (Ceriodaphnia dubia) and sea urchin (Strongylocentrotis purpuratus)
TPH (diesel)	WAF* of diesel C5-C8 Aliphatic: Trace C9-C16 Aromatic: 100%	640	640		Chronic toxicity testing of the water accommodated fraction of gasoline using the mysid shrimp (Americamysis bahia)
TPH (gasoline)	Diesel product C5-C8 aliphatics: 54% C9-C10 aliphatics: 16% C10-C12 aliphatics: 12% C8-C10 aromatics: 6% C10-C12 aromatics: 12%	1500	1500	Canada (eastern): Atlantic PIRI (2012)	Calculated using the Petrotox model, with chronic and acute toxicity endpoints for individual petroleum hydrocarbon fractions combined based on typical product loadings
TPH (diesel)	Gasoline product C9-C10 aliphatics: 5% C10-C16 aliphatics: 45% C16-C34 aliphatics: 20% C10-C16 aromatics: 18% C16-34 aromatics: 11%	100	100		

* Water Accommodated Fraction (WAF) is the fraction of an oil in an aqueous media that is either dissolved or present as a stable dispersion or emulsion.

7.4.2.4 Selection of tier 1 screening values

The data in Table 7-5 indicates that the screening levels for TPH in water range from approximately 0.1 to 4 mg/L, based on the toxicity of the dissolved petroleum hydrocarbons associated with fresh gasoline and diesel products.

Gasolines are defined as hydrocarbon mixtures with carbon fractions predominantly in the C_6-C_{12} range, whereas diesels are predominantly comprised of hydrocarbons in the C_{10}-C_{34} range (TPHCWG, 1997). The data presented by California State Water Board–San Francisco Bay Region (CASWB SFBR, 2016) suggests that the WAF of gasoline-based products, is predominantly comprised TPH C_6-C_9 aromatics (predominantly BTEX) and C_6-C_9 aliphatics, whereas the WAF of diesel-based products is predominantly comprised of C_9-C_{16} aromatics. The distinction between the composition of the whole products and their WAF is related to the inverse relationship between carbon chain length and effective solubility and lower solubility of aliphatic than aromatic compounds, at a given chain length range (refer to Table 7-4).

On the basis of the data presented in Table 7-5, it is considered reasonable to select screening levels for gasoline-based products to represent TPHC_6-C_9 and screening levels for diesel-based products to represent TPHC_{10}-C_{16}. Direct ecotoxicity-based screening levels for TPH>C_{16} are not deemed to be required or appropriate, due to the limited effective solubility and therefore chemical toxicity that is typical of these compounds.

As a conservative approach, the lowest of the screening criteria presented in Table 2 for saline receiving waters (i.e. the Atlantic PRI values) have been adopted in this assessment, as summarised in Table 7-6.

Table 7-6: Summary of recommended TPH screening levels

ASC NEPM TPH Fraction	Aquatic protection screening level (µg/L)
F1 (C6-C10 minus BTEX)	1500
C6-C10 fraction	Not required - BTEX to be assessed separately using ANZG (2018) guidelines
F2 (>C10-C16 minus naphthalene)	100
>C10-C16 fraction	NA - Naphthalene to be assessed separately using ANZG (2018) guidelines
F3 (>C16-C34 fraction)	Not required – insufficiently soluble
F4 (>C34-C40 fraction)	Not required - insufficiently soluble
>C10-C40 (sum of total)	Not required - >C10-C16 to be assessed separately

As noted in Section 7.4.2.2 the analytical methods typically used for TPH analysis may not provide an accurate representation of bioavailable TPH concentrations. To facilitate a more accurate assessment of the toxicity of TPH to aquatic organisms, in the event that these screening levels are exceeded, consideration could be given to the analysis of speciated TPH fractions and a more detailed evaluation of the effective solubility of the individual TPH compounds present.

A number of international jurisdictions also consider that is reasonable to incorporate attenuation factors into aquatic ecosystem screening criteria applied to TPH in groundwater, to reflect likely attenuation within the groundwater, or dilution within the groundwater/surface water interface (e.g. (Atlantic PIRI, 2012), (BC MoE, 2009)). While this approach has not been recommended in this assessment, the potential for attenuation priors to discharge in the marine environment and in the groundwater/surface water mixing zone, has been considered when evaluating the analytical data.

7.4.3 Selected water assessment criteria

On the basis of the considerations discussed above, the assessment criteria selected for the key COPCs are listed in Table 7-7.

Table 7-7: Water assessment criteria

COPC	Assessment Criteria (µg/L)						
	80% Species Protection		90% Species Protection		95% (or 99% where noted) Species Protection		Tier 1 screening levels (refer to Table 7-6)
Heavy metals:	DGV	Ref	DGV	Ref	DGV	Ref	
- Arsenic	2.3	1d	2.3	1d	2.3	1d	-
- Cadmium	0.7	1e	0.7	1e	0.7	1e	-
- Chromium	85	1a	20	1a	4.4	1a	-
- Copper	8	1	3	1	1.3	1	-
- Lead	12	1	6.6	1	4.4	1	-
- Mercury	0.1	1e	0.1	1e	0.1	1e	-
- Nickel	560	1	200	1	70	1d	-
- Zinc	43	1	23	1	15	1	-
TRH:							
- F1 (C6-C10)	20	b	20	b	20	b	-
- F1 (C6-C10 less BTEX)	160	c	160	c	160	c	1,500
- F2 (>C10-C16)	780	c	780	c	780	c	-
- F2 (>C10-C16 less naphthalene)	50	b	50	b	50	b	100
- F3 (>C16-C34)	800	c	800	c	800	c	-
- F4 (>C34-C40)	100	b	100	b	100	b	-
PAH							
- Naphthalene	120	1	70	1	50	1d	-
- Phenanthrene	0.6	1d,e	0.6	1d,e	0.6	1d,e	-
- Anthracene	0.01	1d,e	0.01	1d,e	0.01	1d,e	-
- Fluoranthene	1	1d,e	1	1d,e	1	1d,e	-
- Benzo(a)pyrene	0.1	1d,e	0.1	1d,e	0.1	1d,e	-
PCB							
- Arochlor 1242	0.3	1d,e,f	0.3	1d,e,f	0.3	1d,e f	-
- Arochlor 1254	0.01	1d,e,f	0.01	1d,e,f	0.01	1d,e,f	-

Table notes:

1 Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Canberra ACT, Australia: and New Zealand Governments and Australian state and territory governments (ANZG, 2018b).

a Guideline for Cr VI

b Level of Reporting used as Screening Level

c Verbruggen (2004) SRCeco. Values recalculated to reflect analytical fractions

d Low reliability trigger values

e Recommended 99% protection level used if no data are available for bioaccumulation effects at a specific site

f Freshwater guideline is applied with caution as an unknown reliability value, as no marine value is available.

7.5 Application of selected criteria

The methodology used when assessing contamination levels in soils during remediation/characterisation and validation at the site will be to use the relevant HSLs, HILs , sediment (DGV and DG-high) where required and water quality criteria (as relevant for leachable concentrations) as cut off points to classify materials either as:

- Not contaminated, which pose no risk to the environment or human health and warrant no further action, i.e. concentrations less than or equal to the selected criteria.
- Containing elevated concentrations of contaminants, which may pose a risk to the environment (in particular aquatic ecosystems) but pose no risk to human health under the proposed land use scenario i.e. concentrations greater than the DGVs and less than the adopted HILs or HSLs. A qualitative risk assessment may be sufficient to evaluate the potential impact for the proposed land use.
- Significantly contaminated which pose a risk to both human health and aquatic ecosystems, i.e. concentrations significantly greater than relevant health investigation or DGVs. Soils or sediment in this category would likely require management or disposal off site (including potential containment within the OHDSCA), or further assessment by way of site-specific health and/or ecological risk assessment (Tier 2 or 3) carried out as appropriate for the proposed land use. This may require the collection of additional site data.

7.6 Waste classification criteria

Materials that may require offsite disposal as part of site remediation will be classified using the six-step process and criteria detailed in *Waste Classification Guidelines – Part 1: Classification of Waste* (NSW EPA, 2014a).

In accordance with the Waste Classification Guidelines, the applicable classification principles include (but are not limited to) the following:

- “If asbestos waste is mixed with any other class of waste, all the waste must be classified as asbestos waste. For example, asbestos waste mixed with building and demolition waste, must be managed as asbestos waste.”
- ‘Special waste’ is a class of waste that has unique regulatory requirements. The potential environmental impacts of special waste need to be managed to minimise the risk of harm to the environment and human health.
- Special wastes are:
  - Clinical and related waste
  - Asbestos waste
  - Waste tyres

Producers of special waste do not need to make any further assessment of their waste if it falls within the definitions of special wastes except as follows:

- Asbestos waste means any waste that contains asbestos. Chemical classification of soil contaminated with asbestos is still required.

Materials that may comprise ASS will be classified and handled as per the *Waste Classification Guidelines – Part 4: Acid Sulfate Soils* (NSW EPA, 2014b).

8. Site contamination status

The following review of the site contamination status is based on the results from GHD (2018a), (2021a) and (2021b).

8.1 Soils

Based on the review of the previous investigations (Section 4) the following areas were identified as potentially posing a risk to human health and/or the environment for redevelopment of the site without appropriate remediation and/or management to reduce the risk of potential impacts to sensitive health and ecological receptors to allow for continued commercial/industrial land use.

Identified hotspots

- GBH09 – BaP and TRH above HIL/HSL D. Following additional investigations, delineated vertically and in all directions and deemed to be localised.
- GBH26 - BaP and TRH above HIL/HSL D. Following additional investigations, the lateral extent for GBH26 is unknown in the eastern and western directions.

Substation

- PCB concentrations above DGV in surface soils. Depth of investigations limited, not delineated vertically.

Fill across the site

- One location within Berth 101 area (GBH13A) was identified with elevated BaP TEQ above the HIL-D and not vertically delineated and some odorous and discoloured soils were identified with a potential for unidentified hotspots of contamination to exist. Further, on the western side of conveyor No. 7. fill was noted to contain coal, concrete timber and slag.

Subsurface structures / services

- Existing subsurface oil pipeline and ACM water pipe identified on site and ACM building materials on site (substation)

Stockpiles

- Two large stockpiles with a potential to contain contaminated materials.

8.2 Groundwater

Previous investigations have indicated elevated concentrations of arsenic, copper, mercury, lead, nickel, zinc and ammonia across the site indicating some potential impact to groundwater from former site operation and fill materials on site. However, the groundwater conditions at the site are not considered to represent significant impacts to environmentally sensitive receptors and, at this stage, do not require specific remediation or management for continued commercial/industrial land use. It is expected that levels of contaminants in groundwater will attenuate over time with the planned demolition and excavation of fill materials on the site.

Continuation of the groundwater monitoring program throughout the demolition and post demolition period would increase the groundwater data set with the ability to further investigate anomalous results and analyse trends in groundwater characteristics and chemistry.

GHD recommends two groundwater monitoring events to occur during site demolition / remediation works as follows:

- Initial event – prior to commencement of site remediation works
- Second event – following completion of site remediation

Samples would be collected from the existing monitoring wells (where available) using GHD's standard field operating procedures (as per GHD (2018a) and (2021a)) and will be analysed for the previously identified contaminants of concern including field parameters, heavy metals, TRH, BTEXN, PAH and ammonia.

8.3 Data gaps

The following data gaps are required to be investigated prior to or as part of the proposed demolition / remediation works.

Above and below ground infrastructure

The presence of remaining infrastructure both above and below ground has prevented investigation of soils in areas of remaining infrastructure, and it was recommended that intrusive investigations are conducted once these are demolished/removed. As investigations are proposed to be conducted concurrent with demolition / remediation works, allowance should be made for contingencies as the presence and/or extent of contaminated materials is unknown at this stage and cannot be detailed in the RWP strategy.

The objectives for the additional investigations are to collect data from where spatial data gaps exist across the site, so that sufficient information can be obtained to confirm site conditions and inform preliminary decisions regarding segregation / characterisation of materials and the suitability for re-use (i.e. contaminated soils will be removed regardless of contamination either in demolition stage or as part of the subsequent bulk excavation).

Excavated fill

As the presence of unidentified contaminated fill materials in investigation areas of the site cannot be discounted, it is recommended that excavation of the fill to the required levels is supervised by the environmental consultants with unexpected finds protocols in place. Materials displaying distinct odours, unusual colour changes or containing suspected contaminated fill materials (ACM, extensive slag or coke, etc.) should be segregated and analysed as required prior to a decision made for re-use or disposal off site.

Stockpiles

As the presence of contaminated materials within the large fill stockpiles in the south western portion of site cannot be discounted, it is recommended that these materials are visually characterised with suspected contaminated materials segregated and analysed as required prior to a decision made for re-use or disposal off site.

Waste classification

During remediation works, any soils segregated and proposed for disposal off site must be classified in accordance with the *Waste Classification Guidelines Part 1: Classifying Waste* (NSW EPA, 2014a)and *Waste Classification Guidelines Part 4: Acid Sulfate Soils* (NSW EPA, 2014b).

8.4 Updated conceptual site model

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The development of a CSM is an essential part of all site assessments and provides the framework for identifying contamination sources and how potential receptors may be exposed to contamination.

8.4.1 Potential sources

Based on the previous investigations, the following AECs were identified and associated with the following activities and potential sources of contamination:

- Fill – used in the construction of Berth 101 and adjoining areas including identified hot spots of contamination (GBH09 and GBH26). Contaminants of concern include TRH, BTEX, PAH and heavy metals.
- Electrical substation – presence of PCB contaminated soils beneath and surrounding the structure. ACM contained within building materials including wall /ceiling linings and conduits. Contaminants of concern include TRH, PCBs and ACM.
- Buried oil pipeline and ACM water pipeline – potential for spill and leaks from oil pipeline and transfer of ACM to soils through pipe wear and tear and damage. Contaminants of concern include TRH and ACM.
- Stockpiles – Two large stockpiles of fill materials with identified slag gravels that may contain contaminated materials.

8.4.2 Potential exposure pathways

The primary exposure pathways by which potential receptors could be exposed to the CoPC are considered to be:

- Direct contact with contaminated soil or groundwater
- Inhalation of dust from contaminated soils.
- Inhalation of vapours/gases generated by contaminated soil.

8.4.3 Potential receptors

Based on GHD's understanding of the project, fill material from the berth is proposed to be excavated, stockpiled and then either re-used on site or relocated to the Outer Harbour disposal site. Accordingly, the key receptors of interest include:

- Future site workers and users:
  - Site workers involved in the demolition and remediation works at the site in which the impacted material is disturbed.
  - Individuals involved in potential future construction and maintenance of the site. Intrusive maintenance workers: carrying out repairs or installation on subsurface utilities. It is expected that minor excavation activity could occur in the future (e.g. for installation of additional services).
- Marine ecological receptors: The primary receptor of any identified contamination is considered to be marine aquatic ecosystems of the Inner and Outer Harbour following placement of excavated materials in the OHDSCA, particularly for the construction of the bund. The Inner and Outer Harbours are highly modified industrial settings receiving stormwater runoff and waste discharge from neighbouring industries.

8.5 Source-pathway-receptor linkages

8.5.1 Demolition and remediation work

Initial receptors are considered to be site workers involved with earth works associated with demolition and remediation activities, that is, those coming into direct contact with soil or potentially hazardous materials. Earthworks are to involve shallow to deep excavations across the site to achieve required construction levels or to remove identified contamination, stockpile management, including stockpiled materials which have been identified as unsuitable for placement in the OHDSCA. This exposure scenario provides an increase likelihood that workers will be in direct contact with soil and exposed to dust via inhalation generated during excavation and stockpiling. Therefore, the SPR linkages could be complete.

Based on results of the previous investigation, vapours and gases have not been identified as exposure pathways. Therefore, the SPR linkages are assessed incomplete for vapour inhalation as this form of contamination has not been identified.

8.5.2 Excavation, dredging and placement of materials

The disturbance associated with relocation of the material to the Outer Harbour could facilitate the release of contaminants into the marine water column as follows:

- Placement of materials - leaching and /or suspension of sediments could result in contaminant releases at Berth 101 and at the OHDSCA.
- Following construction and placement - ongoing leaching, influenced by tidal fluctuations of contaminants in the Outer Harbour could occur. Some aquatic species may also burrow into the bund wall.

These exposure scenarios provide increased likelihood that aquatic species will be in direct contact with potentially impacted sediment, water and groundwater during excavation and dredging of Berth 101, and then the construction and post construction of the OHDSCA. Therefore, the SPR linkages could be complete if contamination exists.

Due to the tidal nature of the groundwater in the Berth 101 fill materials, existing contamination will have been subject to potential leaching and discharge into the Inner Harbour for decades. Detailed analysis of the marine ecology values is included in Chapter 13 and Appendix G of the EIS (GHD, 2018b). In summary, short term deterioration of water quality will occur from the excavation and dredging activities and suspended sediments confined to areas within the silt curtain. It was noted that marine ecology in the Harbours were regularly exposed to dredging activities and therefore are considered resilient to short-term increases in suspended solids. Long-term toxic effects were assessed unlikely.

8.6 CSM conclusions

Based on review of the potential SPR linkages, the proposed development may provide direct contact / ingestion exposure pathways to contamination, if present, to workers involved in remediation of impacted soils and to aquatic ecosystems.

It is considered that the potential for the identified SPR linkages to workers to be complete following demolition / remediation will be significantly reduced.

SPR linkages to marine receptors will be complete during the bulk excavation and dredging stages and relocation of material for placement in the OHDSCA, and will need to be managed accordingly.

9. Remediation options review

9.1 Objectives and remediation goals

The overall goal of the remediation is to sustainably and cost effectively manage, remediate or remove and validate identified contaminated soils within the site to mitigate potential environmental and health hazards from exposure of the material, to allow redevelopment of the site.

In order to achieve this overall objective, management or remediation works will be required at the site to address contamination issues identified in Section 8, including unexpected contamination that may be encountered during the site demolition or subsequent excavation of fill materials. The specific remediation goals are as follows:

- Address data gaps identified in Section 8.3.
- Remediate and validate known areas of contamination.
- Appropriately manage or remediate as required any unexpected finds that may be encountered during the site works.

Further investigation and subsequent remediation are to be undertaken to achieve residual concentrations of contaminants less than the adopted criteria as discussed in Section 7.

9.2 Technical and policy considerations

The key principles for remediation and management of contaminated sites presented in the NEPM (NEPC 2013) indicate that the preferred hierarchy of options for site clean-up and management should include (in descending order):

- On-site treatment of the contamination so that it is destroyed or the associated risk is reduced to an acceptable level.
- Off-site treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level, after which soil is returned to the site.

If the above are not practicable:

- Consolidation and isolation of the soil on site by containment with a properly designed barrier.
- Removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material.

Or

- Where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

Other options, which are consistent with the philosophy of contamination management described in the NEPM, could include the following:

- Adopting a less sensitive land use to minimise the need for remedial works, which may include partial remediation.
- Leaving contaminated material in-situ providing there is no immediate danger to the environment or community and the site has appropriate management controls in place.

The NEPM also states the following:

When deciding which option to choose, the sustainability (environmental, economic and social) of each option should be considered, in terms of achieving an appropriate balance between the benefits and effects of undertaking the option.

In cases where no readily available or economically feasible method is available for remediation, it may be possible to adopt appropriate regulatory controls or develop other forms of remediation.

It should be emphasised that the appropriateness of any particular option will vary depending on a range of local factors. Acceptance of any specific option or mix of options in any particular set of circumstances is therefore a matter for the responsible participating jurisdiction.

In relation to asbestos, the (NEPC, 2013) (Schedule B1 section 4.11) notes that remediation options which minimise soil disturbance and therefore public risk are preferred; and management of asbestos in situ is encouraged, which may include covering the contamination with uncontaminated fill or other protective or warning layers. However, Section 4.1 of Schedule B1 notes that this guidance is not applicable to asbestos materials which are wastes such as demolition materials present on the surface of the land. Section 4.3 also notes that if visible asbestos is present and it may be disturbed during work activities, it must be removed.

The Waste Avoidance and Resource Recovery Act 2001 establishes the following hierarchy for the management of resources:

- Avoid unnecessary resource consumption
- Recover resources (including reusing, reprocessing, recycling and recovering energy)
- Disposal

9.3 Evaluation of remediation technologies

9.3.1 Overall approach dictated by the development

Evaluation of remediation technologies applicable to the overall project, including selection of construction and disposal methodology was undertaken as part of the EIS (GHD, 2018b). The alternatives proposed were assessed considering key outcomes such as engineering, design, operational, environmental, social, economic, schedule, cost, approvals, availability/reliability and accessibility. The analysis of alternatives was presented to address a key requirement of the SEARs, which required a justification for the proposed project as opposed to other alternatives considered during the development of the project.

Stockpiled material from the Berth 101 excavation will be relocated to a disposal site within the Outer Harbour. A perimeter bund will be constructed to ensure the stability of the disposal site and may require pre-dredging of existing soft sediments that have previously been placed across the disposal site.

Once the stabilising bund is completed the material that would be excavated and dredged for construction of berth and wharf facilities would be deposited within the bund. The material would be deposited in an order such that potentially contaminated material would be dumped well within the bund and sealed over with lower risk material. The approach is consistent with the approved plans for the redevelopment of the Port Kembla Outer Harbour and previous dredging campaigns for establishment of berth facilities in the Inner Harbour.

Construction would have various waste streams including demolition and construction waste, excavated and dredged material and waste vegetation. The largest waste stream will be excavated and dredged sediment and soil material, which will primarily be placed at the disposal area in the Outer Harbour generally in accordance with NSW Ports reclamation plans. Waste generated by construction would be managed in accordance with the waste hierarchy defined in the Waste Avoidance and Resource Recovery Act 2001 (WARR Act, 2001) through separate waste management plans developed for construction and operation.

Waste materials that are capable of being readily reused, reprocessed, recycled or otherwise recovered such as wood, metal, brick, concrete, asphalt, gravel and other aggregates would be sent to suitably licensed facilities for those purposes as far as practicable.

The excavation and dredging as well as the placement of the material in the disposal area would be carried out in a manner such that higher risk material would be capped with lower risk material while potential acid sulphate soils will be placed at depth to prevent oxidation and acid formation. The potential impacts and management measures concerning excavated and dredged material that is potentially contaminated and/or acid forming material would include the development of specialist management plans.

9.3.2 Summary of adopted remediation approach

The remediation technologies for the proposed demolition and excavations works were adapted to the existing construction design for the redevelopment. The adopted remediation methods and the applicability are as follows:

- Re-use (including at the new berth or in construction of the OHDSCA) of suitable materials.
- Recycling of waste materials that are capable of being readily reused, reprocessed, recycled or otherwise recovered.
- Containment of fill and other suitable materials within the OHDSCA.
- Disposal off site for bulky wastes not suitable for recycling and unexpected finds of contamination (if any are encountered) that are not considered suitable to be placed within the OHDSCA.

9.4 Remediation objectives and constraints

As previously discussed, it is intended to remediate/manage fill at the site to allow demolition of site structures and hardstand and excavation of subsurface fill, followed by bulk excavation and dredging of Berth 101 to required levels and placement of suitable dredged and excavated materials in the OHDSCA (including construction of the OHDSCA bund and cap). A decision tree for segregation and characterisation of excavated and stockpiled materials and the criteria for re-use are presented in Section 10.8.

AIE has advised that their specific objectives for the initial phase of demolition and remediation of the site include the following:

- Removal of all infrastructure both above and below ground to allow for excavation and re-profiling of the site for the future construction of the facility.
- Recycling / re-use where possible of all suitable materials (metal, crushed concrete etc).
- Segregation of potentially contaminated materials where possible and placement of all suitable materials in the OHDSCA.

Constraints to the above remediation method include the following:

- Removal of above ground and underground structures and underground services/pipe work will be a major part of the demolition, and investigation/validation during removal works will form part of the remediation program.
- Issues with segregation of fill materials whereby contamination is not necessary associated with odours or distinct colour changes
- Contaminants other than those identified for remediation may be encountered.

10. Remediation works plan

This section provides a description of the remediation works steps and procedures required to protect health, safety and the environment during the Berth 101 demolition and remediation works.

The roles and responsibilities of the AIE Project Manager, Contractor and Environmental Consultant are outlined in Section 1.6.

10.1 Preliminaries

Prior to commencing demolition and earth works, all relevant licences and approvals must be obtained by AIE and/or remediation contractor from the relevant authorities.

The remediation works are required to be undertaken generally in accordance with the development in the Port Kembla Gas Terminal EIS and the Infrastructure Approval SSI 9471. The Infrastructure Approval includes a number of conditions including the preparation of a suite of management plans including a Spoil Management Plan.

The project plans must address the requirements in the project's Environmental Impact Statement, Infrastructure Approval, EPL and applicable legislative requirements..

It is a requirement for the various plans to be reviewed and accepted by the nominated responsible parties prior to any site works commencing. A separate WHSP will be prepared for environmental consulting works.

It is the responsibility of AIE and the appointed Contractor to prepare and/or obtain all appropriate documentation prior to the commencement of the works including plans, programmes, licences, certificates and notification. All such documents must be completed and approved by the relevant consent authority (where required). These documents are anticipated to include, but are not limited to, the following:

- Management plans requiring approval from DPI&E
- Insurance Certificates
- SafeWork NSW notifications

Following provision and approval of these documents, the Contractor will mobilise all necessary plant, equipment and amenities as required to complete the project in accordance with these requirements.

10.2 Site mobilisation (for demolition and remediation works)

Management of the site mobilisation process is to be included in the Contractor's work plans including the following:

- Site access and security - The Contractor will be responsible for ensuring the security of all work areas and all plant and equipment maintained on-site during remediation works. This includes signage, control of site access (authorised personnel and vehicles only) and safety inductions and documentation.
- Plant re-fuelling/maintenance/cleaning - The Contractor will be responsible for designating locations/areas for equipment refuelling, maintenance, and cleaning activities undertaken during the site works (as required) and to ensure all vehicles leaving the site are free of any contaminated material. No refuelling or maintenance activities shall be undertaken without specific approval from the AIE Project Manager.

- Traffic control - The Contractor will be responsible for ensuring adequate traffic control measures are in place to ensure site safety and take into consideration the entry and egress of vehicles from the main site entrance. A traffic management plan (TMP) shall be prepared by the Contractor.
- Environmental controls - The Contractor will be responsible for installing and maintaining environmental controls consistent with relevant management plans.

10.3 Site demolition

As described in Section 5.2, the remaining above and below ground infrastructure within the excavation zone is required to be demolished.

10.3.1 Asbestos building materials

The SOW (AIE, 2021) has indicated that asbestos is likely to be present at the following locations:

- Wall and ceiling linings and conduit within Substation B
- Subsurface pipework containing asbestos associated with the water supply along the western shoreline

Prior to demolition, site structures will be surveyed for asbestos and other hazardous building materials. Asbestos and other hazardous building materials will be removed in structures where it has been identified. An inspection will be undertaken, and clearance certificate provided by an appropriately licenced asbestos assessor (LAA) confirming appropriate removal has occurred. Once clearance certificate has been issued, and an asbestos management plan (AMP) has been prepared, then demolition will be allowed to proceed.

With respect to any known or potential asbestos building material, the planning of demolition works associated with any asset needs to be undertaken carefully and in accordance with the relevant legislation and guidelines. It should include consideration of the following:

- Requirements of an overarching Asbestos Management Plan (AMP) or similar.
- Recognition that any identified asbestos building material is the minimum amount of asbestos material that may be present.
- Subsequent recognition that the scope and limitations of prior building material survey(s) may result in additional unidentified asbestos materials being present. This may require works to address known information gaps including:
  - Additional surveying and assuming that asbestos building material may be present in areas not previously accessed
  - Completing an asbestos building material risk analysis and incorporating suitable provisions into contract/specifications
  - Potential for the Contractor to undertake their own independent asbestos building material survey (may use existing information) for additional assurance.

It is recommended that demolition works are undertaken in close consultation and under the supervision of an experienced environmental consultant to ensure that appropriate contamination control measures and validation requirements are completed in accordance with guidelines and legislation. During building demolition, an LAA should also be present.

If suspected asbestos materials are encountered during demolition and excavations that were not previously identified, it is recommended that the Contractor undertake additional precautionary testing. In particular, the following testing should be included:

- Any fibrous or otherwise suspect cement building materials (with particular reference to buried debris or moulded fibre cement pipework) observed on the site, should be treated as ACM or sampled and analysed for asbestos fibres.
- Any bituminous water proofing membranes or similar should be treated as ACM or sampled and analysed for asbestos fibres.
- Any other material suspected of being a hazard to health should be sampled and analysed prior to continuing with demolition activity.

Cross trenching (e.g. perpendicular to suspected pipe/underground service alignment) will be completed in areas where subsurface pipes and other infrastructure are known to have been located, with reference to historical site layout plans and drawings to ensure all pipes/infrastructure has been located and subsequently removed. Validation sampling will be undertaken within areas of previous subsurface pipes or infrastructure containing asbestos to assess underlying soils for contamination.

Asbestos clearance and validation

Asbestos clearance works will include the steps as outlined in Table 10-1.

Table 10-1: Asbestos remediation responsibilities

Activity	Responsibility
Full site inspection/clearance following demolition of infrastructure (Substation B) and trenching to remove underground pipes with full time supervision from the independent environmental consultant. These works will include sampling of soils from beneath pipes and structures containing ACM (Section 10.5). The Contractor shall provide detailed procedures for removal of underground pipes for review by AIE and the environmental consultant, prior to commencing remediation or subsurface demolition activities.	Contractor*/ Environmental consultant
Should the site inspection/validation indicate ACM remains following demolition, the asbestos removal contractor will be required to emu pick any affected areas to remove visible fragments of ACM in consultation with the Environmental Consultant. A systematic approach should be adopted whereby picking personnel should be spaced no more than one metre apart and walk a series of traverse lines in a grid pattern with a minimum of three passes across the site. If fragments are partially buried, surface raking of the top 100 mm should be undertaken to disturb the sub-surface soils and remove any partially buried fragments. Visual assessment of raked surface to be undertaken in consultation with the Environmental Consultant.	Contractor*/ Environmental Consultant
Transport recovered asbestos material by licensed waste transporter, to an appropriately licensed site for disposal.	Contractor
Validate area of emu pick with soil sampling and analysis (if required) as per Section 11.	Environmental Consultant

Note: * A licenced bonded asbestos removal contractor (AS-B) would be required for this works, however the contractor should also be licenced for friable asbestos removal (AS-A) in case friable asbestos should be encountered during the remediation works.

10.3.2 Materials handing

Materials generated as a result of the demolition/removal activities of above and below ground structures will be segregated according to the following:

- Suitability for recycling (e.g. structural steel, reinforcing rebar)
- Suitability for re-use (e.g. concrete, including materials that require processing including downsizing)
- Disposal off-site of unsuitable materials as in accordance with NSW EPA (2014a and/or 2014b).

Temporary storage of demolition debris/other waste materials and recyclable metals will occur on site at the southern end of the eastern stockyard. Storage areas shall be established by the Contractor within the allowable working areas.

The Contractor shall implement measures to control dust caused by the demolition works to the required level. The Contractor shall install dust monitoring equipment and provide weekly records to the Company.

10.4 Demolition of hardstand

Following demolition of above ground structures, further removal of concrete slabs and paving, concrete foundations/footings and extraction and cutting-off of piles will occur as applicable to suit the construction of the new wharf.

The hardstand area is constructed of 300 mm heavily bound base course (road building material), 340 mm lightly bound base course (80% blast furnace slag and 20% granulated blast furnace slag) and 200 mm of engineered fill.

As above (Section 10.3.2), materials will be segregated based on existing data or additional characterisation for either recycling, re-use or disposal off site.

10.5 Additional investigation/validation

As described in Section 8.3, soils beneath the above and below ground infrastructure require investigation following demolition/removal. The data from the investigations will inform decisions regarding site status and segregation / characterisation of materials with regard to re-use on site or disposal off-site. Given the extent of investigations undertaken at the site to date, sample locations will be based on a judgemental sampling pattern, with samples collected from within the footprint of the former infrastructure or trench from disused pipelines. These works will be undertaken following site demolition and in conjunction with any other identified remediation requirements.

The analyses are based on contaminants of concern identified in previous investigations and experience with other similar sites. Investigations will be undertaken in accordance with the sampling and analysis plan summarised in Table 10-2, which may be revised during the site works in consultation with the Site Auditor and approval from AIE.

Table 10-2: SAQP – Additional investigations/validation

Area	No. of locations	Target depth (m)	Parameters	No. of analyses
Substation building				
Building footprint (approx. 225 m^2)	5	3.0 m	PCBs	5
ACM conduit	Unknown 1 per 10 LM (min 3)	Trench base	Asbestos (3)	TBC
Oil pipeline				
Pipework validation Est. 280 LM	28 1 per 10 LM	Trench base	TRH/Metals (1)	28
ACM water pipeline				
Pipework validation Est. 418 LM	40 1 per 10 LM	Trench base	Asbestos (3)	40
Other structures				
Tower T1, T3, T4 and T6 Clean Out Pits	Based on UFP. 2 per pit	Excavation base	Metals (1)/TRH/PAH	TBC
T3 Pond	Based on UFP up to 4	Excavation base	Metals (1)/TRH/PAH	TBC
West shore clean out pit	Based on UFP up to 4	Excavation base	Metals (1)/TRH/PAH	TBC
Sewer tanks	Based on UFP 2 per tank	Excavation base	Metals (1)/TRH/PAH	TBC
Stockpiles				
Stockpile characterisation	TBC	Full depth of stockpile	Metals (1)/TRH/PAH Asbestos (3)	TBC (4)
QA/QC				
QC duplicates (2)	10% overall	-	TRH/PAHs/Metals (1)	TBC
Rinsates	1 per day (as required)	-	TRH/PAHs/Metals (1)	TBC
Trip blanks	1 per batch (as required)	-	TRH/PAHs/Metals (1)	TBC
Trip Spikes	1 per batch (as required)	-	TRH/BTEXN	TBC

Table notes:
TBC – To be confirmed
LM – Lineal metres
1. Metals comprise As, Cd, Cr, Cu, Pb, Ni, Zn and Hg
2. Blind and split Quality Control samples at a rate of approximately 10%
3. Analysis for asbestos would initially be for absence/presence. If present, a quantitative assessment as per NEPM 2013 guidelines would be required
4. Sampling density will be in accordance with NEPM (2013) Schedule B2 and VIC EPA.

All fieldwork will be undertaken by experienced Environmental Professionals and completed in accordance with the relevant Standard Operating Procedures for fieldwork activities which are based on relevant industry guidelines and best practice.

At this stage, it is proposed that sample locations will be collected with the aid of a backhoe or tracked excavator (supplied by the Contractor) to a maximum depth of 3 m below current surface levels. Samples will be collected from representative undisturbed soils and will generally include surface 0-0.1 m (if required), 0.5 m and every 1.0 m thereafter. Additional samples may be collected should stratigraphy differ from that expected or where evidence of odours or staining is noted (if observed). Quality assurance and quality control will be as described in Section 11.3.6 of this RWP.

Soils penetrated during the investigation will be described in accordance with the Unified Soil Classification system, with features such as seepage, decolourisation, staining, odours and other indications of contamination being noted. This information will be recorded on the field sheets, completed for the sampling locations.

Samples representative of the depth of fill at each location will be analysed to delineate the depth of identified contamination. Samples will be analysed for parameters to be of potential concern in these areas as summarised in Table 10-2 above and assessed against the criteria in Section 7 of this RWP.

The requirements for analysis for other parameters or analysis of samples from other depth intervals will be discussed with AIE and the Site Auditor.

10.6 Excavation

The proposed works will involve excavation to RL 2.5 m PKHD (this equates to approximately 1.6 m to 4.2 m bgl with the nominated excavation zone between Road No. 7 at the northern end of the West Stockyard to the South Ponds and across to Road No. 9. This stage of the demolition/remediation works is based on the assumption that, prior to excavation, the following works will have been undertaken:

- All above and below ground infrastructure has been demolished with asbestos clearances completed. Demolition materials have been segregated for recycling, reuse or disposal
- Soils within substation footprint and beneath the oil pipeline and ACM pipeline have been investigated and any additional areas with elevated COPC have been identified.

Based on the results of the additional investigations and validation, excavation works may also be required to include areas of contamination identified during the additional investigations, removal of subsurface infrastructure or as part of the unexpected finds protocol (UFP).

Excavated materials will be stockpiled and maintained at the southern end of the eastern stockyard or at the Outer Harbour stockpiling area, until the construction of the OHDSCA has commenced and the materials can be used for bund construction and overall placement within the OHDSCA.

Also refer to Section 5.2 for further detail.

10.6.1 Excavation responsibilities

One of the components of the proposed works at the site will be the bulk excavation of materials (hardstand, Fill, Unit 1 etc). The excavation works (following demolition (Section 10.3) and additional investigations (Section 10.5)) will generally include the following steps as outlined in Table 10-3.

Table 10-3: Excavation works responsibilities

Activity	Responsibility
Locate the areas designated for further investigation / remediation works based on investigations to date (Figure 2 in Appendix A). Identified areas to be marked on site and excavation procedures reviewed by the remediation Contractor in consultation with the Environmental Consultant, including required management measures to protect health and safety and the environment.	Contractor/ Environmental Consultant
Excavation of contaminated material. All excavations shall be undertaken in consultation with the Environmental Consultant, to guide excavations on the basis of visual and olfactory observations as well as on the basis of previous analytical results.	Contractor/ Environmental Consultant
Segregation and stockpiling of different waste streams from the excavation based on visual assessment and results of previous investigations. (see Section 10.8)	Contractor/ Environmental Consultant
Characterisation of excavated material for either re-use on site or waste classification/disposal purposes if appropriate (based on visual assessment and previous results). Collection and analysis of additional samples if required for adequate characterisation of materials.	Contractor/ Environmental Consultant
Transport and placement of materials suitable for re-use on-site to a designated area in the eastern stockyard for future use. The stockpile area must have environmental controls in place prior to placement.	Contractor
Transport of excess materials to Outer Harbour stockpile area for future re-use or placement within the OHDSCA.	Contractor
Waste classification of unsuitable excavated materials for disposal purposes (sampling and analysis by Environmental Consultant, equipment by Contractor). See Section 11.3.	Contractor/ Environmental Consultant
Transport contaminated material by licensed waste transporter, to an appropriately licensed site for disposal (as required).	Contractor
Validation sampling of the base and vertical sides of the excavations by the Environmental Consultant to confirm that soil left in place conforms to allowable limits as per Section 11.	Environmental Consultant
Reinstate excavations (if required) with validated stockpiled material as per Section 11.	Contractor

10.6.2 Method of excavation

Overview

It is anticipated that excavators or backhoes will be used for all excavation operations. All excavations shall be conducted in accordance with relevant management plans and under supervision of the Environmental Consultant to ensure all identified contaminated materials are removed and segregated from uncontaminated materials that will be used in the OHDSCA and that the objectives of the RWP are fulfilled.

Excavation procedure

The following sequence of steps should be followed prior to commencing the excavation operations in areas of identified contamination.

The Environmental Consultant will liaise with the Contractor in the field on the following:

- The boundaries of the area to be excavated
- The expected depth of excavation

- The manner in which materials are to be excavated
- The area where stockpiling of material can take place.

Given the location of the works and proximity to the Inner Harbour, the Contractor shall ensure all required sediment control measures around the excavation areas are in place. Further details are provided in Section 12.4.

Excavation of contaminated materials will proceed as follows:

- Excavation of materials from the surface to the required depths in the nominated areas as detailed in Table 5-1
- Excavations will continue in a lateral and vertical extent to remove material identified as being contaminated based on site observations (stained and/or odorous soils) and analytical results (depths to samples with contaminant results below the criteria).
- Excavated materials will be segregated as required for re-use, further management (e.g. placement within the OHDSCA) or waste classification/disposal purposes.

The Contractor shall ensure that at all times the sides of the excavation are stable and that all excavation and stockpiling works are undertaken in a manner that will not contaminate clean areas of the site and will minimise any mixing of different material types or waste streams (i.e. contaminated and clean materials).

Upon completion of the excavation, the Contractor shall ensure that plant and equipment is cleaned and decontaminated as per Section 10.2. Waste generated during the decontamination works is to be disposed of in accordance with Section 10.9.

10.6.3 Validation sampling

The resultant excavation shall be validated to confirm the removal of any contaminated material (so as to allow subsequent excavations to proceed without restriction), with sample results compared against nominated assessment criteria outlined in Section 7. The validation sampling protocol for the remediation works is detailed in Section 11.

10.6.4 Backfill or reinstatement requirements

On completion of excavation and subsequent validation approval, backfilling of excavations may be required (i.e. for site levelling or safety reasons). Significant backfilling at the site is not anticipated during this phase of the redevelopment. If required, backfilling procedures will be as follows:

- Excavations should be backfilled with either:
  - Materials from the site, assessed as suitable for re-use under the adopted land use criteria
  - If required, Virgin Excavated Natural Material (VENM) or Excavated Natural Material (ENM) sourced externally. Material considered to be VENM or ENM should be assessed by an appropriately qualified environmental consultant to confirm that the material meets the relevant regulatory requirements.
- Backfill material must be of suitable composition and must meet geotechnical and other material property requirements for the area of use and not present hazards to future development.
- VENM or ENM materials are not to be stockpiled in areas still undergoing remediation or come in contact with contaminated soils either through storage or from equipment/plant handling contaminated materials.

- Validation samples should be collected from the on-site or imported material (if required) to confirm its suitability for use. Further details regarding the validation schedule are presented in Section 11.
- It is understood that it is also intended to use fill material and concrete suitable for reuse for the wharf construction. Materials will be crushed on site and stockpiled at the southern end of the eastern stockyard area. This material will be segregated and validated for use as per Section 10.8.

Reinstatement, compaction and further redevelopment works will be undertaken in accordance with the requirements of AIE.

10.6.5 Material tracking control

A critical aspect of the demolition and remediation operation is the manner by which materials are controlled throughout all stages of the works. The following tracking control requirements for each stage shall be implemented by the Contractor to ensure all materials are accounted for:

- Excavation:
  - The area to be excavated shall be clearly delineated.
  - Qualified supervision shall be used during excavation to ensure that all contaminated materials are removed but disturbance of uncontaminated soils is minimised.
  - Materials shall be segregated to the extent practical during excavation to minimise mixing of materials with different degrees or types of contamination.
  - The final extent of excavation and location of validation sampling points shall be measured and recorded by GPS or survey, as required by AIE.
- Stockpiling/Backfilling:
  - Stockpiles shall be kept separate, to minimise mixing of materials (as above).
  - All stockpiling and backfilling operations during the remediation operation will only move material from one location to another when expressly approved by the Environmental Consultant. All such movements shall be clearly documented by the Contractor in a materials tracking register equivalent to the example provided in Appendix C. The materials tracking register shall document (as a minimum) the following information:
    - Stockpile identification
    - Source of material
    - Volume of material
    - Destination (including on-site locations for intermediate movement)
    - Date of movement
    - Authorisation
    - Material Description

10.7 Transport of material

Transportation of material shall be undertaken in accordance with relevant management plans including:

- All material movements, including on-site movements, shall be recorded on a material tracking plan documenting material source, type, description, volume, destination, reference to testing results, approval for movement and date(s) of movement. A register setting out this information shall be established as part of relevant management plans.
- Wastes shall only be removed off-site after the material has been classified and written approval has been received for the disposal of the contaminated soil at the nominated treatment or disposal site, or evidence of appropriate recycling (in accordance with regulatory requirements and relevant codes of practice) has been provided.
- All asbestos debris and contaminated PPE should be doubled bagged prior to transportation to an appropriately licensed landfill that can accept asbestos waste. Management of asbestos waste is to be undertaken in accordance with the POEO (Waste) Regulation 2014.
- Waste tracking shall be undertaken in accordance with EPA requirements (specifically the POEO (Waste) Regulation 2014) and include evidence of instructions, load registers/records (source, classification, volume, date and time, vehicle details etc), weigh bridge dockets.
- Any vehicles used to transport contaminated materials from the site shall meet NSW EPA licensing requirements for the waste transported.
- All trucks carrying contaminated materials off-site shall have the load covered, the exterior of the vehicle, including wheels, thoroughly cleaned down by the Contractor after it has received its load and prior to the vehicle leaving the site. Only vehicles which have clean exterior bodywork and which will not pollute the off-site transportation corridors shall be permitted to leave the site.

10.8 Segregation of materials for re-use on site

The discussion presented below is based the proposed re-use of uncontaminated materials generated during excavation of materials to RL 2.5 m PKHD across the nominated area as bunding and or fill within the OHDSCA. Early identification and classification of the different material streams on-site will lower the costs associated with on-site treatment, transportation and/or landfill disposal during excavation works.

The selected segregation methodology shall be described in detail by the contractor, and will depend on the frequency of occurrence and the nature of any contaminated materials (odorous, discoloured or ACM and other foreign materials) in excavated fill and Unit 1 soils materials, as well as the physical characteristics of the materials themselves. The methodology may need to be varied depending on the effectiveness during the works.

One of the major components to allow re-use of excavated uncontaminated materials, will be the separation of the materials from contaminated materials and validation (visual or sampling and analysis) prior to re-use. Procedures and responsibilities will be as shown in Table 10-4.

Table 10-4: Segregation, stockpiling and re-use responsibilities

Activity	Responsibility
Identify the area for excavation and the uncontaminated areas of the site containing materials suitable for re-use, based on previous analytical results and site observations.	Contractor/ Environmental Consultant/AIE
Removal of hard stand as appropriate	Contractor
Excavation with segregation of different material streams if appropriate, based on previous results, visual assessment, mechanical screening or sampling and analysis i.e. materials suitable for re-use, materials for recycling, materials for disposal and materials for further management.	Contractor/ Environmental Consultant
Validation of segregated materials by Environmental Consultant in accordance with the validation protocol detailed in Section 11 for re-use on site or within the OHDSCA bund.	Contractor/ Environmental Consultant
Characterisation of unsuitable segregated materials (sampling and analysis) by Environmental Consultant, equipment by Contractor) if disposal off site is required (Waste Classification sampling as per Section 11).	Contractor/ Environmental consultant
Transport of suitable materials to an appropriate portion of the site for stockpiling for future use, as directed by AIE/Environmental Consultant.	Contractor
Transport of excess materials to Outer Harbour stockpile area for future re-use or placement within the OHDSCA	Contractor
If required, transport contaminated material by licensed waste transporter, to an appropriately licensed site for disposal.	Contractor
Reinstatement as required of excavated area.	Contractor

A decision tree outlining the process for segregation and characterisation of the excavated materials for either re-use on the AIE site, as the bund or cap in the OHDSCA, for placement in the OHDSCA or for disposal off site is presented in Figure 10-1 below.

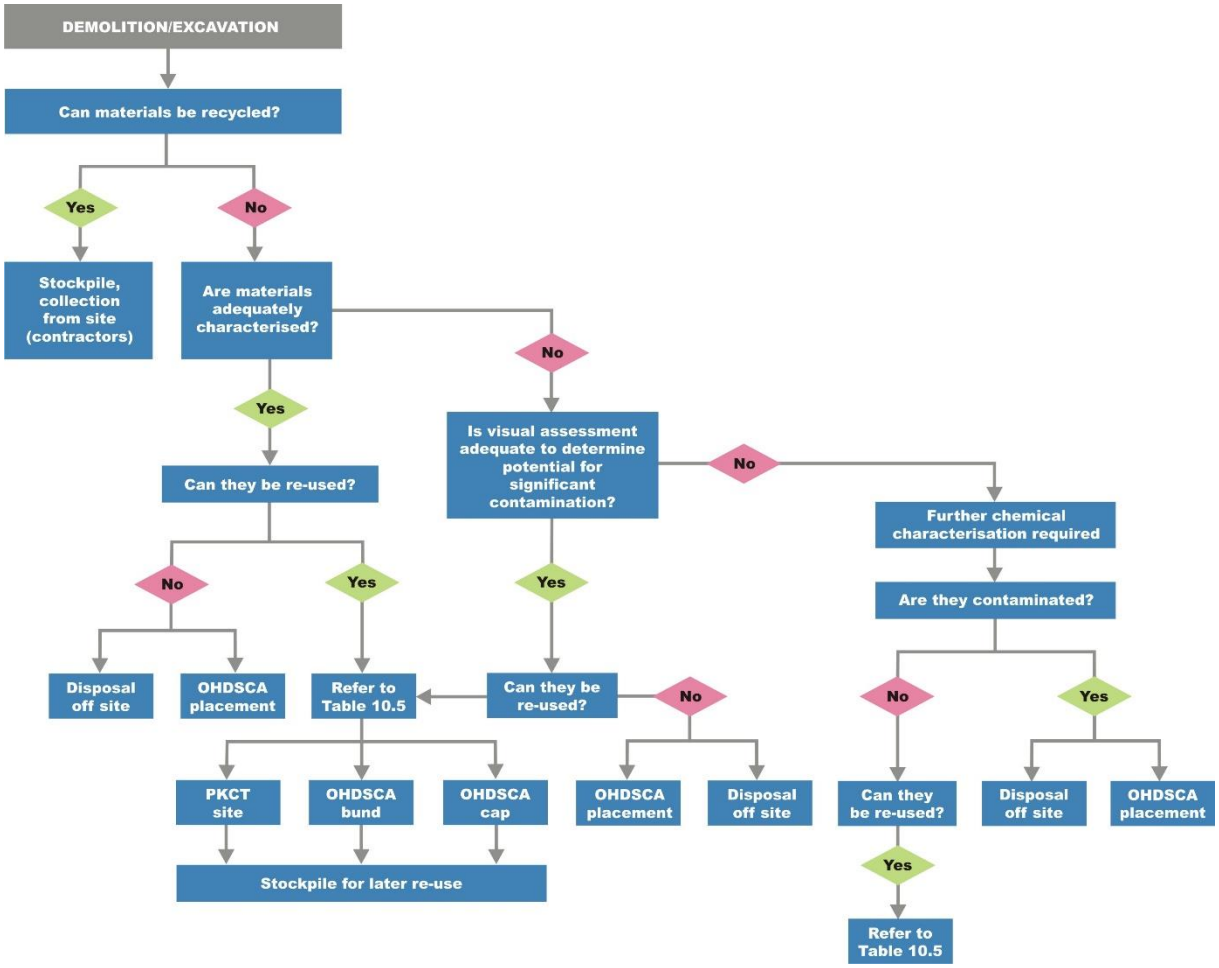

Figure 10-1: Decision tree for material segregation and characterisation

Table 10-5 details the criteria that will apply to the decision-making process with regard to the options for re-use on site.

Table 10-5: Criteria for re-use on site

Re-use on site options [1]	Decision criteria
PKCT site	Less than HIL D or can be managed by capping
OHDSCA bund wall construction	Less than sediment DGV's
OHDSCA cap construction	Less than HIL D
OHDSCA placement materials	TBA
Disposal off site	Unsuitable for all of the above

1. All materials for re-use must also be deemed suitable for the geotechnical requirements for the selected end use.

10.9 Disposal off-site

The following procedure shall be undertaken for excavated materials that are required to be disposed of off-site:

- Soil to be disposed off-site must be classified for waste disposal purposes and disposed in accordance with the requirements of the *Protection of the Environment Operations (Waste) Regulation 2014* made under the POEO Act 1997, and NSW EPA (2014). The Environmental Consultant shall be responsible to oversee the classification of the waste. The Contractor or AIE Project Manager shall ensure its transport and disposal to an appropriately licensed landfill.
- Documentation of waste classification, transport and disposal shall be provided in accordance with the *Protection of the Environment Operations (Waste) Regulation 2014* and NSW EPA, 2014a and/or 2014b and provided for inclusion in the validation report. Documents required will include:
  - Materials tracking register
  - Independent waste classification report in accordance with the requirements of NSW EPA
  - NSW EPA online waste tracking documentation (Waste Tracker)
  - Receiving waste facility EPL (to show it can lawfully receive the waste), limit conditions and/or consent from appropriate regulatory authority.
  - Consignment authorisation / disposal receipts / tip dockets
  - Reconciliation documents matching materials register and disposal receipts.

10.10 Remediation contingency plan

The site has been investigated for contamination as detailed in previous investigation reports. However, a degree of uncertainty is inherent in any site contamination investigation. In particular, due to the limited investigations undertaken beneath the existing infrastructure, there is a potential for contamination to be present beneath these structures. Further, due to the size of the site and nature of the fill material, there is a potential for unidentified areas of contamination across the site.

A contingency response plan for unexpected situations shall be prepared by the Contractor and the Contractor will be required to follow the contingency response plan if unexpected situations are encountered. Table 10-6 outlines some of the unexpected situations that may arise.

Table 10-6: Contingency procedures

Issue	Response
A greater volume of soil contamination may be encountered than is presently estimated, or other types of contamination may be encountered.	In the event that significant additional volumes of contamination or previously unidentified types of contaminants are identified, work would cease in the area of concern. An assessment of the impact of the additional contaminated materials would be undertaken by the Environmental Consultant. The presence of previously unidentified types of contaminants may be identified during remedial works. If previously unidentified types of contaminants are detected, then the validation criteria may have to be revised to incorporate those contaminants. Any potential contaminated material in addition to the type already identified will be treated in a method considered suitable for the type of contaminant. Additional testing would be undertaken to determine requirements in this respect.

Issue	Response
Identification of friable asbestos containing materials (ACM)	Bonded asbestos is expected at this site and removal will be undertaken in accordance with the AMP. However, if friable asbestos is encountered, the contingency procedures in the AMP are to be implemented. An assessment of the impact of the ACM would be undertaken by the Environmental Consultant and the appropriate remediation measures implemented (usually removal).
Wastes, previously unidentified, buried in the work area may be encountered	In the event that buried wastes are encountered during remediation works, the extent of the impact from the buried wastes will be assessed. Following assessment, if required, the waste will be removed, stored, classified and disposed of in accordance with NSW EPA 2014a and/or 2014b.
Dewatering of excavations may be required.	If dewatering of excavations is required, the water will be pumped into suitable storage and either used for dust suppression or compaction (following appropriate testing), tested prior to discharge or disposed of at a licenced facility approved to accept potentially contaminated groundwater. In the event that excavations are unstable, demolition and excavation works will be reassessed in consultation with the AIE Project Manager.
Unacceptable Environmental Impacts as a result of remediation activities	The RWP has considered the potential environmental impacts of side effects of the works such as noise, odour, dust and surface runoff. These shall be further considered in relevant management plans prepared by the Contractor. However, in the event that unacceptable levels of such side effects are detected at the site boundaries during remedial works, the Contractor shall cease work and the Environmental Consultant will assess the situation and direct corrective action in accordance with the following: • Existing management plans • Current EPA regulations and requirements • In consultation with the AIE Project Manager

10.11 Review of RWP

This RWP will require review and updating if any significant changes in characteristics of the site are encountered, including those resulting from unexpected finds.

10.12 Site management

10.12.1 Interim site management

As the site is secure with limited potential for unauthorised access and based on the current site usage (former port operations), occupation of the site for current land uses is considered acceptable to continue until remediation commences. However, the proposed remediation works may generate exposure hazards to sensitive receptors. Mitigation measures shall be included as part of the WHSP and EMP as prepared by the Contractor.

10.12.2 Long term site management

Implementation of a long term site management plan for any contamination that remains on site, including potential contamination remaining at depths not disturbed by the redevelopment and the OHDSCA, would likely be required.

A long term management plan for the OHDSCA will be developed as part addressing relevant approval conditions.

11. Validation

The process as outlined in the following sections applies to all areas of the site proposed for remediation and/or validation and will be based on aesthetic issues/visual observations combined with collection of soil samples from the walls and base of excavation and trenches with analysis for the contaminants of concern as discussed in Section 8.

11.1 Data quality objectives

Data Quality Objectives (DQOs) have been established for this RWP to assist the design and implementation of data collection activities, to ensure the type, quantity and quality of data obtained are appropriate and address the project objectives. The DQO process as described in Schedule B2, Appendix B, of the ASC NEPM (NEPC, 2013) was adopted for this project. The DQO process involves seven steps as described below.

The DQO steps defined above have been addressed as follows.

Step 1 - State the problem

AIE intend to redevelop Berth 101 of PKCT with the construction of facilities for an LNG import facility. The development will involve demolition of Berth 101 and existing above and below ground structures and services and excavation of hardstand and fill materials to RL 2.5 m PKHD (this equates to approximately 1.6 m to 4.2 m bgl).

Uncontaminated materials previously identified as fill (“Fill”), reclaimed sands and alluvium (“Unit 1”) will be used to develop the OHDSCA perimeter bund wall which will then contain remaining excavated / dredged materials (i.e. estuarine sands, residual soils, harbour sediments and muds).

Contamination has been identified at the site that may adversely impact the suitability of the fill to be used in the OHDSCA and/or may have adverse impacts upon environmental receptors. Sources of contamination at the site have been identified to include:

- Fill materials – identified hotspots (two locations) and minor exceedance (one location) of BaP and TRH
- Substation – potential PCB contamination, and ACM building materials within the substation.
- Fill across the site – potential for unidentified contamination to exist.
- Subsurface structures and services – subsurface oil pipeline and ACM water pipe identified on site and ACM building materials on-site (substation)
- Uncharacterised fill in stockpiles in the south western portion of the site

There is also a potential for contamination to be present in inaccessible areas beneath remaining structures (substation, ponds, pits and drains).

GHD carried out an evaluation of existing data to assess the suitability of Fill and Unit 1 to be reused in the perimeter bund wall. It was concluded that “*the majority of Fill and Unit 1 are considered to pose a low risk to the marine aquatic environment based on the characterisation carried out, however some limited supplementary assessment would be beneficial to confirm this*.” (GHD, 2020).

Construction of the OHDSCA and redevelopment of the site as an LNG facility (continued commercial/industrial land use) requires appropriate management of contaminated soils.

Step 2 – Identify the decisions

The decisions are those required to ensure the successful management or remediation of contamination at the site and consequently the protection of the environment and human health. Key decisions include:

- Have the identified data gaps been adequately addressed?
- Have the surface and subsurface structures and services been removed and appropriate assessment of previously inaccessible soils been undertaken?
- Have known areas of contamination been remediated and validated to achieve residual concentrations of contamination less than the adopted criteria?
- Has excavated materials (hardstand, fill, sands etc) been adequately segregated and validated suitable for reuse on site, in the OHDSCA perimeter bund or capping or for placement with the OHDSCA?
- Have any unexpected finds encountered during site works been appropriately managed or remediated?

Step 3 – Identify inputs to the decision

Data to be input to the decision making process includes:

- Information from previous investigations
- Information from additional investigations proposed in 5
- Current assessment criteria as discussed in Section 7
- Consideration of future land use / material placement
- Monitoring the Contractor's work and site conditions
- Review of relevant documentation to be provided by the remediation contractor
- Observations and analyses to be undertaken during the site remediation and validation works

Step 4 - Define the study boundaries

The lateral boundaries of the study area are defined by the extent of the excavation area which extends from Road No. 7 at the northern end of the West Stockyard to the South Ponds and across to Road No. 9, and includes the Berth 101 area as shown in Figure 2, Appendix A.

The vertical boundaries of the study are the vertical extent of proposed earthworks and infrastructure removal, generally noted between the surface and RL 2.5 m PKHD but up to 3 m bgl (approximately equates to 1.8 m to 2.0 m PKHD) in the area of the substation footprint.

Step 5 – Develop a decision rule

Review of previous site investigations has been used to identify the main contaminants of concern and areas requiring remediation or management prior to site redevelopment.

Concentrations of contaminants for validation (where required) will be compared with the criteria discussed in Section 7, giving consideration to the proposed use or placement of material, to assess the success of the remediation and/or screening processes and/or to assess waste disposal requirements.

In order to decide whether the data obtained is precise, accurate, reliable and reproducible for the site at the time of the investigation, field and laboratory quality control and quality assurance (QA/QC) procedures will be utilised throughout the sampling programs. All sampling work will be carried out in accordance with Standard Operating Procedures for field activities, based on standard industry practices. QA/QC results will be compared to nominal acceptance limits (as outlined in in Section 11.2).

Step 6 - Specify limits on decision errors

The guidelines as listed in Section 7 will be used to assess the contamination status of the soils within the subject site. DQIs as described in Section 11.2 will be used to evaluate the acceptability of the data.

Where quantitative data is used as a basis for decisions, data will be evaluated on a statistical basis as described in the NEPM (NEPC, 2013), to a 95% confidence level.

Step 7 - Optimise the design for obtaining data

To optimise the design of the remediation, a sampling and analytical program for remediation validation has been prepared as included in Section 11.3 below.

11.2 Data quality indicators

The DQIs for sampling techniques and laboratory analysis of collected samples defines the acceptable level of error required for this investigation. The data quality objectives will be assessed by reference to data quality indicators as follows:

- **Data Representativeness** - expresses the degree which sample data accurately and precisely represents a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples in an appropriate pattern across the site, and by using an adequate number of sample locations to characterise the site. Consistent and repeatable sampling techniques and methods are utilised throughout the sampling.
- **Completeness** - defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study. If there is insufficient valid data, then additional data are required to be collected.
- **Comparability** - is a qualitative parameter expressing the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples and ensuring analysing laboratories use consistent analysis techniques and reporting methods.
- **Precision** - measures the reproducibility of measurements under a given set of conditions. The precision of the data is assessed by calculating the Relative Percent Difference (RPD) between duplicate sample pairs.

$$RPD(\%) = \frac{|C_o - C_d|}{C_o + C_d} \times 200$$

Where Co = Analyte concentration of the original sample
Cd = Analyte concentration of the duplicate sample

GHD adopts a nominal acceptance criteria of ± 30% RPD for field duplicates and splits for inorganics and a nominal acceptance criteria of ± 50% RPD for field duplicates and splits for organics, however it is noted that this will not always be achieved, particularly in heterogeneous soil or fill materials, or at low analyte concentrations.

- **Accuracy** - measures the bias in a measurement system. Accuracy can be undermined by such factors as field contamination of samples, poor preservation of samples, poor sample preparation techniques and poor selection of analysis techniques by the analysing laboratory. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes, laboratory blanks and analyses against reference standards. The nominal “acceptance limits” on laboratory control samples are defined as follows:
  - Laboratory spikes – 70-130% for metals/inorganics 60-140% for organics
  - Laboratory duplicates - <30% for metals/inorganics, <50% for organics
  - Laboratory blanks - <practical quantitation limit

Accuracy of field works is assessed by examining the level of contamination detected in equipment blanks. Equipment blanks should return concentrations of all organic analytes as being less than the practical quantitation limit of the testing laboratory.

The individual testing laboratories will conduct an assessment of the laboratory QC program, internally; however the results will also be independently reviewed and assessed by the Environmental Consultant.

11.3 Validation methodology

11.3.1 Validation following asbestos removal

Validation for asbestos is primarily concerned with asbestos remediation works related to removal of the ACM building materials and conduit in the substation and removal of the ACM water pipeline (estimated to be 418 m in length). Validation sampling procedures are described below.

- The building footprint and the base and sides along the length of the excavation/trench shall be visually inspected for ACM debris by a LAA or competent person (as described in the SafeWork NSW Codes of Practice) and by the independent Environmental Consultant.
- Validation samples for the building footprint will be collected as per NSW EPA (1995) with a minimum of five samples collected from any excavated / disturbed surface area.
- Validation samples along the length of the trench will be collected at a rate of one sample per 10 linear metres.
- Samples will be analysed for asbestos in accordance with procedures described in WA DoH (2009) for quantification of asbestos in soil.

Emu picking of isolated fragments or scraping and disposal of surface soils may be undertaken to enable successful validation. Large-scale removal of ACM from soils to enable re-use on site is not proposed for this site.

11.3.2 Validation of excavations

Where required, validation of the remediation excavations will be undertaken in accordance with the NSW EPA (1995) *Contaminated Sites: Sampling Design Guidelines*.

The Environmental Consultant will record and document the excavation and removal activities of contaminated soils from the excavations and trenches. Systematic sampling will be undertaken on the base and walls of the excavations. The validation sampling procedure will comprise:

- Documentation of the excavation activities.
- Visual confirmation that the extent of excavation has removed all contaminated fill material (stained and odorous).

- Validation will be required following excavation of impacted soils. The resultant excavations will be validated to confirm the removal of the contaminated material with collection of at least five samples (four wall samples, one base sample) from any excavation and analysis for contaminants of concern (based on the results of previous investigations and observations during the remediation). Base samples will be collected at a minimum rate of 1 per 25 m^2, and wall samples at a minimum rate of one per 5 linear metres, with samples collected from each distinct strata of soil.
- Validation of a trench excavation (e.g. bunker oil pipeline) will involve sampling along the length of the trench at a rate of one sample per 10 linear metres.
- Ensuring detailed material tracking by maintaining and reviewing a material tracking register (including on-site soil movement) and waste disposal dockets, to be provided by the Contractor.

Validation sampling locations will be systematic, or biased towards areas of apparent contamination, if present (to provide a conservative approach). Photographs of the excavation will be taken as part of the validation works. The extent and depth of the completed excavation shall be measured by the environmental consultant, with reference to site boundaries or physical features.

11.3.3 Validation of imported material

Significant importation of materials at the site is not anticipated during this phase of the redevelopment. However, in the event that materials will be imported to site, options include VENM (as defined by NSW EPA (2014a), ENM or other materials subject to a Resource Recovery Order and Exemption.

Materials may only be classified as VENM if they have been excavated from an area that is not contaminated with other waste materials or by manufactured chemicals. Imported materials should be validated as VENM, ENM or otherwise suitable for importation to site by an appropriately qualified environmental professional. Classification of all imported materials involves the following steps:

- The history of the site of origin of the material should be understood and documented to identify whether any potentially contaminating activities have been undertaken at that location.
- An inspection of the source site or materials should be undertaken by an appropriately qualified environmental professional, including a visual inspection of the stockpiled materials. Findings of the inspection should be fully documented.
- Validated as suitable for use with reference to NEPM Schedule B2 / EPA Victoria Industrial Waste Resource Guidelines 702 (Vic EPA IWRG 702) (2009) which involves collection of samples at a prescribed rate depending on the volume of material, with at least three samples from any particular source.
- A visual inspection of the VENM, ENM or any other imported materials should be undertaken as it is imported onto site to ensure that the material is consistent with documented observations.

11.3.4 Validation of excavated material stockpiles

Where material has not been adequately characterised by existing investigations, characterisation sampling of stockpiles including those to be disposed off-site will involve sample collection and analysis in accordance with the Vic EPA IWRG 702 (2009) as referenced in the NEPM Schedule B2, or at least three samples from each distinct area of excavation or “batch” of material.

Material exhibiting visual evidence of heterogeneity may require sampling at a higher rate to ensure all characteristic elements of the material are sampled. “Procedure B” from the *Sampling Design Guidelines* (NSW EPA, 1995) will be used to assess if the number of samples is adequate to show that the average concentrations of contaminants are below the relevant criteria.

Analysis will be undertaken for heavy metals, TRH and PAHs for the “batch” of material being tested and results compared to the following:

- Re-use on site – Results compared to relevant health and ecological criteria and use of the segregating materials decision tree (Section 10.8).
- Disposal off site – Results compared to the NSW EPA Waste Classification Guidelines (2014a and/or 2014b). If necessary for additional waste classification purposes or for assessment of potential environmental impacts, a Toxicity Characteristics Leaching Procedure (TCLP) test for selected parameters will be undertaken in conjunction with total concentration analysis.

11.3.5 Quality assurance

All fieldwork will be conducted in general accordance with Standard Operating Procedures for field activities, which are aimed at collecting environmental samples using uniform and systematic methods. Key requirements of these procedures are as follows:

- Decontamination procedures - including the use of new disposable gloves for the collection of each sample, decontamination of the sampling equipment between each sampling location and the use of dedicated sampling containers provided by the laboratory.
- Sample identification procedures - collected samples will immediately be transferred to sample containers of appropriate composition and preservation for the required laboratory analysis. All sample containers will be clearly labelled with a sample number, sample location, sample depth and sample date. The sample containers will then be transferred to a chilled cooler for sample preservation prior to and during shipment to the testing laboratory.
- Chain of custody information requirements - a chain-of-custody form, for each batch of samples, will be completed and forwarded to the testing laboratory.
- Sample duplicate frequency approximately 10% (5% each for intra and inter laboratory duplicates) – for chemical analysis only.

Field quality control procedures to be used during the project include the collection and analysis of the following (for chemical analysis only):

- **Intra Laboratory (Blind) duplicates/replicates:** Comprise a single sample that is divided into two separate sampling containers. Both samples are sent anonymously to the project laboratory. Blind duplicates/replicates provide an indication of the analytical precision of the laboratory, but are inherently influenced by other factors such as sampling techniques and sample media heterogeneity. It is proposed to collect and analyse blind duplicate samples at a rate of at least 5%.
- **Inter Laboratory duplicates/replicates:** Individual samples are split in two in the field by the sampling crew and are placed in two separate containers. One sample is sent to the project laboratory and one sample is sent to an independent check laboratory. Field split duplicate samples provide an indication of the analytical accuracy of the project laboratory, but may be affected by other factors such as sampling methodology and the inherent heterogeneity of the sample medium. It is proposed to collect and analyse blind duplicate samples at a rate of at least 5%.

Rinse blanks will be collected where sampling equipment is used, but may not be analysed daily unless cross contamination is considered an issue.

It is noted that based on the contaminants of concern for the site (i.e. no volatile contaminants have been identified), the use of trip blank and trip spike samples is not required.

11.3.6 Laboratory program

The National Association of Testing Authorities of Australia (NATA) accredited project laboratory will use their internal procedures and NATA accredited methods in accordance with their quality assurance system. The environmental consultant is to ensure that the laboratory analytical methods and limits of reporting are acceptable for analysis required.

Laboratory quality control procedures used during the project should include (where relevant):

- **Laboratory duplicate samples**: Duplicate sub samples collected by the laboratory from one sample submitted for analytical testing at a rate equivalent to one in twenty samples per analytical batch, or one sample per batch if less than twenty samples are analysed in a batch. A laboratory duplicate provides data on the analytical precision and reproducibility of the test result.
- **Spiked Samples**: An authentic field sample is spiked by adding an aliquot of known concentration of the target analyte(s) prior to sample extraction and analysis. A spike documents the effect of the sample matrix on the extraction and analytical techniques. Spiked samples will be analysed for each batch where samples are analysed for organic chemicals of concern.
- **Certified Reference Standards**: A reference standard of known (certified) concentration is analysed along with a batch of samples. The Certified Reference Standard (CRS) or Laboratory Control Spike provides an indication of the analytical accuracy and the precision of the test method and is used for inorganic analyses.
- **Surrogate Standard/Spikes**: These are organic compounds which are similar to the analyte of interest in terms of chemical composition, extractability, and chromatographic conditions (retention time), but which are not normally found in environmental samples. These surrogate compounds are spiked into blanks, standards and samples submitted for organic analyses by gas-chromatographic techniques prior to sample extraction. Surrogate Standard/Spikes provide a means of checking that no gross errors have occurred during any stage of the test method leading to significant analyte loss.
- **Laboratory Blank**: Usually an organic or aqueous solution that is as free as possible of analytes of interest to which is added all the reagents, in the same volume, as used in the preparation and subsequent analysis of the samples. The reagent blank is carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The reagent blank is used to correct for possible contamination resulting from the preparation or processing of the sample.

The individual testing laboratories will conduct an assessment of the laboratory QC program, internally; however the results will also be independently reviewed and assessed by the Environmental Consultant.

Laboratory duplicate samples should return RPDs within the NEPM acceptance criteria of ±30%. Per cent recovery is used to assess spiked samples and surrogate standards. Per cent recovery; although dependent on the type of analyte tested, concentrations of analytes and sample matrix; should normally range from about 70-130%. Method (laboratory) blanks should return analyte concentrations as ‘not detected’.

11.3.7 Dispatch and transport of samples

All samples will be dispatched and transported in accordance with laboratory procedures and requirements. The Environmental Consultant will conduct a review of these procedures and requirements to ensure that all statutory requirements are complied with.

The Environmental Consultant will seek to ensure that the specified holding times for analytes are not exceeded due to delays between sample dispatch and laboratory receipt.

12. Protection of environment and community

Demolition and remediation activities have the potential to disturb contaminated soils, particularly during the earthworks stage. If inadequately managed, the disturbance of any areas of contamination has the potential to impact on human health and surrounding environment. A major part of the site management will involve the installation and maintenance of environmental protection and pollution control measures designed to achieve the following objectives:

- Protection of the surrounding environment during all phases of demolition and remediation works
- Protection of the local community during all phases of the remediation works
- The containment of all contaminated and potentially contaminated materials (soils, sludge, run-off etc.) to the site

As per Section 10, prior to commencing works, the Contractor must possess plans, programmes, licences, certificates and other documents necessary for the commencement of the work, addressing as a minimum the requirements of this RWP. These documents shall be subject to review by the AIE Project Manager and the Environmental Consultant.

The remedial program shall be undertaken with due regard to legislative requirements and any relevant environment planning instruments that apply to the site. Where approved plans exist (as prepared by AIE or the Contractor), the more stringent requirements will apply.

12.1 Interim controls

Prior to the commencement of site remediation works, the following interim controls should be put in place:

- The Contractor is responsible for the construction and/or maintenance of permanent fences around the subject area meeting appropriate specifications to prevent unauthorised entry.
- The Contractor is responsible for the construction of silt and sediment controls around the remediation site, meeting appropriate specifications to prevent erosion and runoff.

12.2 Hours of operation

Remediation works will typically be undertaken during standard construction hours including:

Monday to Friday: 7:00 am –6:00 pm

Saturdays: 8:00 am – 1:00 pm

No work undertaken on Sundays or Public Holidays.

It is noted that AIE have received approval for 24 hour to be undertaken for specific activities associated with project development including earth-moving at Berth 101 and the emplacement area. Remediation activities can therefore be undertaken outside of standard construction hours where required in accordance with the Out of Hours Works approval issued by DPI&E.

12.3 Contact details during remediation

During remediation works, representatives and on-site supervisors shall be available to be contacted at all times. Management plans prepared by the Contractor should detail the incident reporting procedure for reporting environmental incidents during the project. Additionally, the Site Health & Safety and Environmental Management Plans as prepared by the Contractor will detail contact numbers for key project contacts once confirmed, emergency services and utility authorities.

12.4 Soil and water management

All remediation works will be undertaken in accordance with relevant management plans that will provide the specific details of the soil and water management measures. The Contractor shall be responsible for the implementation and maintenance of soil and water management measures throughout the remediation works. A summary of relevant measures is presented below:

- Surface runoff control – may include diversion drains, silt fences, sumps and pumping systems to prevent runoff entering or leaving excavation areas and to prevent runoff/suspended solids entering or leaving land farm or stockpile areas.
- Stockpiles - are not to be placed on walkways or roads and shall be placed away from drainage lines, water's edge, gutters or stormwater pits or inlets. Stockpiles likely to generate dust or odours shall be covered and stockpiles of contaminated soil shall be stored in a secure area.
- Vehicle access - Movement of excavation equipment and trucks to and from the site will be strictly controlled, restricted to a minimum and will only take place during the designated working hours. Controls must be in place to prevent any material being tracked onto offsite roads including wheel washing and sediment barriers. Soil, earth, mud and other similar materials must be removed from the roadway preferably by dry methods (sweeping, shovelling).
- Groundwater management - Based on the depth to groundwater in this area, the requirement for groundwater management is likely. Groundwater management such as dewatering of excavations will require a Dewatering Management Plan (DMP) which would outline the requirements on storage, treatment and discharge for groundwater that is likely to be pumped out of excavations during the construction.

12.5 Noise

It is the responsibility of the Contractor to minimise noise generated from the remediation operations in accordance with the approved noise management plan and Out of Hours Works Approval for the project

12.6 Vibration

The use of any plant and/or machinery shall not cause vibrations that can be felt or are capable of being measured at any off-site premises.

12.7 Waste management

The Contractor shall establish appropriate waste disposal containers as part of site mobilisation, which shall be maintained on site for the duration of the works. All waste materials (e.g. garbage) must be disposed of using safe waste disposal practises. No waste shall be disposed of on-site. The waste disposal containers shall be emptied as necessary to avoid overflowing, and the contents disposed of to a waste disposal facility approved for the relevant waste type.

The Contractor shall prepare a waste management plan identifying materials that can be re-used or recycled, and how these will be managed during the remediation works.

All potential pollutant materials shall be stored well clear of any poorly drained areas, flood-prone areas, and stormwater drainage areas. Such materials should be stored in a designated area. Containment bunds should be constructed with provision for collection and storage of any spilt material.

12.8 Air quality

General

Dust emissions shall be confined within the site boundary. The following dust control procedures may be employed to comply with this requirement (as required):

- Erection of dust screens around the perimeter of the site
- Covering of all stockpiles of contaminated soil remaining for periods longer than 24 hours
- Keeping excavation surfaces moist

Asbestos

Where works are undertaken involving disturbance of asbestos containing materials, airborne fibre monitoring shall be conducted in accordance with the SafeWork NSW *Code of Practice: How to Safely Remove Asbestos* (2019a) and the WHS legislation (NSW). The monitoring should be conducted in accordance with NOHSC *Guidance Note on the Membrane Filter Method for Estimating Method Airborne Asbestos Fibres* 2nd Edition (NOHSC:3003, 2005).

Air monitoring requirements vary depending on the type of asbestos being removed, the location/position of the asbestos, if an enclosure is used and whether the asbestos removal work is within a building or outside.

- Friable asbestos – Air monitoring is mandatory for all friable asbestos removal and includes prior to dismantling an enclosure and for the purposes of the clearance inspection. An independent licensed asbestos assessor must be engaged to carry out air monitoring.
- Non-friable asbestos (>10 m²) – Air monitoring is not required but may be considered to be carried out by an independent licensed asbestos assessor or competent person to ensure compliance with the duty to eliminate or minimise exposure to airborne asbestos and to ensure the exposure standard is not exceeded.
- Public Location – Air monitoring should be considered where the asbestos removal work is being undertaken in or next to a public location.
- Exposure air monitoring – Air monitoring should be carried out at other times to determine a worker's exposure to airborne asbestos if, based on reasonable grounds, there is uncertainty as to whether the exposure standard may be exceeded and a risk assessment by a competent person indicates it is necessary. Since most uses of asbestos are prohibited, exposure monitoring should not be required frequently.

Air monitoring may be required when:

- It is not clear whether new or existing control measures are effective.
- There is evidence (for example, dust deposits are outside the enclosure) the control measures have deteriorated as a result of poor maintenance.
- Modifications or changes in safe work methods have occurred that may adversely affect worker exposure.
- There has been an uncontrolled disturbance of asbestos at the site.

Table 12-1: Air Monitoring Action Levels

Action Level	Action
< 0.01 fibres/mL	Continue with control measures
At 0.01 fibres/mL or ≤ 0.02 fibres/mL	Review control measures, investigate cause and implement controls to minimise exposure and prevent further release.
> 0.02 fibres/mL	Stop removal work Notify relevant regulator (phone followed by written statement) Investigate the cause Implement controls to eliminate or minimise exposure and prevent further release Do not recommence removal work until further air monitoring is conducted and fibre levels are < 0.01 fibres/ml

Odours

No odours should be detected at any boundary of the property relying purely on a sense of smell. Techniques that may be employed to reduce odours include covering stockpiles, use of mist sprays, use of hydrocarbon mitigating agents such as surfactants and adequate maintenance of machinery to minimise exhaust emissions.

12.9 Fuelling of machinery

Fuelling is perceived to be a high risk activity, in particular when near water. The Contractor shall include fuelling plan for approval by AIE as part of the work plan prior to start of works.

12.10 Traffic movements and management

No major traffic disruptions are expected to result from the entry and egress of vehicles from the main site entrance. Any heavy equipment or machinery will be transported to the site in accordance with the standard regulatory requirements.

12.11 Unexpected finds protocol

The site has been investigated for contamination as detailed in previous investigation reports. However, a degree of uncertainty is inherent in any site contamination investigation and a potential exists for undetected contaminated soils or wastes to be identified during the proposed remediation works. In particular, there is a potential for previously unidentified contamination to be present beneath the remaining above and below ground structures and services and also with the extensive fill units across the site. Indications of potential contamination may include:

- Stained or discoloured fill, soils or seepage water
- Odorous fill, soils or seepage waters
- Construction/demolition wastes such as concrete, bricks, timber, tiles, asbestos sheeting, fragments and pipes
- General rubbish such as plastic, glass, packaging

- Imported materials

An unexpected findings protocol (UFP) shall be developed as part of management plans to be prepared by the Contractor. Figure 12-1 below outlines suggested procedures that should be followed in the event of an unexpected find and therefore should be considered when preparing the UFP.

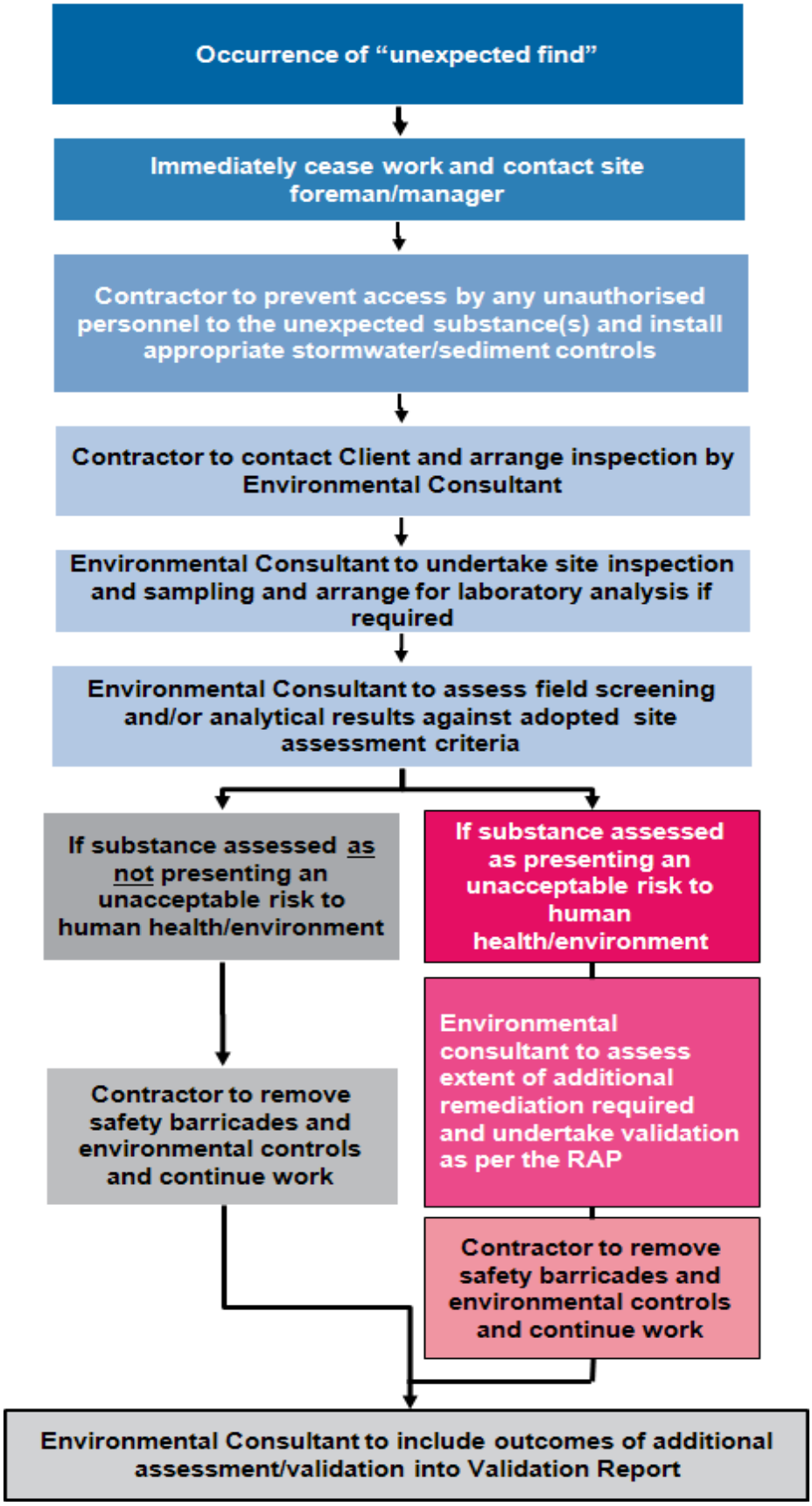

Figure 12-1: Unexpected finds decision process

12.12 Environmental protection and pollution control contingency plan

The Contractor will follow the contingency plan (to be provided in relevant management plans) if unexpected situations are encountered. The following outlines some of the unexpected situations that may arise:

- Spills or leaks
- Adverse weather conditions
- Dust, noise, odour levels measured at site boundary may exceed acceptable levels
- Surface runoff may leave the site

The Contractor shall have available measures to counter these contingencies. In such cases the AIE Project Manager will stop work and appropriate situation specific action will be taken.

13. Health and safety

13.1 Work health and safety

Work Health and Safety (WHS) is a necessity on all remediation projects to ensure the health and safety of all personnel working/visiting the site. Therefore, work shall be carried out in accordance with a site-specific Work Health and Safety Plan (WH&S Plan). The Contractor shall prepare a site specific WHS Plan (or combined HSE Plan) for the remediation works, addressing as a minimum the requirements of this RWP, and shall appoint a Site Safety Officer for the duration of the works.

The purpose of the plan is to provide all relevant health and safety information for all personnel undertaking work at the site and to provide and maintain safety standards and practices which offer the highest practical degree of personal protection to the on-site workers, based on current knowledge.

The plan will recognise the legislative obligations of the Contractor and of AIE and will in particular:

a. Recognise that the work to be undertaken as part of the RWP may involve a “construction project” (as defined in the relevant legislation) in respect of which AIE and/or the Contractor has obligations as Principal Contractor. These obligations will be expressly dealt with in the plan.

b. Recognise that the work to be undertaken as part of the RWP includes “high risk construction work” (as defined in the relevant legislation) in respect of which both the Contractor and AIE have obligations. These obligations will be expressly dealt with in the plan.

It is the responsibility of the Contractor and the AIE Project Manager to take all necessary practicable actions to safeguard the safety and health of all employees and subcontractors while they are on the site.

All work undertaken shall be performed in accordance with the provisions of the Work Health and Safety Act 2011, the Work Health and Safety Regulations 2017 and any other relevant regulations or directions issued by regulatory authorities.

13.2 Community health and safety

To ensure the protection of the local community, the Contractor shall control the exposure pathways identified in this section.

Control mechanisms will include the following:

- Site security measures to control direct contact with the contamination
- Dust suppression measures to control inhalation exposure
- Cleaning and tarping trucks to control direct contact from migration of contaminated soils

These measures are described in Section 12 - Protection of the Environment and Community, and shall be documented in detail in relevant management plans prepared by the Contractor.

14. Conclusions

AIE commissioned GHD to prepare a RWP for the demolition and remediation works at Berth 101 at the Port Kembla Gas Terminal. The purpose of this RWP is to manage contamination issues during the Berth 101 demolition works, to support subsequent excavation and dredging of material and transfer to the off-site areas of the project.

This RWP provides a summary of identified site contamination issues, and a description of the proposed demolition and remediation, procedures and standards which are to be followed during the course of the works to ensure the successful remediation, segregation and management of excavated materials and consequently the protection of the environment and human health.

The investigations that have been undertaken are considered sufficient to develop this RWP, which, if appropriately implemented, will enable the successful segregation of demolition, excavated and stockpiled materials with re-use of suitable materials for construction of, and placement within the OHDSCA. Additional areas may require excavation / remediation based on results of the investigations to be completed beneath structures and services as part of the preliminary remediation works.

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16. Limitations

This Berth 101 Remediation Work Plan ("RWP"):

- Has been prepared by GHD Pty Ltd ("GHD") for Australian Industrial Energy (AIE).
- May be used and relied on by AIE.
- May be used by and provided to the Site Auditor acting as an agent of AIE in this respect.
- May be used by and provided to the NSW EPA and the relevant planning authority for the purpose of meeting statutory obligations in accordance with the relevant sections of the CLM Act 1997 or the Environment Planning and Assessment (EP&A) Act 1979.
- May only be used for the purpose as stated in Section 1 of the RWP (and must not be used for any other purpose).

GHD and its servants, employees and officers otherwise expressly disclaim responsibility to any person other than AIE arising from or in connection with this RWP.

To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by GHD and the RWP are excluded unless they are expressly stated to apply in this RWP.

The services undertaken by GHD in connection with preparing this RWP:

- Were limited to those specifically detailed in Section 1.5 of this RWP.
- Were undertaken in accordance with current profession practice and by reference to relevant environmental regulatory authority and industry standards, guidelines and assessment criteria in existence as at the date of this RWP and any previous site investigations referred to in the RWP.

The opinions, conclusions and any recommendations in this RWP are based on assumptions made by GHD when undertaking services and preparing the RWP ("Assumptions"), as specified throughout this RWP.

GHD expressly disclaims responsibility for any error in, or omission from, this Report arising from or in connection with any of the Assumptions being incorrect.

Subject to the paragraphs in this section of the RWP, the opinions, conclusions and any recommendations in this RAP are based on conditions encountered and information reviewed at the time of preparation of this RWP and are relevant until such times as the site conditions or relevant legislations changes, at which time, GHD expressly disclaims responsibility for any error in, or omission from, this RWP arising from or in connection with those opinions, conclusions and any recommendations."

This RWP is based solely on the investigations and findings contained in the reports referenced in the RWP (Section 15) and on the conditions encountered and information reviewed at the time of each Report. This RWP should be read in conjunction with the referenced Reports. It is also subject to all the limitations and recommendations in the referenced Reports.

GHD has prepared this RWP on the basis of information provided by AIE and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked ("Unverified Information") beyond the agreed scope of work.

GHD expressly disclaims responsibility in connection with the Unverified Information, including (but not limited to) errors in, or omissions from, the RWP, which were caused or contributed to by errors in, or omissions from, the Unverified Information.

The opinions, conclusions and any recommendations in this RWP are based on information obtained from, and testing undertaken at or in connection with, specific sampling points and may not fully represent the conditions that may be encountered across the site at other than these locations. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this RWP are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this RWP.

GHD has considered and/or tested for only those chemicals specifically referred to in this RWP and makes no statement or representation as to the existence (or otherwise) of any other chemicals.

Site conditions (including any the presence of hazardous substances and/or site contamination) may change after the date of this RWP. GHD expressly disclaims responsibility:

- Arising from, or in connection with, any change to the site conditions
- To update this RWP if the site conditions change

Except as otherwise expressly stated in this RWP GHD makes no warranty or representation as to the presence or otherwise of asbestos and/or asbestos containing materials ("ACM") on the site. If fill material has been imported on to the site at any time, or if any buildings constructed prior to 1970 have been demolished on the site or material from such buildings disposed of on the site, the site may contain asbestos or ACM.

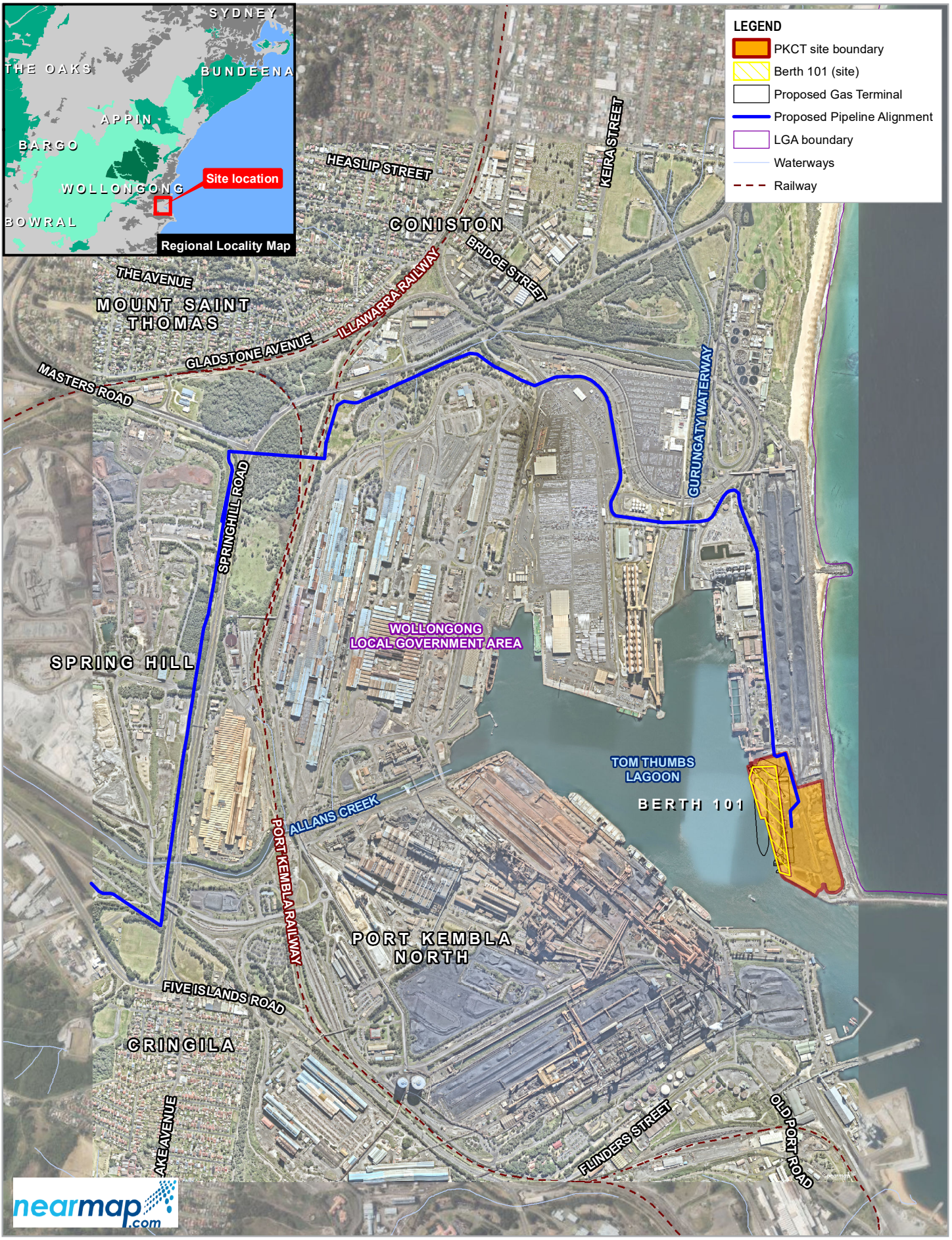
Subsurface conditions can vary across a particular site and cannot be exhaustively defined by the investigations carried out prior to this RWP. As a result, it is unlikely that the results and estimations expressed or used to compile this RWP will represent conditions at any location other than the specific points of sampling. A site that appears to be unaffected by contamination at the time of the reports attached to this RWP may later, due to natural causes or human intervention, become contaminated.

Except as otherwise expressly stated in this RWP, GHD makes no warranty, statement or representation of any kind concerning the suitability of the site for any purpose or the permissibility of any use, development or re-development of the site.

These Disclaimers should be read in conjunction with the entire RWP. This RWP must be read in full and no excerpts are taken to be representative of the findings of this RWP.

Appendices

Appendix A – Figures



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Metres
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Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

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Australian Industrial Energy
Berth 101 LNG Facility, Port Kembla, NSW
Remediation Works Plan

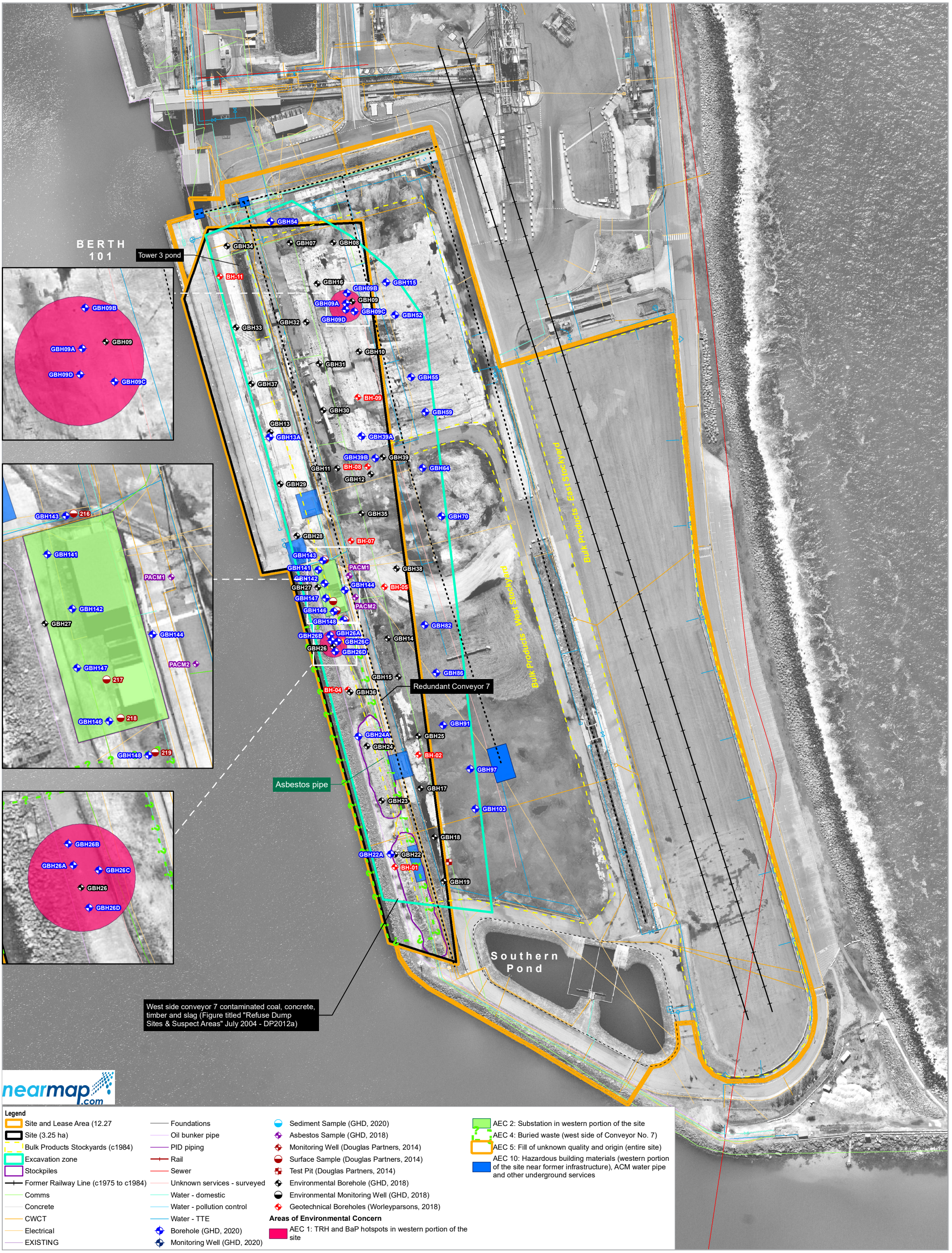
Project No. **21-27477**
Revision No. **-**
Date **25/02/2021**

Remediation Works Plan – Berth 101

FIGURE 1

N:\AU\Sydney\Projects\21\27477\GIS\Maps\Deliverables\Contam\BerthRW\21_27477_Z001_RWP_SiteLocation.mxd

Data source: Aerial imagery - nearmap 2021 (image date 16/04/2018, date extracted 01/08/2018) & sixmaps 2021 © Department of Customer Service 2020; General topo - NSW LPI DTDB 2017, 2015 & 2015; Inset map - Geoscience Australia; Berth footprint - Australian Industrial Energy. Created by: kschroder-turner



Legend

- Site and Lease Area (12.27
- Site (3.25 ha)
- Bulk Products Stockyards (c1984)
- Excavation zone
- Stockpiles
- Former Railway Line (c1975 to c1984)
- Comms
- Concrete
- CWCT
- Electrical
- EXISTING
- Foundations
- Oil bunker pipe
- PID piping
- Rail
- Sewer
- Unknown services - surveyed
- Water - domestic
- Water - pollution control
- Water - TTE
- Borehole (GHD, 2020)
- Monitoring Well (GHD, 2020)
- Sediment Sample (GHD, 2020)
- Asbestos Sample (GHD, 2018)
- Monitoring Well (Douglas Partners, 2014)
- Surface Sample (Douglas Partners, 2014)
- Test Pit (Douglas Partners, 2014)
- Environmental Borehole (GHD, 2018)
- Environmental Monitoring Well (GHD, 2018)
- Geotechnical Boreholes (Worleyparsons, 2018)

Areas of Environmental Concern

- AEC 1: TRH and BaP hotspots in western portion of the site
- AEC 2: Substation in western portion of the site
- AEC 4: Buried waste (west side of Conveyor No. 7)
- AEC 5: Fill of unknown quality and origin (entire site)
- AEC 10: Hazardous building materials (western portion of the site near former infrastructure), ACM water pipe and other underground services

Paper Size ISO A3

1:2,000

0 10 20 30 40

Metres

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

Australian Industrial Energy
Berth 101 LNG Facility, Port Kembla, NSW
Baseline Contamination Assessment

Project No. **21-27477**
Revision No. **A**
Date **25/02/2021**

Site Layout Plan showing AECs

FIGURE 2

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Data source: Aerial imagery - nearmap 2021 (image date 05/09/2020, date extracted 20/10/2020); General topo - NSW LPI DTDB 2017, 2015 & 2012; Berth footprint - Australian Industrial Energy; Survey - PKCT 2020. Created by: kschroder-turner

Appendix B – Summary table of results

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code								BH05	BH08	BH09	BH11				PACM1	PACM2	GBH07		GBH08	GBH09			GBH
Date								23-Aug-18	28-Aug-18	23-Aug-18	13-Aug-18		14-Aug-18	15-Aug-18	21-Aug-18	21-Aug-18	10-Sep-18		23-Aug-18	23-Aug-18			18/1
Field ID								BH05/15.5-15.95	BH08/16.0-16.45	BH09/16.0	BH11/0.2-0.3	BH11/1.5-2.0	BH11/9.1-9.5	BH11/19.6-20.0	PACM1	PACM2	GBH07/6.7-7.0	GBH07/8.7-9.0	GBH08/0.1-0.3	GBH09/0.1-0.3	GBH09/0.75-1.0	GBH09/4.2-4.4	GBH 09A 5.0-5.3
Depth								15.5-15.95	16.0-16.45	16.00	0.2-0.3	1.5-2.0	9.1-9.5	19.6-20.0	Surface	Surface	6.7-7.0	8.7-9.0	0.1-0.3	0.1-0.3	0.75-1.0	4.2-4.4	5 - 5.3
Sample Type								Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand* 0-1m	1-2m	2-4m	>=4m	NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil																			
Metals																															
Arsenic	mg/kg	2					3,000[#2]								6.5	17	15	-	5.2	5.9	15	-	-	5.6	54	< 2	-	2.4	16	-
Cadmium	mg/kg	0.4					900								< 0.4	< 0.4	< 0.4	-	< 0.4	< 0.4	< 0.4	-	-	< 0.4	< 0.4	< 0.4	-	< 0.4	< 0.4	-
Chromium (III+VI)	mg/kg	5					3,600[#3]								8.2	15	18	-	5.7	< 5	25	-	-	< 5	< 5	6.9	-	87	11	-
Copper	mg/kg	5					240,000								9.0	22	17	-	9.4	< 5	29	-	-	< 5	< 5	5.5	-	8.1	20	-
Lead	mg/kg	5					1,500[#4]								< 5	12	9.8	-	9.0	< 5	10	-	-	< 5	< 5	< 5	-	9.8	20	-
Mercury	mg/kg	0.1					730[#5]								< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	-	-	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	-
Nickel	mg/kg	5					6,000								< 5	7.5	11	-	< 5	< 5	< 5	-	-	< 5	< 5	< 5	-	8.3	7.6	-
Zinc	mg/kg	5					400,000								12	24	29	-	35	30	11	-	-	< 5	6.2	9.8	-	32	76	-
BTEXN																															
Benzene	mg/kg	0.1	430	1,100	77	160		*3*	*3*	*3*	*3*				< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	-	-	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	<0.1
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]				< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	-	-	< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	<0.1
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]				< 0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	-	-	< 0.1	< 0.1	0.1	-	< 0.1	< 0.1	<0.1
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		*230*	*NL* [#1]	*NL* [#1]	*NL* [#1]				< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3	-	-	< 0.3	< 0.3	< 0.3	-	< 0.3	< 0.3	<0.3
TRH - NEPM 2013																															
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	*NL* [#1]				< 20	< 20	< 20	-	< 20	< 20	< 20	-	-	< 20	< 20	< 20	-	< 20	< 20	<20
C6-C10 Fraction	mg/kg	10													< 20	< 20	< 20	-	< 20	< 20	< 20	-	-	< 20	< 20	< 20	-	< 20	< 20	<20
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]				< 50	< 50	< 50	-	< 50	< 50	< 50	-	-	< 50	< 50	< 50	-	< 50	130	<50
>C10-C16 Fraction	mg/kg	50													< 50	< 50	< 50	-	< 50	< 50	< 50	-	-	< 50	< 50	< 50	-	< 50	130	<50
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000											< 100	< 100	< 100	-	< 100	2,600	< 100	-	-	< 100	< 100	< 100	-	< 100	5,400	<100
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000											< 100	< 100	< 100	-	< 100	1,100	< 100	-	-	< 100	< 100	< 100	-	< 100	500	<100
TRH - NEPM 1999																															
C6-C9 Fraction	mg/kg	10													<20	<20	<20	-	<20	<20	<20	-	-	<20	<20	<20	-	<20	<20	<20
C10-C14 Fraction	mg/kg	20													<20	<20	<20	-	<20	<20	<20	-	-	<20	<20	<20	-	32	42	<20
C15-C28 Fraction	mg/kg	50													<50	<50	<50	-	<50	1300	<50	-	-	<50	<50	72	-	78	3800	<50
C29-C36 Fraction	mg/kg	50													<50	<50	<50	-	<50	1800	<50	-	-	<50	<50	<50	-	<50	1600	<50
PAHs - standard 16																															
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]				< 0.5	< 0.5	< 0.5	-	< 0.5	< 0.5	< 0.5	-	-	< 0.5	< 0.5	< 0.5	-	< 0.5	4.4	<0.5
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]								< 0.5	< 0.5	< 0.5	-	12.4	< 0.5	< 0.5	-	-	< 0.5	< 0.5	< 0.5	-	< 0.5	1,552	1.6
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]								0.6	0.6	0.6	-	1.8	0.6	0.6	-	-	0.6	0.6	0.6	-	0.6	150	0.6
OTHER																															
Ammonia (as N)	mg/kg														< 5	-	5	-	-	< 5	16	-	-	-	-	-	-	-	-	-
Cyanide (total)	mg/kg						1,500								< 5	-	< 5	-	-	< 5	< 5	-	-	-	-	-	-	-	-	-
ASBESTOS															-	-	-	ND	-	-	-	**Chrysotile, amosite, crocidolite**	**Chrysotile, amosite**	-	-	ND	ND	-	-	-
PCBs																															
Arochlor 1016	µg/kg	500													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1221	µg/kg	100													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1232	µg/kg	500													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1242	µg/kg	500													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	µg/kg	500													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	µg/kg	500													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	µg/kg	500													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs (Total)	µg/kg	100					7,000								-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
#3 In the absence of a guideline value for total chromium, chromium VI value adopted
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be
#5 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be
#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand*				NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil
								0-1m	*1-2m*	*2-4m*	*>=4m*	
Metals												
Arsenic	mg/kg	2					3,000[#2]					
Cadmium	mg/kg	0.4					900					
Chromium (III+VI)	mg/kg	5					3,600[#3]					
Copper	mg/kg	5					240,000					
Lead	mg/kg	5					1,500[#4]					
Mercury	mg/kg	0.1					730[#5]					
Nickel	mg/kg	5					6,000					
Zinc	mg/kg	5					400,000					
BTEXN												
Benzene	mg/kg	0.1	430	1,100	77	160		*3*	*3*	*3*	*3*	
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*	
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*	
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		*230*	*NL[#1]*	*NL[#1]*	*NL[#1]*	
TRH - NEPM 2013												
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	*NL[#1]*	
C6-C10 Fraction	mg/kg	10										700[#9]
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*	
>C10-C16 Fraction	mg/kg	50										1,000[#9]
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								3,500
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								10,000
TRH - NEPM 1999												
C6-C9 Fraction	mg/kg	10										
C10-C14 Fraction	mg/kg	20										
C15-C28 Fraction	mg/kg	50										
C29-C36 Fraction	mg/kg	50										
PAHs - standard 16												
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*	
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]					
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]					
OTHER												
Ammonia (as N)	mg/kg											
Cyanide (total)	mg/kg						1,500					
ASBESTOS												
PCBs												
Arochlor 1016	µg/kg	500										
Arochlor 1221	µg/kg	100										
Arochlor 1232	µg/kg	500										
Arochlor 1242	µg/kg	500										
Arochlor 1248	µg/kg	500										
Arochlor 1254	µg/kg	500										
Arochlor 1260	µg/kg	500										
PCBs (Total)	µg/kg	100					7,000					

Location Code	H09A		GBH09B		GBH09C		GBH09D	GBH09D	GBH10			GBH11		GBH12		GBH13	
Date	/2020		18/11/2020	19/11/2020	17/11/2020		17/11/2020	19/11/2020	24-Aug-18			24-Aug-18		24-Aug-18	27-Aug-18	22-Aug-18	
Field ID	QC18	QC18A	GBH 09B 4.9-5.	GBH 09B 4.2-4.	GBH 09C 4.3-4.	GBH 09C 5.3-5.	GBH 09D 4.7-5.	GBH 09D 4.2-4.	GBH10/0.1-0.3	QC8	QC8A	GBH11/0.05-0.3	GBH11/1.4-1.6	GBH12/0.5-0.7	GBH12/1.7-1.2	GBH13/1.0-1.1	GBH13/2.7-3.0
Depth	5 - 5.3	5 - 5.3	4.9 - 5	4.2 - 4.4	4.3 - 4.5	5.3 - 5.5	4.7 - 5	4.2 - 4.4	0.1-0.3	0.1-0.3	0.1-0.3	0.05-0.3	1.4-1.6	0.5-0.7	1.7-1.2	1.0-1.1	2.7-3.0
Sample Type	Field_D	Interlab_D	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Field_D	Interlab_D	Primary	Primary	Primary	Primary	Primary	Primary
Metals																	
Arsenic	-	-	-	-	-	-	-	-	< 2	< 2	<5	< 2	< 2	-	3.9	< 2	5.8
Cadmium	-	-	-	-	-	-	-	-	< 0.4	< 0.4	<1	< 0.4	< 0.4	-	< 0.4	< 0.4	< 0.4
Chromium (III+VI)	-	-	-	-	-	-	-	-	< 5	8.1	3.0	< 5	8.3	-	9.3	6.8	< 5
Copper	-	-	-	-	-	-	-	-	< 5	< 5	<5	200	25	-	11	< 5	< 5
Lead	-	-	-	-	-	-	-	-	< 5	< 5	<5	11	< 5	-	16	< 5	7.9
Mercury	-	-	-	-	-	-	-	-	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1
Nickel	-	-	-	-	-	-	-	-	< 5	< 5	<2	< 5	< 5	-	< 5	< 5	< 5
Zinc	-	-	-	-	-	-	-	-	< 5	< 5	<5	61	17	-	75	< 5	29
BTEXN																	
Benzene	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.2	<0.2	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1
Toluene	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.2	<0.5	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1
Ethylbenzene	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.2	<0.5	< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1
Xylene Total	<0.3	<0.5	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	< 0.3	< 0.6	<0.5	< 0.3	< 0.3	-	< 0.3	< 0.3	< 0.3
TRH - NEPM 2013																	
F1 (C6-C10 minus BTEX)	<20	<10	<20	<20	<20	<20	<20	<20	< 20	< 40	<10	< 20	< 20	-	< 20	< 20	< 20
C6-C10 Fraction	<20	<10	<20	<20	<20	<20	<20	<20	< 20	< 40	<10	< 20	< 20	-	< 20	< 20	< 20
F2 (>C10-C16 minus Naphthalene)	<50	<50	<50	<50	<50	<50	<50	<50	< 50	< 50	<50	< 50	< 50	-	< 50	< 50	< 50
>C10-C16 Fraction	<50	<50	<50	<50	<50	<50	<50	<50	< 50	< 50	<50	< 50	< 50	-	< 50	< 50	< 50
F3 (>C16-C34 Fraction)	<100	<100	<100	<100	<100	<100	<100	<100	< 100	< 100	<100	< 100	< 100	-	< 100	< 100	170
F4 (>C34-C40 Fraction)	<100	<100	<100	<100	<100	<100	<100	<100	< 100	< 100	<100	< 100	< 100	-	< 100	< 100	< 100
TRH - NEPM 1999																	
C6-C9 Fraction	<20	<10	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	-	<20	<20	<20
C10-C14 Fraction	<20	<50	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	-	<20	<20	<20
C15-C28 Fraction	<50	<100	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	65	-	<20	<20	130
C29-C36 Fraction	<50	<100	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	<50	<50	62
PAHs - standard 16																	
Naphthalene	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	< 0.5	< 0.5	<0.5	< 0.5	< 0.5	-	< 0.5	< 0.5	< 0.5
PAHs (Sum of total)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	< 0.5	< 0.5	<0.5	< 0.5	< 0.5	-	< 0.5	< 0.5	47
Total 8 PAHs (as BaP TEQ) (half LOR)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	-	0.6	0.6	6.5
OTHER																	
Ammonia (as N)	-	-	-	-	-	-	-	-	< 5	< 10	< 20	-	< 5	-	-	-	< 5
Cyanide (total)	-	-	-	-	-	-	-	-	< 5	< 5	*	-	< 5	-	-	-	< 5
ASBESTOS	-	-	-	-	-	-	-	-	ND	-	-	-	ND	ND	-	ND	-
PCBs																	
Arochlor 1016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1221	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1232	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1242	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs (Total)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
#3 In the absence of a guideline value for total chromium, chromium VI value adopted
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be
#5 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be
#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code																														
Date												GBH13A			GBH14	GBH15	GBH16		GBH17		GBH18		GBH19	GBH20		G
Field ID												17/11/2020			10-Sep-18	27-Aug-18	12-Sep-18		27-Aug-18		27-Aug-18		27-Aug-18	10-Sep-18		22
Depth												GBH 13A 2.8-3.0	GBH13A 3.4-3.5		GBH14/1.7-2.0	GBH14/2.7-3.0	GBH16/5.7-6.0	GBH16/9.7-1.0	GBH17/1.5-1.7	GBH17/3.7-4.0	GBH18/0.5-0.7	GBH18/4.7-5.0	GBH19/0.5-0.7	GBH20/6.7-7.0	GBH20/8.7-9.0	GBH21/0.5-0.7	
Sample Type												2.8 - 3	3.4-3.5		1.7-2.0	2.7-3.0	5.7-6.0	9.7-10.0	1.5-1.7	3.7-4.0	0.5-0.7	4.7-5.0	0.5-0.7	6.7-7.0	8.7-9.0	0.5-0.7	
												Primary	Primary		Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand* 0-1m	1-2m	2-4m	>=4m	NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil																
Metals																														
Arsenic	mg/kg	2					3,000[#2]					7.2	-	-	3.3	5.6	4.8	2.2	4.4	5.9	3.8	6.0	< 2	4.4	6.0	6.2	
Cadmium	mg/kg	0.4					900					< 0.4	-	-	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	
Chromium (III+VI)	mg/kg	5					3,600[#3]					< 5	-	-	< 5	< 5	< 5	< 5	6.3	< 5	9.7	< 5	8.3	< 5	< 5	21	
Copper	mg/kg	5					240,000					< 5	-	-	< 5	< 5	< 5	< 5	5.7	< 5	6.1	< 5	18	8.7	5.7	17	
Lead	mg/kg	5					1,500[#4]					< 5	-	-	< 5	7.3	< 5	< 5	7.3	11	12	< 5	< 5	13	16	16	
Mercury	mg/kg	0.1					730[#5]					< 0.1	-	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Nickel	mg/kg	5					6,000					< 5	-	-	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	9.7	
Zinc	mg/kg	5					400,000					< 5	-	-	13	50	< 5	< 5	57	68	93	21	21	83	83	81	
BTEXN																														
Benzene	mg/kg	0.1	430	1,100	77	160		*3*	*3*	*3*	*3*	-	<0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]	-	<0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]	-	<0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		*230*	*NL* [#1]	*NL* [#1]	*NL* [#1]	-	<0.3	-	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	
TRH - NEPM 2013																														
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	*NL* [#1]	-	<20	<20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
C6-C10 Fraction	mg/kg	10										-	<20	<20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]	-	<50	50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	
>C10-C16 Fraction	mg/kg	50										-	<50	50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								-	110	1700	< 100	< 100	< 100	< 100	< 100	< 100	100	< 100	< 100	< 100	< 100	< 100	
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								-	<100	360	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	
TRH - NEPM 1999																														
C6-C9 Fraction	mg/kg	10										-	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
C10-C14 Fraction	mg/kg	20											<20	26	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
C15-C28 Fraction	mg/kg	50											71	1300	<20	<20	<20	<20	<50	<50	86	<50	50	<50	<50	<50	
C29-C36 Fraction	mg/kg	50											52	600	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	
PAHs - standard 16																														
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]	-	<0.5	1.1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]					-	28.9	581	< 0.5	< 0.5	< 0.5	< 0.5	0.6	< 0.5	0.7	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]					-	4.9	65	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	
OTHER																														
Ammonia (as N)	mg/kg											-	-	-	-	-	-	-	-	< 5	-	-	-	-	< 5	-	
Cyanide (total)	mg/kg						1,500					-	-	-	-	-	-	-	-	< 5	-	-	-	-	< 5	-	
ASBESTOS												-	-	-	-	-	-	-	-	-	ND	-	ND	-	-	ND	
PCBs																														
Arochlor 1016	µg/kg	500										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1221	µg/kg	100										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1232	µg/kg	500										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1242	µg/kg	500										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1248	µg/kg	500										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1254	µg/kg	500										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Arochlor 1260	µg/kg	500										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
PCBs (Total)	µg/kg	100					7,000					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
#3 In the absence of a guideline value for total chromium, chromium VI value adopted
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be
#5 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be
#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code								BH21	GBH22			GBH22A			GBH22A								
Date								Aug-18	22-Aug-18		31-Aug-18	20/11/2020			20/11/2020								
Field ID								GBH21/1.5-1.8	GBH22/0.4-0.5	GBH22/3.2-3.5	GBH22/5.2-5.5	GBH 022A 0.4-0.5	GBH 022A 6.2-6.5	GBH 022A 8.0-8.5	GBH 022A 10.0-10.3	GBH 022A 12.0-12.5	GBH 022A 13.5-14.5	GBH23/0.5-0.7	GBH23/8.7-9.0				
Depth								1.5-1.8	0.4-0.5	3.2-3.5	5.2-5.5	0.4 - 0.5	6.2 - 6.5	8 - 8.5	10 - 10.3	12 - 12.5	13.5 - 14	0.5-0.7	8.7-9.0				
Sample Type								Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary				
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand* 0-1m	1-2m	2-4m	>=4m	NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil												
Metals																							
Arsenic	mg/kg	2					3,000[#2]					6.1	5.2	4.9	9.0	-	6.4	3.3	5.9	<2	2.4	3.9	9.2
Cadmium	mg/kg	0.4					900					< 0.4	< 0.4	< 0.4	< 0.4	-	<0.4	<0.4	<0.4	<0.4	<0.4	< 0.4	< 0.4
Chromium (III+VI)	mg/kg	5					3,600[#3]					16	13	< 5	< 5	-	<5	6.4	5.9	<5	9.5	13	20
Copper	mg/kg	5					240,000					21	16	< 5	< 5	-	<5	<5	<5	<5	14	25	31
Lead	mg/kg	5					1,500[#4]					33	11	11	< 5	-	<5	<5	<5	<5	11	25	69
Mercury	mg/kg	0.1					730[#5]					< 0.1	< 0.1	< 0.1	< 0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.1
Nickel	mg/kg	5					6,000					6.7	6.8	< 5	< 5	-	<5	<5	<5	<5	<5	< 5	14
Zinc	mg/kg	5					400,000					170	62	81	22	-	5.5	<5	<5	<5	16	230	520
BTEXN																							
Benzene	mg/kg	0.1	430	1,100	77	160		*3*	*3*	*3*	*3*	< 0.1	< 0.1	< 0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.1
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]	< 0.1	< 0.1	< 0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.1
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]	< 0.1	< 0.1	< 0.1	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	< 0.1	< 0.1
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		*230*	*NL* [#1]	*NL* [#1]	*NL* [#1]	< 0.3	< 0.3	< 0.3	-	-	<0.3	<0.3	<0.3	<0.3	<0.3	< 0.3	< 0.3
TRH - NEPM 2013																							
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	*NL* [#1]	< 20	< 20	< 20	< 20	-	-	<20	<20	<20	<20	<20	< 20	< 20
C6-C10 Fraction	mg/kg	10										< 20	< 20	< 20	< 20	-	-	<20	<20	<20	<20	<20	< 20	< 20
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]	< 50	< 50	< 50	< 50	-	-	<50	<50	<50	98	<50	55	< 50
>C10-C16 Fraction	mg/kg	50										< 50	< 50	< 50	< 50	-	-	<50	<50	<50	98	<50	55	< 50
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								< 100	< 100	< 100	< 100	-	-	<100	<100	<100	<100	<100	170	< 100
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								< 100	< 100	< 100	< 100	-	-	<100	<100	<100	<100	<100	< 100	< 100
TRH - NEPM 1999																							
C6-C9 Fraction	mg/kg	10										<20	<20	<20	<20	-	-	<20	<20	<20	<20	<20	<20	<20
C10-C14 Fraction	mg/kg	20										<20	<20	<20	<20	-	-	<20	<20	<20	35	<20	45	<20
C15-C28 Fraction	mg/kg	50										<50	<50	<50	<50	-	-	57	<50	<50	130	<50	140	<50
C29-C36 Fraction	mg/kg	50										<50	<50	<50	<50	-	-	<50	<50	<50	<50	<50	52	<50
PAHs - standard 16																							
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]	< 0.5	< 0.5	< 0.5	< 0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	< 0.5	1.4
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]					< 0.5	20	< 0.5	< 0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	2.2	2.0
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]					0.6	1.8	0.6	0.6	-	0.6	0.6	0.6	0.6	0.6	0.6	0.6
OTHER																							
Ammonia (as N)	mg/kg											-	-	< 5	< 5	-	-	-	-	-	-	-	-
Cyanide (total)	mg/kg						1,500					-	-	< 5	< 5	-	-	-	-	-	-	-	-
ASBESTOS												-	ND	-	-	-	-	-	-	-	-	-	-
PCBs																							
Arochlor 1016	µg/kg	500										-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1221	µg/kg	100										-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1232	µg/kg	500										-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1242	µg/kg	500										-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	µg/kg	500										-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	µg/kg	500										-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	µg/kg	500										-	-	-	-	-	-	-	-	-	-	-	-
PCBs (Total)	µg/kg	100					7,000					-	-	-	-	-	-	-	-	-	-	-	-

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
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#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
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#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code								GBH23			GBH24	GBH24	GBH24A	GBH25	GBH26			GBH026A		GBH026A		
Date								11-Sep-18			21-Aug-18	21-Aug-18	20/11/2020	27-Aug-18	21-Aug-18			18/11/2020		18/11/2020		19/11/2020
Field ID								GBH23/9.7-10.0	QC18	QC18A	GBH24/0.0-0.3	GBH24/3.7-3.9	GBH 024A 0.0-0.3	GBH25/2.5-2.7	GBH26/0.05-0.4	GBH26/0.4-0.6	GBH26/4.75-4.9	GBH 026A 0.1-0.3	GBH 026A 5.0-5.3	GBH 026A 5.4-5.5	GBH 026A 5.8-6.0	GBH 026A 9.0-9.5
Depth								9.7-10.0	9.7-10.0	9.7-10.0	0.0-0.3	3.7-3.9	0 - 0.3	2.5-2.7	0.05-0.4	0.4-0.6	4.75-4.9	0.1 - 0.3	5 - 5.3	5.4 - 5.5	5.8 - 6	9 - 9.5
Sample Type								Primary	Field_D	Interlab_D	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand* 0-1m	1-2m	2-4m	>=4m	NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil												
Metals																						
Arsenic	mg/kg	2					3,000[#2]				2.8	6.4	8	2.3	5.1	3.2	5.0	2.3	3.2	7.5	<2	4.4	-	-	3.9
Cadmium	mg/kg	0.4					900				< 0.4	< 0.4	<1	< 0.4	< 0.4	<0.4	< 0.4	< 0.4	< 0.4	< 0.4	<0.4	<0.4	-	-	<0.4
Chromium (III+VI)	mg/kg	5					3,600[#3]				< 5	11	10	17	< 5	25	< 5	15	< 5	7.3	8.2	<5	-	-	7.1
Copper	mg/kg	5					240,000				< 5	18	9	140	< 5	180	< 5	220	< 5	6.1	<5	<5	-	-	<5
Lead	mg/kg	5					1,500[#4]				< 5	42	25	50	9.1	180	9.7	11	5.1	19	<5	<5	-	-	<5
Mercury	mg/kg	0.1					730[#5]				< 0.1	< 0.1	<0.1	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1	-	-	0.1
Nickel	mg/kg	5					6,000				< 5	10	5	9.9	< 5	15	< 5	6.5	< 5	< 5	<5	<5	-	-	<5
Zinc	mg/kg	5					400,000				< 5	350	235	330	68	1,300	76	76	27	140	8.4	35	-	-	<5
BTEXN																						
Benzene	mg/kg	0.1	430	1,100	77	160		*3*	*3*	*3*	*3*		< 0.1	< 0.1	<0.2	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 0.1	< 0.1	<0.5	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 0.1	< 0.1	<0.5	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		*230*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 0.3	< 0.3	<0.5	< 0.3	< 0.3	<0.3	< 0.3	< 0.3	< 0.3	< 0.3	<0.3	<0.3	<0.3	<0.3	<0.3
TRH - NEPM 2013																						
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		*260[#8]*	*370[#8]*	*630[#8]*	*NL[#1]*		< 20	< 20	<10	< 20	< 20	<20	< 20	< 20	< 20	< 20	<20	<20	<20	<20	<20
C6-C10 Fraction	mg/kg	10										700[#9]	< 20	< 20	<10	< 20	< 20	<20	< 20	< 20	< 20	< 20	<20	<20	<20	<20	<20
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 50	< 50	<50	98	< 50	<50	< 50	< 50	< 50	160	<50	<50	<50	<50	<50
>C10-C16 Fraction	mg/kg	50										1,000[#9]	< 50	< 50	<50	98	< 50	<50	< 50	< 50	< 50	160	<50	<50	<50	<50	<50
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								3,500	< 100	< 100	<100	390	< 100	180	< 100	290	< 100	**4,100**	<100	<100	<100	<100	<100
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								10,000	< 100	< 100	<100	< 100	< 100	<100	< 100	290	< 100	350	<100	<100	<100	<100	<100
TRH - NEPM 1999																						
C6-C9 Fraction	mg/kg	10											<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
C10-C14 Fraction	mg/kg	20											<20	<20	<20	61	<20	<20	<20	31	<20	45	<20	<20	<20	<20	<20
C15-C28 Fraction	mg/kg	50											<50	<50	<50	290	<50	130	<50	140	<50	3000	<50	<50	<50	<50	<50
C29-C36 Fraction	mg/kg	50											<50	<50	<50	150	<50	<50	<50	240	<50	1200	<50	<50	<50	<50	<50
PAHs - standard 16																						
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 0.5	0.6	<0.5	< 0.5	< 0.5	<0.5	< 0.5	< 0.5	< 0.5	3.4	-	<0.5	<0.5	<0.5	<0.5
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]						< 0.5	0.6	15.8	9.4	< 0.5	2	< 0.5	1.5	< 0.5	1,111	-	<0.5	<0.5	<0.5	<0.5
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]						0.6	0.6	1.8	0.7	0.6	0.6	0.6	0.6	0.6	110	-	0.6	0.6	0.6	0.6
OTHER																						
Ammonia (as N)	mg/kg												< 5	< 5	-	-	< 5	-	-	-	< 5	-	-	-	-	-	-
Cyanide (total)	mg/kg						1,500						< 5	< 5	-	-	< 5	-	-	-	< 5	-	-	-	-	-	-
ASBESTOS													-	-	-	-	-	-	ND	ND	-	-	-	-	-	-	-
PCBs																						
Arochlor 1016	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1221	µg/kg	100											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1232	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1242	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs (Total)	µg/kg	100					7,000						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
#3 In the absence of a guideline value for total chromium, chromium VI value adopted
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be
#5 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be
#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code												GBH26A		GBH026B	GBH026B	GBH026C		GBH026D				GBH27			
Date												19/11/2020		18/11/2020	18/11/2020	17/11/2020		18/11/2020				28-Aug-18		29-Aug-18	
Field ID												GBH 026A 11.0-11.5	GBH 026A 13.5-14.0	GBH 026B 4.7-4.9	GBH 026B 5.7-6.0	GBH 026C 4.7-4.8	GBH 026C 4.8-5.0	GBH 026D 4.7-4.8	GBH 026D 5.7-6.0	QC20	QC20A	GBH27/1	GBH27/5.7-6.0	GBH27/8.7-9.0	GBH28/1.4-1.6
Depth												11 - 11.5	13.5 - 14	4.7 - 4.9	5.7 - 6	4.7 - 4.8	4.8 - 5	4.7 - 4.8	5.7 - 6	4.7 - 4.8	4.7 - 4.8	1.7-2.0	5.7-6.0	8.7-9.0	1.4-1.6
Sample Type												Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Field_D	Interlab_D	Primary	Primary	Primary	Primary
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand*				NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil															
								0-1m	*1-2m*	*2-4m*	*>=4m*															
Metals																										
Arsenic	mg/kg	2					3,000[#2]						<2	<2	-	-	-	-	-	-	-	-	-	6.0	3.1	2.9
Cadmium	mg/kg	0.4					900						<0.4	<0.4	-	-	-	-	-	-	-	-	-	< 0.4	< 0.4	< 0.4
Chromium (III+VI)	mg/kg	5					3,600[#3]						<5	<5	-	-	-	-	-	-	-	-	-	< 5	8.7	< 5
Copper	mg/kg	5					240,000						<5	6.2	-	-	-	-	-	-	-	-	-	< 5	< 5	< 5
Lead	mg/kg	5					1,500[#4]						<5	<5	-	-	-	-	-	-	-	-	-	< 5	6.0	5.3
Mercury	mg/kg	0.1					730[#5]						<0.1	<0.1	-	-	-	-	-	-	-	-	-	< 0.1	< 0.1	< 0.1
Nickel	mg/kg	5					6,000						<5	<5	-	-	-	-	-	-	-	-	-	< 5	< 5	< 5
Zinc	mg/kg	5					400,000						<5	<5	-	-	-	-	-	-	-	-	-	< 5	< 5	30
BTEXN																										
Benzene	mg/kg	0.1	430	1,100	77	160		*3*	*3*	*3*	*3*		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	-	< 0.1	< 0.1	< 0.1
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	-	< 0.1	< 0.1	< 0.1
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	-	< 0.1	< 0.1	< 0.1
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		*230*	*NL* [#1]	*NL* [#1]	*NL* [#1]		<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.5	-	< 0.3	< 0.3	< 0.3
TRH - NEPM 2013																										
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	*NL* [#1]		<20	<20	<20	<20	<20	<20	<20	<20	<20	<10	-	< 20	< 20	< 20
C6-C10 Fraction	mg/kg	10										700[#9]	<20	<20	<20	<20	<20	<20	<20	<20	<20	<10	-	< 20	< 20	< 20
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]		<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	< 50	< 50	< 50
>C10-C16 Fraction	mg/kg	50										1,000[#9]	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	-	< 50	< 50	< 50
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								3,500	<100	<100	<100	<100	410	<100	<100	<100	<100	<100	-	< 100	< 100	< 100
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								10,000	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	-	< 100	< 100	< 100
TRH - NEPM 1999																										
C6-C9 Fraction	mg/kg	10											<20	<20	<20	<20	<20	<20	<20	<20	<20	<10	-	< 20	< 20	< 20
C10-C14 Fraction	mg/kg	20											22	<20	<20	<20	<20	<20	<20	<20	<20	<50	-	< 20	< 20	< 20
C15-C28 Fraction	mg/kg	50											75	<50	<50	<50	300	<50	<50	<50	<50	<100	-	< 20	< 20	< 50
C29-C36 Fraction	mg/kg	50											<50	<50	<50	<50	88	<50	<50	<50	<50	<100	-	< 50	< 50	< 50
PAHs - standard 16																										
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]		<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	-	-	< 0.5	< 0.5	< 0.5
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]						<0.5	<0.5	<0.5	15.4	137.6	<0.5	1.4	<0.5	<0.5	<0.5	-	< 0.5	< 0.5	< 0.5
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]						0.6	0.6	0.6	2.3	18	0.6	0.6	0.6	0.6	0.6	-	0.6	0.6	0.6
OTHER																										
Ammonia (as N)	mg/kg												-	-	-	-	-	-	-	-	-	-	-	< 5	-	-
Cyanide (total)	mg/kg						1,500						-	-	-	-	-	-	-	-	-	-	-	< 5	-	-
ASBESTOS													-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs																										
Arochlor 1016	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1221	µg/kg	100											-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1232	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1242	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs (Total)	µg/kg	100					7,000						-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
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#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be
#5 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be
#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code								GBH28		GBH29		GBH30		GBH31	GBH32				GBH33					GBH34	
Date								21-Aug-18		21-Aug-18		24-Aug-18		10-Sep-18	23-Aug-18				20-Aug-18					20-Aug-18	
Field ID								GBH28/3.8-4.0	QC4	GBH29/0.03-0.2	GBH29/2.4-2.5	GBH30/0.3-0.5	GBH30/1.2-1.4	GBH31/4.7-5.0	GBH32/1.0-1.2	GBH132/4.1-4.2	QC7	QC7A	GBH33/0.05-0.2	GBH33/0.2-0.4	QC2	QC2A	GBH34/0.1-0.4	QC1
Depth								3.8-4.0	3.8-4.0	0.03-0.2	2.4-2.5	0.3-0.5	1.2-1.4	4.7-5.0	1.0-1.2	4.1-4.2	4.1-4.2	4.1-4.2	0.05-0.2	0.2-0.4	0.2-0.4	0.2-0.4	0.1-0.4	0.1-0.4
Sample Type								Primary	Field_D	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Field_D	Interlab_D	Primary	Primary	Field_D	Interlab_D	Primary	Field_D
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand* 0-1m	1-2m	2-4m	>=4m	NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil																				
Metals																															
Arsenic	mg/kg	2					3,000[#2]								5.8	5.4	< 2	5.7	< 2	4.5	4.9	2.0	6.0	4.9	<5	2.8	4.4	4.5	<5	4.1	4.0
Cadmium	mg/kg	0.4					900								< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	<1	< 0.4	< 0.4	< 0.4	<1	< 0.4	< 0.4
Chromium (III+VI)	mg/kg	5					3,600[#3]								< 5	< 5	5.8	< 5	390	14	< 5	190	< 5	< 5	<2	15	< 5	7.7	3.0	15	14
Copper	mg/kg	5					240,000								< 5	< 5	< 5	< 5	12	54	< 5	9.2	< 5	< 5	<5	81	7.8	17	11	120	130
Lead	mg/kg	5					1,500[#4]								7.4	8.6	< 5	9.0	< 5	13	< 5	< 5	5.3	< 5	<5	15	7.3	8.9	11	38	26
Mercury	mg/kg	0.1					730[#5]								< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	< 0.1	< 0.1	< 0.1	<0.1	< 0.1	< 0.1
Nickel	mg/kg	5					6,000								< 5	< 5	< 5	< 5	24	10	< 5	11	< 5	< 5	<2	9.8	< 5	< 5	2.0	9.9	9.5
Zinc	mg/kg	5					400,000								22	21	< 5	34	58	54	< 5	46	20	16	14	140	28	36	31	130	130
BTEXN																															
Benzene	mg/kg	0.1	430	1,100	77	160		*3*	*3*	*3*	*3*				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.2	< 0.1	< 0.1	< 0.1	<0.2	< 0.1	< 0.1
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.5	< 0.1	< 0.1	< 0.1	<0.5	< 0.1	< 0.1
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*				< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.5	< 0.1	< 0.1	< 0.1	<0.5	< 0.1	< 0.1
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		*230*	*NL[#1]*	*NL[#1]*	*NL[#1]*				< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	<0.5	< 0.3	< 0.3	< 0.3	<0.5	< 0.3	< 0.3
TRH - NEPM 2013																															
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	*NL[#1]*				< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	<10	< 20	< 20	< 20	<10	< 20	< 20
C6-C10 Fraction	mg/kg	10													< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	<10	< 20	< 20	< 20	<10	< 20	< 20
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*				< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	<50	< 50	< 50	< 50	<50	< 50	< 50
>C10-C16 Fraction	mg/kg	50													< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	<50	< 50	< 50	< 50	<50	< 50	< 50
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000											< 100	< 100	< 100	< 100	< 100	< 100	< 100	150	< 100	< 100	<100	< 100	< 100	< 100	<100	220	250
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000											< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	< 100	<100	< 100	< 100	< 100	<100	150	160
TRH - NEPM 1999																															
C6-C9 Fraction	mg/kg	10													<20	<20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	<20	< 10	< 20	< 20	< 20	< 10	< 20	< 20
C10-C14 Fraction	mg/kg	20													<20	<20	< 20	< 20	< 20	< 20	< 20	23	< 20	<20	< 50	< 20	< 20	< 20	< 50	< 20	< 20
C15-C28 Fraction	mg/kg	50													<50	<50	< 50	61	< 50	< 50	< 50	110	< 50	<50	<100	81	< 50	63	<100	130	120
C29-C36 Fraction	mg/kg	50													<50	<50	< 50	< 50	< 50	< 50	< 50	59	< 50	<50	<100	< 50	< 50	< 50	<100	160	180
PAHs - standard 16																															
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*				< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	<0.5	< 0.5	< 0.5	< 0.5	<0.5	< 0.5	< 0.5
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]								6.4	9.0	< 0.5	19	< 0.5	< 0.5	< 0.5	1.1	< 0.5	< 0.5	<0.5	< 0.5	13	26	15.7	1.3	0.6
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]								1.1	1.3	0.6	3.1	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	2.0	3.3	2.0	0.6	0.6
OTHER																															
Ammonia (as N)	mg/kg														-	-	-	< 5	-	-	-	< 5	-	-	-	-	< 5	< 5	< 20	-	-
Cyanide (total)	mg/kg						1,500								-	-	-	< 5	-	-	-	< 5	-	-	-	-	< 5	< 5	< 1	-	-
ASBESTOS															-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs																															
Arochlor 1016	µg/kg	500													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1221	µg/kg	100													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1232	µg/kg	500													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1242	µg/kg	500													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1248	µg/kg	500													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1254	µg/kg	500													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arochlor 1260	µg/kg	500													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs (Total)	µg/kg	100					7,000								-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
#3 In the absence of a guideline value for total chromium, chromium VI value adopted
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be
#5 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be
#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code												GBH35	GBH37			GBH38		GBH39	GBH39A		GBH39B	216	216A	217	217A
Date												24-Aug-18	21-Aug-18			28-Aug-18		24-Aug-18	18/11/2020		20/11/2020	24/11/2011	18/11/2020	24/11/2011	18/11/2020
Field ID												GBH35/2.5-2.7	GBH37/0.6-0.8	GBH37/1.9-2.1	GBH37/4.8-5.0	GBH38/0.5-0.7	GBH38/3.7-4.0	GBH39/2 2-2.4	GBH 039A 1.3-1.5	GBH 039A 2.2-2.4	GBH 039B 1.9-2.1	216/0.0-0.1	216A 0.0-0.2	217/0.0-0.1	217A 0.05-0.25
Depth												2.5-2.7	0.6-0.8	1.9-2.1	4.8-5.0	0.5-0.7	3.7-4.0	2.2-2.4	1.3 - 1.5	2.2 - 2.4	1.9 - 2.1	0.0-0.1	0.0-0.2	0.0-0.1	0.05-0.25
Sample Type												Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary	Primary
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand*				NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil															
								0-1m	*1-2m*	*2-4m*	*>=4m*															
Metals																										
Arsenic	mg/kg	2					3,000[#2]						5.4	2.5	-	3.8	5.6	2.3	4.9	2.4	3.7	2.3	6.4	-	-	-	-
Cadmium	mg/kg	0.4					900						< 0.4	< 0.4	-	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	<0.4	<0.4	<0.4	-	-	-	-
Chromium (III+VI)	mg/kg	5					3,600[#3]						< 5	< 5	-	9.1	< 5	90	< 5	44	51	<5	11	-	-	-	-
Copper	mg/kg	5					240,000						< 5	< 5	-	24	< 5	13	< 5	78	7.5	<5	11	-	-	-	-
Lead	mg/kg	5					1,500[#4]						8.8	< 5	-	6.2	< 5	< 5	5.1	380	6.1	<5	21	-	-	-	-
Mercury	mg/kg	0.1					730[#5]						< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.1	<0.1	-	-	-	-
Nickel	mg/kg	5					6,000						< 5	< 5	-	5.7	< 5	< 5	< 5	8.4	<5	<5	<5	-	-	-	-
Zinc	mg/kg	5					400,000						32	5.4	-	27	< 5	40	18	96	37	5.6	110	-	-	-	-
BTEXN																										
Benzene	mg/kg	0.1	430	1,100	77	160		*3*	*3*	*3*	*3*		< 0.1	< 0.1	-	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	-	-	<0.1	-	-	-	-
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 0.1	< 0.1	-	< 0.1	< 0.1	0	< 0.1	< 0.1	-	-	<0.1	-	-	-	-
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 0.1	< 0.1	-	< 0.1	< 0.1	0.9	< 0.1	< 0.1	-	-	<0.1	-	-	-	-
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		*230*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 0.3	< 0.3	-	< 0.3	< 0.3	2.7	< 0.3	< 0.3	-	-	<0.3	-	-	-	-
TRH - NEPM 2013																										
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	*NL[#1]*		< 20	< 20	-	< 20	< 20	30	< 20	< 20	-	-	<20	-	-	-	-
C6-C10 Fraction	mg/kg	10										700[#9]	< 20	< 20	-	< 20	< 20	34	< 20	< 20	-	-	<20	-	-	-	-
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 50	< 50	-	< 50	< 50	88	< 50	300	-	-	<50	-	-	-	-
>C10-C16 Fraction	mg/kg	50										1,000[#9]	< 50	< 50	-	< 50	< 50	89	< 50	300	-	-	<50	-	-	-	-
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								3,500	110	< 100	-	< 100	< 100	190	< 100	560	-	-	<100	-	-	-	-
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								10,000	< 100	< 100	-	< 100	< 100	< 100	< 100	100	-	-	<100	-	-	-	-
TRH - NEPM 1999																								-	-	-
C6-C9 Fraction	mg/kg	10											< 20	< 20	-	< 20	< 20	23	< 20	< 20	-	-	<20	<25	-	<25	-
C10-C14 Fraction	mg/kg	20											< 20	< 20	-	< 20	< 20	62	< 20	220	-	-	<20	<50	-	<50	-
C15-C28 Fraction	mg/kg	50											90	< 50	-	< 50	< 50	160	< 50	420	-	-	<50	<100	-	<100	-
C29-C36 Fraction	mg/kg	50											< 50	< 50	-	< 50	< 50	59	< 50	200	-	-	<50	<100	-	<100	-
PAHs - standard 16																								-	-	-
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		*NL[#1]*	*NL[#1]*	*NL[#1]*	*NL[#1]*		< 0.5	< 0.5	-	< 0.5	< 0.5	1.5	< 0.5	< 0.5	-	-	-	-	-	-	-
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]						34	< 0.5	-	< 0.5	< 0.5	2.5	< 0.5	4.3	-	-	-	-	-	-	-
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]						4.1	0.6	-	0.6	0.6	0.6	0.6	0.6	-	-	-	-	-	-	-
OTHER																										
Ammonia (as N)	mg/kg												< 5	-	-	< 5	-	-	< 5	< 5	-	-	-	-	-	-	-
Cyanide (total)	mg/kg						1,500						< 5	-	-	< 5	-	-	< 5	< 5	-	-	-	-	-	-	-
ASBESTOS													-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs																										
Arochlor 1016	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	<100	<500	<100	<500
Arochlor 1221	µg/kg	100											-	-	-	-	-	-	-	-	-	-	-	<100	<100	<100	<100
Arochlor 1232	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	<100	<500	<100	<500
Arochlor 1242	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	<100	<500	<100	<500
Arochlor 1248	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	<100	<500	<100	<500
Arochlor 1254	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	300	<500	500	<500
Arochlor 1260	µg/kg	500											-	-	-	-	-	-	-	-	-	-	-	<100	<500	<100	1,500
PCBs (Total)	µg/kg	100					7,000						-	-	-	-	-	-	-	-	-	-	-	300	<500	500	1,900

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
#3 In the absence of a guideline value for total chromium, chromium VI value adopted
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be
#5 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be
#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix B
Table LR1
Summary of soil analytical results - Proposed excavation area in remediation works plan

Location Code											218	218A	219	219A	GBH141	GBH142	GBH143			GBH145	GBH146	GBH147	GBH148
Date											24/11/2011	18/11/2020	24/11/2011	18/11/2020	18/11/2020	18/11/2020	18/11/2020			18/11/2020	18/11/2020	18/11/2020	18/11/2020
Field ID											218/0.0-0.1	218A 0.0-0.2	219/0.0-0.1	219A 0.0-0.2	GBH141 0.0-	GBH142 0.0-0.2	GBH143 0.0-0.2	QC23	QC23A	GBH145 0.0-0.15	GBH146 0.0-0.2	GBH147 0.0-0.2	GBH148 0.0-0.2
Depth											0.0-0.1	0.0-0.2	0.0-0.1	0.0-0.2	0 - 0.2	0 - 0.2	0 - 0.2	0 - 0.2	0 - 0.2	0 - 0.15	0 - 0.2	0 - 0.2	0 - 0.2
Sample Type											Primary	Primary	Primary	Primary	Primary	Primary	Primary	Field_D	Interlab_D	Primary	Primary	Primary	Primary
	Unit	EQL	CRC CARE 2011 Soil Direct Contact HSL-D Commercial / Industrial	CRC CARE 2011 Soil Direct Contact Intrusive Works	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,0 to <2m,Sand	CRC CARE 2011 Soil HSL Vap.Int Intrusive Works,2 to <4m,Sand	NEPM 2013 Table 1A(1) HIL D Comm/Ind	*NEPM 2013 Table 1A(3) HSL D Comm/Ind Soil for Vapour Intrusion, Sand* 0-1m	1-2m	2-4m	>=4m	NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil													
Metals																										
Arsenic	mg/kg	2					3,000[#2]					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/kg	0.4					900					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium (III+VI)	mg/kg	5					3,600[#3]					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/kg	5					240,000					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	mg/kg	5					1,500[#4]					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/kg	0.1					730[#5]					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/kg	5					6,000					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/kg	5					400,000					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BTEXN																										
Benzene	mg/kg	0.1	430	1,100	77	160		*3*	*3*	*3*	*3*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	mg/kg	0.1	99,000	120,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	mg/kg	0.1	27,000	85,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylene Total	mg/kg	0.3	81,000	130,000	NL[#1]	NL[#1]		*230*	*NL* [#1]	*NL* [#1]	*NL* [#1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRH - NEPM 2013																										
F1 (C6-C10 minus BTEX)	mg/kg	10	26,000	82,000	NL[#1]	NL[#1]		260[#8]	370[#8]	630[#8]	*NL* [#1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C6-C10 Fraction	mg/kg	10										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F2 (>C10-C16 minus Naphthalene)	mg/kg	50	20,000	62,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
>C10-C16 Fraction	mg/kg	50										-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F3 (>C16-C34 Fraction)	mg/kg	100	27,000	85,000								-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F4 (>C34-C40 Fraction)	mg/kg	100	38,000	120,000								-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TRH - NEPM 1999												-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C6-C9 Fraction	mg/kg	10										<25	-	<25	-	-	-	-	-	-	-	-	-	-	-	-
C10-C14 Fraction	mg/kg	20										<50	-	<50	-	-	-	-	-	-	-	-	-	-	-	-
C15-C28 Fraction	mg/kg	50										<100	-	200	-	-	-	-	-	-	-	-	-	-	-	-
C29-C36 Fraction	mg/kg	50										<100	-	<100	-	-	-	-	-	-	-	-	-	-	-	-
PAHs - standard 16												-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	0.5	11,000	29,000	NL[#1]	NL[#1]		*NL* [#1]	*NL* [#1]	*NL* [#1]	*NL* [#1]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAHs (Sum of total)	mg/kg	0.5					4,000[#6]					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total 8 PAHs (as BaP TEQ) (half LOR)	mg/kg	0.5					40[#7]					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OTHER																										
Ammonia (as N)	mg/kg											-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanide (total)	mg/kg						1,500					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ASBESTOS												-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PCBs																										
Arochlor 1016	µg/kg	500										<100	<500	<100	<500	<500	<500	<500	<500	-	<500	<500	<500	<500	<500	<500
Arochlor 1221	µg/kg	100										<100	<100	<100	<100	<100	<100	<100	<100	-	<100	<100	<100	<100	<100	<100
Arochlor 1232	µg/kg	500										<100	<500	<100	<500	<500	<500	<500	<500	-	<500	<500	<500	<500	<500	<500
Arochlor 1242	µg/kg	500										<100	<500	<100	<500	<500	<500	<500	<500	-	<500	<500	<500	<500	<500	<500
Arochlor 1248	µg/kg	500										<100	<500	<100	<500	<500	<500	<500	<500	-	<500	<500	<500	<500	<500	<500
Arochlor 1254	µg/kg	500										200	<500	400	500	<500	<500	<500	<500	-	<500	<500	<500	<500	<500	<500
Arochlor 1260	µg/kg	500										<100	<500	<100	1,800	<500	<500	<500	<500	-	<500	<500	<500	<500	<500	<500
PCBs (Total)	µg/kg	100					7,000					200	<500	400	2,300	<500	<500	<500	700	<100	<500	<500	<500	<500	<500	<500

Table notes:
#1 Not limiting: Derived soil HSL exceeds soil saturation concentration
#2 Arsenic: HIL assumes 70% oral bioavailability. Site-specific bioavailability maybe important and should be considered where appropriate (refer Schedule B7).
#3 In the absence of a guideline value for total chromium, chromium VI value adopted
#4 Lead: HILs A,B,C based on blood lead models (IEUBK & HIL D on adult lead model for where 50% bioavailability considered. Site-specific bioavailability should be
#5 Elemental mercury: HIL does not address elemental mercury. a site specific assessment should be considered if elemental mercury is present, or suspected to be
#6 Total PAHs: Based on sum of 16 most common reported (WHO 98). HIL application should consider presence of carcinogenic PAHs (should meet BaP TEQ HIL) &
#7 Carcinogenic PAHs: HIL based on 8 carc. PAHs & their TEFs (rel to BaP ref Schedule 7) BaP TEQ calc by multiplying the conc of each carc. PAH in sample by its
#8 To obtain F1 subtract the sum of BTEX concentrations from the C6 - C10 fraction.
#9 Separate management limits for BTEX & naphthalene are not available hence should not be subtracted from the relevant fractions to obtain F1 & F2

Appendix C – Materials tracking register

Outline material tracking table

The following table indicates the information that should be provided by the consultant to facilitate audit of waste management as per the requirements of EPA (2017) *Guidelines for the NSW Auditor Scheme*. Information should be provided in excel format to facilitate checking totals, sorting data etc.

Waste type / source area*	Stockpile # (if relevant)	Description	Excavation Date	Disposal Date	Time (if relevant)	Vehicle rego	Estimated Volume**	Actual Weight**	Disposal Docket #	Classification	Destination (final or interim)	Classification doc ref#

* Group spreadsheet entries by this

** Provide basis for volume estimates. Weights as per disposal weighbridge. Provide subtotals for each waste group.
The consultant (or contractor) is to reconcile and check all quantities, and compile (in number or date order) and provide dockets.

The Validation Report should provide a summary and discussion based on these detailed records (typically appended to, or (preferred if information is substantial) as a separate volume to the Validation Report).

A similar format may be used for imported material or for on-site material tracking, inserting information that is relevant to those activities (i.e. not all information may be required, other information may be useful).

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2127477-48186-933/https://projects.ghd.com/oc/Sydney1/eastcoastlngterminal/Delivery/Documents/2127477-REP_PKCT Berth 101 RWP v0.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	E. Griffin C. Quayle	I. Gregson		K. Rosen		26/02/2021
B	E. Griffin C. Quayle	I. Gregson		K. Rosen		03/03/2021
0	E. Griffin C. Quayle	I. Gregson		K. Rosen		12/03/2021

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Appendix C

Unanticipated Finds Protocol

Appendix D - Unanticipated Find Protocol (Contamination)

Australian Industrial Energy (AIE) proposes to develop the Port Kembla Gas Terminal (the project) in Port Kembla, New South Wales (NSW) (the site). The project involves the development of a liquefied natural gas (LNG) import terminal at Berth 101 and stored in Floating Storage and Regasification Unit (FSRU). The LNG would be distributed via a carbon steel high-pressure pipeline connection from the berth to the existing gas transmission network. The installation of this pipeline forms part of the development works.

GHD Pty Ltd (GHD) completed contamination assessments for Berth 101 and proposed pipeline route in 2018. The contamination assessments identified several areas of environmental concern associated with historical potentially contaminating activities. At Berth 101, localised soil contamination was identified in the form of benzo(a)pyrene toxic equivalence quotient (BaP TEQ) and total recoverable hydrocarbons (TRH); and asbestos was identified in two fibre cement fragments at the surface. Some relatively minor impacts from heavy metals and ammonia were identified in a perched fresh to brackish groundwater lens within Berth 101. The limited sampling carried out along the pipeline route did not identify soil contamination.

Due to the preliminary nature of the contamination assessments and the volume of fill material to be excavated, in particular from Berth 101, a potential occurrence of unidentified contamination during construction activities cannot be precluded.

Therefore, the objective of this unexpected finds procedure is to inform workers involved with earthworks of potentially encountering asbestos and other forms of contamination. The procedure provides information on expected conditions and provides examples of unexpected finds along with control measures appropriately addressing the find.

1 Background

The SCSB JV is responsible to provide advice and a copy of this Unexpected Finds Procedure to all excavation / construction personnel prior to commencing work to identify the known potential site hazards as required under Work Health and Safety Act 2011 (amended 2018).

The plan is to be implemented by contractors during any construction works where the ground surface may be disturbed. The plan provides a procedure to be followed in the event of an unexpected find of contamination during these development works.

The SCSB JV is responsible for ensuring that the procedure is implemented by contractors during construction works at the site.

This plan applies for the period of construction and earthworks being carried out at the site.

After construction works are completed, this plan does not include procedures for on-going long term management. Should on-going management be determined to be required at a later date, then this plan should be updated or an alternative plan prepared.

1.1 EXPECTED SUBSURFACE CONDITIONS

The subsurface conditions encountered in previous investigations are summarised in the following tables.

Table 10: Expected subsurface conditions at Berth 101

Unit / origin	Description	Occurrence in subsurface (m bgs)
Pavements	Concrete / asphalt / Hard fill	to 0.15
Fill	Gravelly sand / sandy gravel / sand / silt: dark brown, black, grey, pale green. Foreign materials: slag, coal, steel, concrete, wood and/or coal reject.	to 2.5
Fill	Sand / clayey sand / gravelly clay: brown, pale brown, yellow, orange sands. However, clays are typically black, dark grey, grey. Fine black sand layers (probable heavy mineral sands). Foreign materials: charcoal, wood and coal.	to 5.5
Unit 1A Possible Alluvium / Tidal Sands	Sand: brown, pale brown, yellow, orange, shell fragments. Trace iron stained sand, fine black sand layers (probable heavy mineral sands).	to >10.0*
Unit 1B Alluvium / Estuarine	Clay / silty sand: brown, grey clays; and dark brown, grey, brown silty sands. Shell fragments within silty sand layers.	to >10.0*
Unit 2 Residual	Sandy clay with lesser amounts of silty clay, silty/clayey sand and clay	0 to 29.7**
Unit 3 Weathered rock	Siltstone with lesser amounts of sandy siltstone, silty sandstone and sandstone.	6 to 29.5**

Table notes: bgs = below ground surface; * = terminated in the same material/strata, true thicknessunknown; ** = based on geotechnical boreholes.

Sub-surface conditions can be of different nature from what have been identified in the relied upon information. In such events, it is being referred to Unexpected finds. Unexpected finds can be in the form of obstruction of any type or in the form of boulders, blocks or other that could have been dumped in the outer harbor during previous dredging campaign. Such obstructions/unexpected finds have not been highlighted in relied upon information nor in the EIS and as such are not considered for the writing of Project Management Plans. In the event obstructions/unexpected finds were to be found in the inner harbor or the outer harbor, the contractor will advise the company and seek approval from the company on a suitable technical approach at a minimum cost to the company to deal with the issue.

Table 11: Expected subsurface conditions along the pipeline route*

Unit / origin	Description	Occurrence in subsurface(m bgs)
Fill	Cobbles / gravel / gravelly sand / gravelly clay / silty sand: dark grey, pale grey and brown, dark brown, black. Blue-grey soils were noted at some locations. Foreign materials: coal, coal wash, rubble, ballast, asphalt, steel fragments and slag with trace fragments of potential asbestos containing materials and other anthropogenic materials.	to 5.7
Probable alluvium	Sand / sandy clay / clayey silt / clayey sand / clay: brown, dark grey, brown-grey, pale brown and yellow, orange-brown mottled, grey, grey-black. Shell fragments and some iron staining at some locations. Organic clays, black, present at some locations between 0.6 m and 5.5 m. Sand in the east with increasing clay content in the western extents of the alignment.	to 25.4

*Subsurface conditions based on geotechnical borehole logs provided by WorleyParsons which werepresented in GHD's 2018 report (Ref: 2127477-81359).

Subsurface conditions differing from those described or encountered in areas not previously known to include such materials may constitute an unexpected find (refer to Section 1.2 for more detail) and can be managed through the implementation of an Unexpected Finds Procedure (Section 1.3).

1.2 UNEXPECTED FINDS

Unexpected finds of potential contamination on site may be identified by visual (appearance) and/or olfactory (odour/staining) observations during earthworks.

Based on previous investigation results, unexpected finds are likely to fall into two categories, non-specific and specific. Non-specific unexpected finds refer to any possible occurrence within any area of the site not investigated. The second category refers to areas of the site where, for example, contamination was identified yet the source or the extent was not confirmed.

1.2.1 NON-SPECIFIC UNEXPECTED FINDS

Based on findings of previous investigations and site history, potential 'unexpected finds' which could reasonably be possible within the site (although are unexpected) are discussed in Table 1. However, based on their very nature, it is not practical to cover all types of possible unexpected finds.

It is possible that indications of contamination not specifically covered by this procedure may be encountered. In such cases it is assumed that "if in doubt" about a potential find, the precautionary principle will be employed and the unexpected finds procedure as documented in the following section should be activated.

Some of the key contaminants of potential concern mentioned in the following table are:

- Total recoverable hydrocarbons (TRH)
- Benzene, toluene, ethylbenzene, xylene (BTEX)
- Polycyclic aromatic hydrocarbon (PAH)
- Volatile halogenated compounds (VHC)
- Asbestos
- Phenols
- Heavy metals (arsenic, cadmium, chromium, copper, nickel, lead, zinc, mercury)
- Additional contaminants of potential concern associated with Berth 101 include:
- Tributyltin (TBT)
- Dioxin
- Cyanide
- Ammonia

Table 1: Summary of Non-specific Unexpected Finds

Potential Unexpected Find	Observed Characteristic	Typical Key Contaminant of Concern	Example of an unexpected find where applicable
Buried or surface asbestos containing materials and/or buried asbestos pipes	It is often very difficult to identify the presence of asbestos by sight. The only way to be certain is to have a sample of the material analysed by a laboratory. Cement bound asbestos (fibro cement sheet) may be present in: building materials such as wall sheeting, pipes and roofing, backing of electrical switch boards, linoleum floor tiles etc.; fragments of broken building materials (often found close to the building) and building wastes. Friable forms of asbestos including lagging and insulation may be evidenced fibrous material which flakes and powders easily. Textured coatings may also contain asbestos.	Asbestos	
Buried waste materials	May include a variety of waste materials, inclusive of waste oil drums, wood, plastic, metal fragments, building rubble (e.g. concrete, brick, asphalt, asbestos containing materials). We do not consider that a trivial piece or fragment of foreign material constitutes as an unexpected find (e.g. a single brick).	TRH, BTEX, PAH, VHC asbestos, heavy metals	

Potential Unexpected Find	Observed Characteristic	Typical Key Contaminant of Concern	Example of an unexpected find where applicable
Underground storage tanks (USTs)	Considered unlikely but can be identified as follows: A buried cylindrical steel underground tank; Deeper sand fill sometimes with observed hydrocarbon odours or staining. Encountering relatively small concrete footings or steel pipelines, sometimes with observed hydrocarbon odours or staining.	TRH, BTEX, PAH, VHC, phenols, lead	
Hydrocarbon Compounds	May be identified by a hydrocarbon odour which may vary in strength from possible (just detectable) to very strong (easily detectable at a distance from the source). The odour may or may not be accompanied by specific areas of dark staining (black-grey) or larger scale discolouration of strata from a previously identified 'natural colour' e.g. staining of orange and brown clay to dark grey and green.	TRH, BTEX, PAH, lead	

Potential Unexpected Find	Observed Characteristic	Typical Key Contaminant of Concern	Example of an unexpected find where applicable
Ash or slag deposits	Ash materials typically light weight, grey and white gravel and sand sized (1 mm to 10 mm) particles (see photograph example). Slag materials can be varied in consistency and colour. Typically slags from steelmaking are pale grey to grey, however can be blue/green/grey, loose or cemented. Slag gravels can be very angular and appear to have a vesicular (i.e. 'honeycomb') shape.	PAH, heavy metals	
Other unusual odours	Solvent odour Acetone odour Alcohol odour Sulphur (rotten egg) odour (possibly associated with Acid Sulphate Soils) Acidic (Acetic/Formic/Citric) odour. Ammonia odour Caustic odour	Variable	

1.2.2 SPECIFIC UNEXPECTED FINDS

At Berth 101, localised soil contamination was identified in the form of BaP TEQ and TRH F3 (>C16-C34) near the inferred base of fill material between 4 m to 5 m bgl at two locations. The BaP (TEQ) concentrations exceeded the health based criterion whilst TRH exceeded Management Limits criterion. Further assessment of the extent of BaP TEQ hotspots and development of mitigation measures to manage potential health impacts were recommended to be undertaken during construction works. These hotspots were not visually apparent.

Asbestos was identified in the form of two fibre cement fragments at the surface of Berth 101. Based on available information, asbestos fragments would need to be managed with an Asbestos Management Plan (AMP) and removed prior to excavation activities commencing. All asbestos works will be managed by licensed asbestos removalist and in accordance with Code of Practice: How to Manage and Control Asbestos in the Workplace (Safework NSW 2019) and How to Safely Remove Asbestos (Safework NSW 2016).

Some relatively minor impacts from heavy metals and ammonia were identified in a perched fresh to brackish groundwater lens within Berth 101. The size of the lens is not well understood, however, the proposed piling and excavation works will limit the amount of perched water discharging into the marine environment, which will in any event significantly attenuate the concentrations of contaminants observed in this investigation.

The limited sampling carried out along the pipeline route did not identify soil contamination.

1.3 UNEXPECTED FINDS PROCEDURE

1.3.1 TRAINING AND INDUCTION OF PERSONNEL AND LIMITATIONS

All personnel involved in earthworks on site are to be inducted on the identification of potential unexpected finds. The induction can be undertaken at the time of general site induction and toolbox meetings.

Personnel involved in earthworks are required to have the general competencies to identify unexpected finds of contamination in the field and that this competency will be used in good faith during earthworks.

It is not possible to provide awareness induction to cover all types of possible unexpected finds. It is possible that indications of contamination not specifically covered by the induction may be encountered. In such cases it is assumed that “if in doubt” about a potential find the precautionary principal will be employed and the unexpected finds procedure documented in the following section will be duly activated.

Additionally, it is noted that some forms of potential contamination may not be associated with any visual or olfactory indications in the field. The unexpected finds procedure relies on these indicators to be activated, and as such may not be proof against all such finds.

1.3.2 PROCEDURE IN THE EVENT OF AN UNEXPECTED FIND

Should an unexpected find of potential contamination be encountered during excavation activities, the following procedure should be followed:

1. Stop work in the potentially hazardous area as soon as it is safe to do so and move to a designated meeting point.
2. Assess the potential risk to human health posed by the unexpected find and assess if evacuation or emergency services need to be contacted.
3. Delineate an exclusion/quarantine zone around the affected area using fencing and/or appropriate barriers and signage. Additional control measures are required for:
    a. Odours and/or volatile compounds: odour suppression and no smoking signage.
    b. Potential asbestos containing materials: if area is small, cover with weighted plastic sheeting or geofabric. For larger areas, regular dust suppression.
    c. If land based, stockpile material in the designated MBD Stockpile area for assessment waste classification
    d. If marine based, the find will be placed in the emplacement cell, where it can either be assessed on the emplacement cell, or transferred to emplacement Cell Stockpile area for assessment
4. Contact the appointed environmental consultant for advice and request a site visit to undertake an assessment of the unexpected find.
5. The environmental consultant will assess the unexpected find and provide advice as follows:
    a. Preliminary assessment of the contamination and need for immediate management controls (if any)
    b. What further assessment and/or remediation works are required and how such works are to be undertaken in accordance with contaminated site regulations and guidelines
    c. In the case of asbestos, adopt management protocols outlined in the AMP
    d. Provide remediation / clean up advice
    e. Remediation / clean up works where required
    f. Validation works required following remediation / clean up works (if applicable)
    g. Classification in accordance with the NSW EPA Waste Classification Guidelines Part 1: Classifying Waste 2014 (EPA Publication).
6. Works are not to recommence in the affected area until appropriate advice has been obtained from the environmental consultant and Construction Manager have provided clearance for works to recommence.
7. If it is deemed safe to do so, the environmental consultant will provide clearance for works to proceed in the affected area. If it is not considered to be safe, works must remain on hold until appropriate assessment, remediation and/or validation measures have been actioned.

1.4 OFFSITE DISPOSAL - MATERIAL CLASSIFICATION

Potentially contaminated waste and spoil identified as part of an unexpected find will be tested in-situ to determine the waste classification and need for off-site disposal.

Samples will be collected and analysed at a rate in accordance with the Vic EPA IWRG 702 (2009) as referenced in the NEPM Schedule B2, or at least three samples from any particular stockpile or type of material.

Samples will be collected in 250 mL jars and analysed to determine the classification of the material in accordance with the Waste Classification Guidelines (NSW EPA 2014). The total and leachable concentrations of each contaminant must be assessed against the criteria

1.5 QUALITY ASSURANCE /QUALITY CONTROL

Quality Assurance and Control (QA/QC) measures for waste classification sampling will comprise:

- Sample collection and observations made by a qualified Environmental Scientist or Engineer;
- Intra-laboratory at a minimum rate of 5% per batch;
- Inter laboratory blind duplicate sample collection at a minimum rate of 5% per batch;
- Appropriate sample labelling, preservation, storage and transport under chain-of-custody procedures;
- Laboratory analyses conducted within appropriate holding times;
- Use of laboratories that hold NATA accreditation for the analyses;
- Analysis of laboratory internal QA/QC samples to include, blanks, matrix spikes, matrix spike duplicates and surrogates.

The QA/QC data will be reviewed to confirm the appropriateness of the data for use in a waste classification.

Appendix D

Erosion and Sediment Control Plan

Port Kembla Gas Terminal (PKGT)

Erosion and Sediment Control Plan (ESCP)

DRAWING SCHEDULE

- 2020.01 FIG 1— Site Layout
- 2020.01 FIG 2— Site Drainage Network
- 2020.01 FIG 3— ESCP Control Devices
- 2020.01 FIG 4—Assessment of onsite Capacity
- 2020.01 FIG 5—Design Calculations and Notes

Liberty industrial are undertaking the demolition stage of works package during the Port Kembla LNG Terminal Expansion Project. The scope of works includes: removal of concrete, excavation of soil, removal of piles and Environmental Management during that time.

Concrete will be removed crushed/processed for future re-use on the project, as will stock-piles of spoil following classification. The risk of contamination on the project has been identified and a rigorous characterisation and sampling and program will be implemented to identify any such occurrences as soon as practicable and implement appropriate controls to prevent such contamination entering the marine environment.

This erosion and sediment control plan will be subject to change and amendment throughout the project as works are undertaken on the ground and more details as well as improvement opportunities are realised. Results from daily inspections undertaken at Berth 101 and from the water will provide valid qualitative data to record in weekly and monthly reports, and drive improvements in subsequent versions of this ESCP.

Site Layout

- Traffic routes will be maintained as hardstand
- The existing site drainage network (shown in Figure 2, shall be maintained and existing water bodies capacity shall also be maintained
- A Silt Curtain will be installed to prevent migration of sediments into the Harbour
- A Water Treatment Plant will be installed as an additional layer of contingency to prevent overflow from the sedi-ment basin into the harbour
-

Legend

- Existing and to be retained Water Bodies
- Disturbed/Stockpile Areas
- Flow lines
- Flow Channels/Bunds
- Site Boundary
- Entrance/Exit Gates
- Silt Curtain Alignment
- Spill Kit Location (indicative)
- Water relocation pipelines
- Water Treatment Plant

	/ /	
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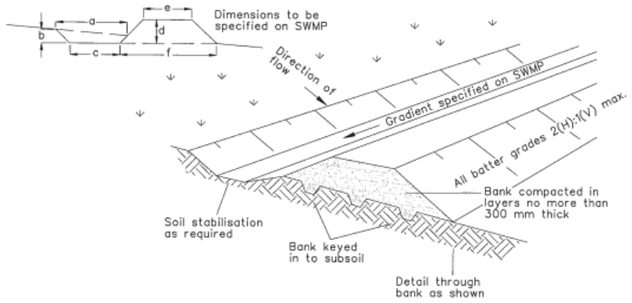
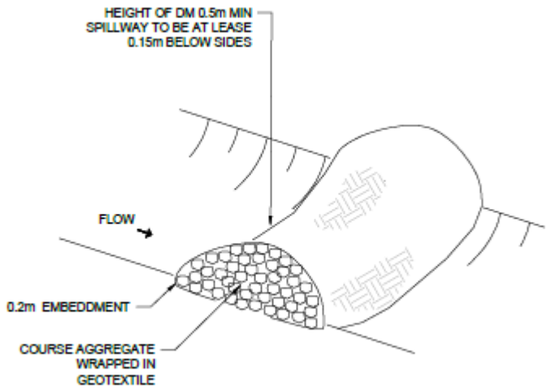
No. Re-visions	Approved	Date

LIBERTY INDUSTRIAL

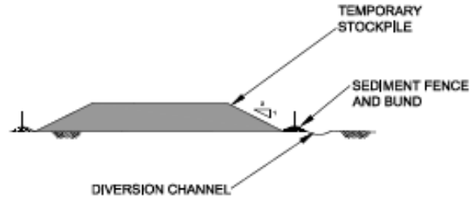
Drawn	John Stevanoni	**PKGT-ESCP**	
Designed	John Stevanoni		
Draft Check	Tom Anderson	**2020.01 FIG 1—Site Layout**	
Design Check		Rev: **02**	
Approved		A3	Scale:

Earth Bank (High Flow)

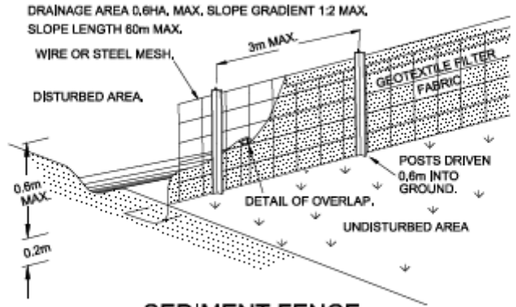




ROCK CHECK DAM

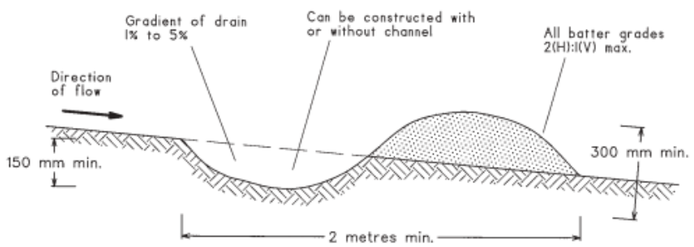


TYPICAL STOCKPILE

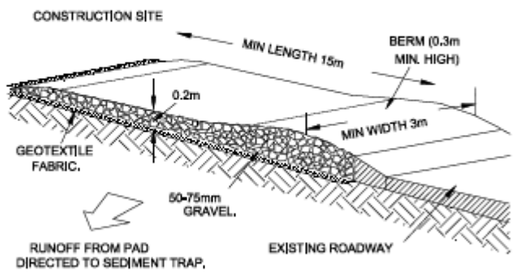


SEDIMENT FENCE

Earth Bank (Low Flow)



NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.



TEMPORARY CONSTRUCTION EXIT

Erosion and Sediment Control Devices

- Where applicable a variety of localized sediment control devices will be used as shown adjacent but not limited to these)
- The installation of these devices as will be as per the 'Blue book' design drawings and following a risk assessment (JHSEA)
- Silt socks + fabric to be installed around drainage grates with geofabric under the drains where required.
- Dust Control Polymers to be applied to Stockpiles once sealed to prevent generation.
-

			Copyright "This document is and shall remain the property of Liberty Industrial Pty Ltd. The document may only be used for the purpose for which it was commissioned and in accordance with the terms of engagement for the commission. Unauthorised use of the document in any way is prohibited."©	LIBERTY INDUSTRIAL	Drawn	John Stevanoni	**PKGT-ESCP**
		/ /			Designed	John Stevanoni	
		/ /			Draft Check	Tom Anderson	**2020.01 FIG 3—ESCP Devices**
		/ /			Design Check		Rev: **01**
No. Revisions	Approved	Date			Approved		A3 Scale: **NOT TO SCALE**

Major Basin Capacity Calculation			
Number	Area (m^2)	Depth (m)	Volume (m^3)
SB1	3649.75	1.8	6,568.2
Total=			6,568.2
85th Percentile 5 Day Required Capacity (Freeboard)=			5,655.0

Assessment of Onsite Capacity

- The Major Basin capacity was investigated using near maps
- Assessment using a conservative approach found adequate and excess storage onsite based on 85th percentile 5 day rainfall data, and was found to be adequate figure 5. *Settling Depth of 1.5 m will be maintained
- Water Treatment Plant (WTP) will be located at close proximity to the sediment basin and available to be used in the

Water Treatment Plant

- To satisfy conditions within the EPL referring to prevention of pollution to the environment— Liberty Industrial have commissioned a water treatment plant that has the capacity to the treat at 10 L/s making a total volume pf treated water in a day 400 m3 for 10 hours of operation. And 900 m3 for 24 hour operation (if required)
- The catchment area of the site directs rainfall almost entirely to the large sediment basin in the southern corner of the site. In a significant rain event there is potential for the sediment basin to overflow. In order to mitigate this risk Liberty have procured and commissioned a Water Treatment Plant (WTP). The WTP will remove solids and balance pH prior to discharge to the environment. These parameters are in line with the WQMP.
- Representative sampling of the current pre-works water quality has been conducted which showed exceedances in the EPL suspended soils criteria (50 mg/L) however no other potential COCs were encountered at levels which would case pollution. Monitoring of water quality as such will be conducted real time (Turbidity for TSS which correlates to <100 NTU) and sampled for contaminants which require required reporting as part of the EPL. As site conditions change further characterization sampling may be conducted

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No. Revisions	Approved	Date

LIBERTY INDUSTRIAL

Drawn	John Stevanoni	PKGT-ESCP	
Designed	John Stevanoni		
Draft Check	Tom Anderson	2020.01 FIG 4—Assessment of Onsite Capacity	
Design Check		Rev: 01	
Approved		A3	Scale: NOT TO SCALE

Water Treatment Plant (WTP)

Liberty industrial are undertaking the demolition stage of works package during the Port Kembla LNG Terminal Expansion Project. The scope of works includes: removal of concrete, excavation/management of spoil, removal of piles and Environmental Management during that time.

Concrete will be removed crushed/processed for future re-use on the project, as will stockpiles of spoil following classification. The risk of contamination on the project has been identified and a rigorous characterisation and sampling and program will be implemented to identify any such occurrences as soon as practicable and implement appropriate controls to prevent such contamination entering the marine environment.

This erosion and sediment control plan will be subject to change and amendment throughout the project as works are undertaken on the ground and more details as well as improvement opportunities are realised. Results from daily inspections undertaken at Berth 101 and from the water will provide valid qualitative data to record in weekly and monthly reports, and drive improvements in subsequent versions of this ESCP.

Water Treatment Plant Operations Protocol

- The catchment area of the site directs rainfall almost entirely to the large sediment basin in the southern corner of the site. In a significant rain event there is potential for the sediment basin to overflow. In order to mitigate this risk Liberty have procured and commissioned a Water Treatment Plant (WTP). The WTP will remove solids and balance pH prior to discharge to the environment. These parameters are in line with the WQMP.
- In the event of an imminent significant rain event The WTP may be turned on precautionarily to prevent any overflow the basin and subsequent overflow into the harbour / marine environment. This is in compliance with the project specific EPL.
- Successfully treated water can be discharged directly to the environment.
- Due diligence sampling for known contaminants on the site will be undertaken at 3 week intervals and included in monthly reports
-

Site area	Sub-catchment or Name of Structure	Notes
Total catchment area (ha)	13	Total Site Area
Disturbed catchment area (ha)	13	Conservative Estimate

Soil analysis (enter sediment type if known, or laboratory particle size data)

Sediment Type (C, F or D) if known:		From Appendix C (if known)
% sand (fraction 0.02 to 2.00 mm)	80	Enter the percentage of each soil fraction. E.g. enter 10 for 10%
% silt (fraction 0.002 to 0.02 mm)	10	
% clay (fraction finer than 0.002 mm)	8	
Dispersion percentage	2.0	E.g. enter 10 for dispersion of 10%
% of whole soil dispersible	0.26	See Section 6.3.3(e). Auto-calculated

Rainfall data

Design rainfall depth (no of days)	5	See Section 6.3.4 and, particularly, Table 6.3 on pages 6-24 and 6-25.
Design rainfall depth (percentile)	85	
x-day, y-percentile rainfall event (mm)	43.5	
Rainfall R-factor (if known)	5000	Only need to enter one or the other here
IFD: 2-year, 6-hour storm (if known)		

RUSLE Factors

Rainfall erosivity (*R-factor)*	5000	Auto-filled from above
Soil erodibility (*K-factor)*	0.048	RUSLE LS factor calculated for a high rill/interrill ratio.
Slope length (m)	100	
Slope gradient (%)	5	
Length/gradient (*LS-factor)*	1.35	
Erosion control practice (*P-factor)*	1.3	
Ground cover (*C-factor)*	1	

Sediment Basin Design Criteria (for Type D/F basins only. Leave blank for Type C basins)

Storage (soil) zone design (no of months)	2	Minimum is generally 2 months
Cv (Volumetric runoff coefficient)	1	See Table F2, page F-4 in Appendix F

Calculations and Type D/F Sediment Basin Volumes

Soil loss (t/ha/yr)	421	
Soil Loss Class	4	See Table 4.2, page 4-13
Soil loss (m^3/ha/yr)	324	Conversion to cubic metres
Sediment basin storage (soil) volume (m^3)	701	See Sections 6.3.4(i) for calculations
Sediment basin settling (water) volume (m^3)	5655	See Sections 6.3.4(i) for calculations
Sediment basin total volume (m^3)	6356	

SOIL EROSION AND SEDIMENT CONTROL

1. THESE PLANS SHALL BE USED AS A GUIDE. ALL EROSION AND SEDIMENT CONTROLS

SHALL BE IN ACCORDANCE WITH

a. THE PROJECT APPROVALS

b. THE 'BLUE BOOK' LANDCOM 2004, 4th EDITION.

2. ALL SEDIMENT AND EROSION CONTROLS SHALL BE CHECKED BEFORE AND AFTER RAINFALL EVENTS OR MONTHLY DURING DRY PERIODS (WHICHEVER OCCURS FIRST.) SEDIMENT BUILD UP TO BE REMOVED AND CONTROLS REPAIRED WHERE NECESSARY.

3. SOIL AND SEDIMENT CONTROL DEVICES SHALL BE TO THE STANDARD RECOMMENDED BY THE NSW DEPARTMENT OF HOUSINGS 'BLUE BOOK' TITLED "MANAGING URBAN STORMWATER AND CONSTRUCTION – VOLUME 1", 4TH EDITION 2004.

4. THE CONTRACTOR SHALL REGULARLY MAINTAIN ALL SEDIMENT AND EROSION CONTROL DEVICES AND REMOVE ACCUMULATED SEDIMENT FROM SUCH DEVICES BEFORE 50% CAPACITY IS USED. ALL THE ACCUMULATED SEDIMENT SHALL BE RE-SPREAD OR REMOVED IN ACCORDANCE WITH THE SUPERINTENDENTS INSTRUCTIONS. THE DEVICES SHALL BE MAINTAINED BY THE CONTRACTOR UNTIL SUCH TIME AS THE DISTURBED AREAS HAVE BEEN REHABILITATED TO A CONDITION SATISFACTORY TO THE SUPERINTENDENT.

5. THE CONTRACTOR SHALL MAINTAIN ALL RE-VEGETATED AREAS INCLUDING WATERING AND FERTILISING UNTIL SUCH TIME AS THE VEGETATION HAS STABILIZED (MINIMUM TIME IS AT LEAST UNTIL THE END OF THE WORKS).

6. THE CONTRACTOR SHALL ENSURE TEMPORARY CONTROLS DO NOT DAMAGE EXISTING STRUCTURES, KERBING, PAVEMENT OR SUBGRADES.

7. VEHICULAR ACCESS TO THE SITE SHALL BE CONTROLLED THROUGH THE ACCESS POINTS IDENTIFIED. VEHICLES NOT REQUIRED IN THE PERFORMANCE OF THE WORKS SHALL BE PARKED OFF SITE AWAY FROM DISTURBED AREAS.

8.ALL EROSION AND SEDIMENT CONTROL MEASURES TO BE INSTALLED PRIOR TO SITE DISTURBANCE TO THE EXTENT THAT THIS CAN BE PRACTICALLY ACHIEVED.

9. PUBLIC ROADS ARE TO BE SWEPT FREE OF DEBRIS RESULTING FROM CONSTRUCTION ACTIVITIES. SWEEPING SHALL BE UNDERTAKEN AT A MINIMUM TWICE MONTHLY.

10. THE CONTRACTOR SHALL TAKE CARE NOT TO DISTURB ANY PORTION OF THE SITE OTHER THAN IN THE IMMEDIATE AREA OF WORKS. NOMINATED UNDISTURBED AREAS SHALL BE BARRICADED PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.

11. DRAINAGE INLET PROTECTION TO BE PROVIDED FROM THE COMMENCEMENT OF THE EXCAVATION.

12. THE CONTRACTOR SHALL ENSURE EROSION AND SEDIMENT CONTROL DEVICES SHALL NOT AFFECT THE OPERATIONS WITHIN THE SITE.

13. NO DISTURBED AREA SHALL REMAIN DENUDED FOR A PERIOD LONGER THAN 20 DAYS.

14. THE CONTRACTOR MUST ENSURE THE SUITABILITY AND INTEGRITY OF ALL WORKS AT THE END OF EACH DAYS WORK.

15. ALL REASONABLE AND PRACTICABLE MEASURES MUST BE TAKEN TO ENSURE STORMWATER RUNOFF FROM ACCESS ROADS AND STABILIZED ENTRY/EXIT SYSTEMS, DRAINS TO AN APPROPRIATE SEDIMENT CONTROL DEVICE.

16. SEDIMENT DEPOSITED OFF SITE AS A RESULT OF ON-SITE ACTIVITIES MUST BE COLLECTED AND THE AREA CLEANED/REHABILITATED AS SOON AS REASONABLE AND PRACTICABLE.

17. CONCRETE WASTE AND CHEMICAL PRODUCTS, INCLUDING PETROLEUM AND OIL-BASED PRODUCTS, MUST BE PREVENTED FROM ENTERING ANY INTERNAL OR EXTERNAL WATER BODY, OR ANY EXTERNAL DRAINAGE SYSTEM, EXCLUDING THOSE ONSITE WATER BODIES SPECIFICALLY DESIGNED TO CONTAIN AND/OR TREAT SUCH MATERIAL. APPROPRIATE MEASURES MUST BE INSTALLED TO TRAP THESE MATERIALS ONSITE.

18. STOCKPILES OF ERODIBLE MATERIAL MUST BE PROVIDED WITH AN APPROPRIATE PROTECTIVE COVER (SYNTHETIC, ORGANIC OR POLYMER APPLICATION) IF THE MATERIALS ARE LIKELY TO BE STOCKPILED FOR MORE THAN 10 DAYS. ALL STOCKPILES SHALL BE REGULARLY MONITORED FOR EROSION AND WEEDS WITH APPROPRIATE CONTROLS IMPLEMENTED WHEN REQUIRED.

19. MEASURES USED MUST BE APPROPRIATE FOR ALL WORKING HOURS, OUT OF HOURS, WEEKENDS, PUBLIC HOLIDAYS, AND DURING ANY OTHER SHUTDOWN PERIODS.

20. ALL MATERIALS REMOVED FROM EROSION AND SEDIMENT CONTROL DEVICES DURING MAINTENANCE, OR DECOMMISSIONING, WHETHER SOLID OR LIQUID, MUST BE DISPOSED OF IN A MANNER THAT DOES NOT CAUSE ANY ONGOING EROSION OR POLLUTION HAZARD.

No. Revisions	Approved	Date
		/ /
		/ /
		/ /

LIBERTY INDUSTRIAL

Drawn	John Stevanoni	**PKGT-ESCP**	
Designed	John Stevanoni		
Draft Check	Tom Anderson	**2020.01 FIG 5—Design Calculation and Notes**	
Design Check		Rev: **01**	
Approved		A3	Scale: **NOT TO SCALE**

Appendix E

Incident Notification and Response Flow Chart

Port Kembla Gas Terminal (PKGT) Project
Incident Notification & Response Flow Chart

Stakeholder, Community or Landowner(s) identify an issue

Incident occurs on site

Call Placed to Toll Free Project Contact Number : 1800 810 860

Notification made to Forman or Construction Manager

Call Emergency Services immediately if the incident requires their response

Undertake any immediate actions to control or manage the incident if safe to do so

Notify Contractor Project Manager

Environmental Manager notified and generates an incident notification report. If required, they will mobilise to the location to conduct an inspection and direct further rectification

AIE are notified of the incident type, location and any measures taken to control or manage it

The Department to be notified in writing to compliance@planning.nsw.gov.au immediately after the Proponent becomes aware of an incident on site. The notification must identify the development, including the application number, and set out the location and nature of the incident.

Incident investigation completed and report compiled with corrective or preventive actions identified

Incident Investigation report prepared and submitted to AIE

Incident Investigation report is provided to relevant Authority

Corrective & preventive actions implemented on site, completed actions logged in monthly reporting

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