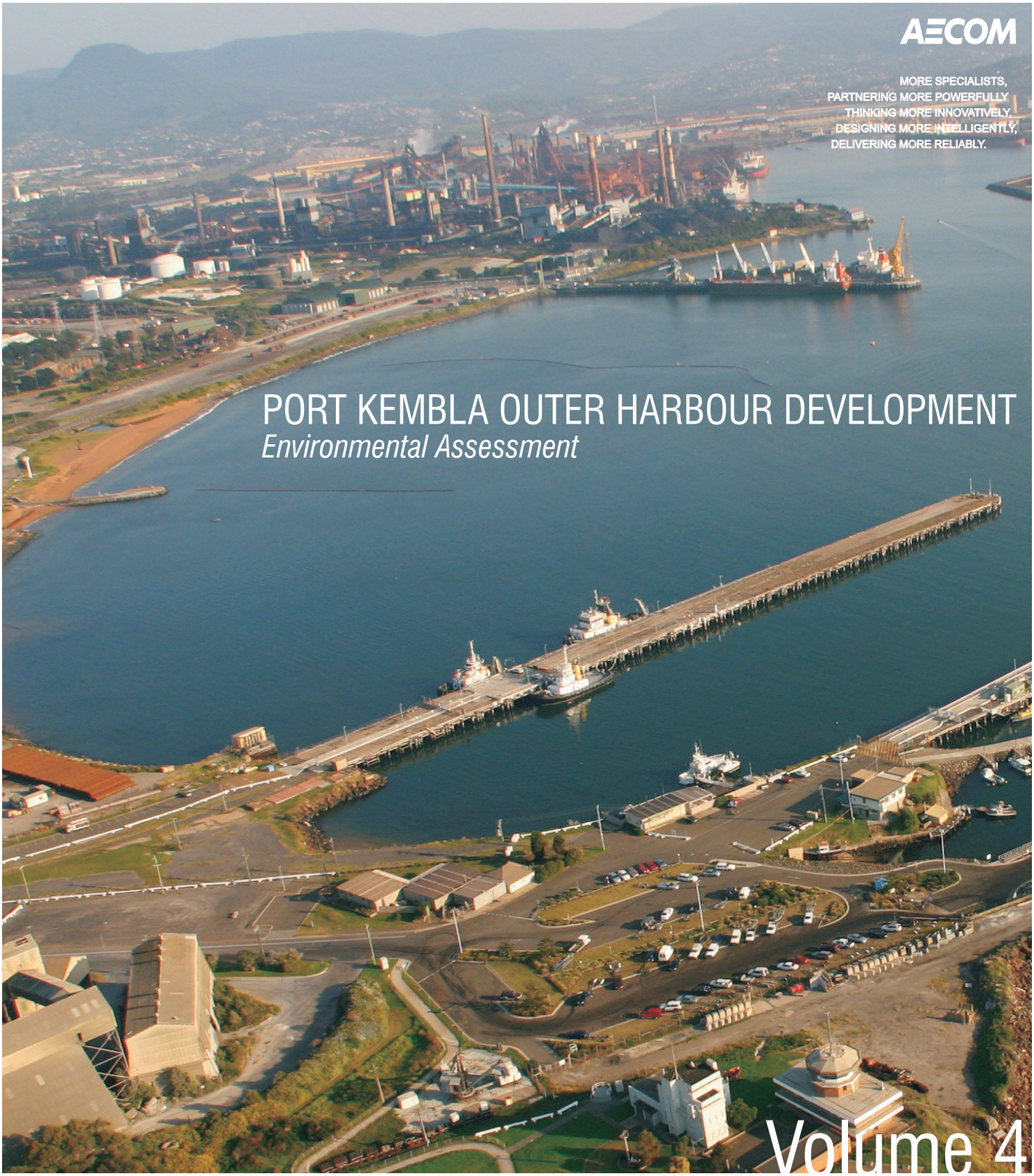


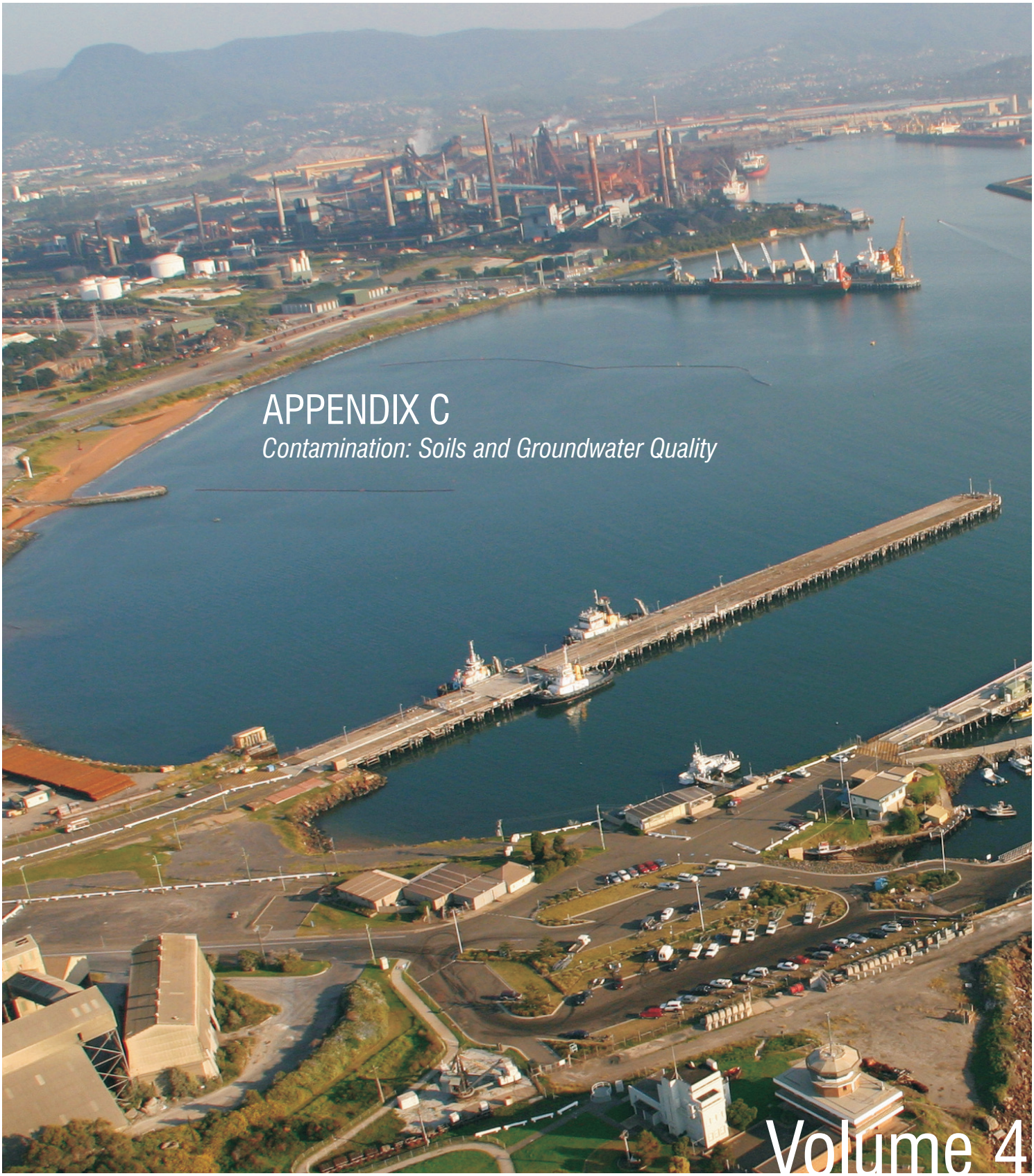
PORT KEMBLA OUTER HARBOUR DEVELOPMENT

Appendix C: Contamination: Soils and Groundwater Quality
Appendix D: Qualitative Human Health and Ecological Risk Assessment: InSitu Sediment and Groundwater Contamination

Prepared for
Port Kembla Port Corporation

March 2010

PORT KEMBLA
PORT CORPORATION



APPENDIX C

Contamination: Soils and Groundwater Quality

Volume 4

FINAL

Sediment Investigation
Port Kembla Port Corporation
5 March 2010

AECOM

Land Based Investigation

Port Kembla Port Corporation

Distribution

Land Based Investigation
Port Kembla Port Corporation

5 March 2010

Copies	Recipient
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1 Electronic Copy	**Greg Newman** **Senior Regional Operations Officer** **NSW Department of Environment and Climate Change** Level 3, 84 Crown Street Wollongong NSW 2520
1 Electronic Copy	**Deborah Bowden** **Principal Environmental Scientist** **AECOM** Level 8, 17 York Street Sydney, NSW 2000

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By
AECOM Australia Pty Ltd
ABN: 20 093 846 925
Level 5, 828 Pacific Highway Gordon NSW 2072
PO Box 726 Pymble NSW 2073
Ph: +61 2 8484 8999 Fax: +61 2 8484 8989

Kate Pigram

Kate Pigram
Environmental Scientist

Kate O'Brien
Project Environmental Scientist

Technical Peer Reviewer: **Date:**

8/03/10

Andrew Rolfe
Senior Environmental Scientist

Michael Jones
Principal Engineer

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Glossary of Terms

General Terms	
ACM	Asbestos containing material(s)
ANZECC	Australian and New Zealand Environment and Conservation Council
AHD	Australian Height Datum
ASS	Acid Sulfate Soil
BaP	Benzo(a)pyrene (a PAH compound)
BTEX	Benzene, toluene, ethylbenzene and xylenes
DEC	NSW Department of Environment and Conservation
DECC	NSW Department of Environment and Climate Change
DECCW	NSW Department of Environment, Climate Change and Water
DQOs	Data Quality Objectives
DQIs	Data Quality Indicators
EPA	New South Wales Environment Protection Authority
EMP	Environmental Management Plan
EQL	Estimated Quantification Limit
HASP	Health and Safety Plan
HRA	Health Risk Assessment
Heavy metals	Generally, arsenic (a metalloid), cadmium, chromium, copper, mercury, nickel, lead and zinc
M bgs	Metres below ground surface
M btoc	Metres below top of casing
NEHF	National Environmental Health Forum
NEPC	National Environment Protect Council
NEPM	National Environmental Protection Measure
NSW EPA	New South Wales Environment Protection Authority
OCPs	Organochlorine pesticides
OH&S	Occupational Health & Safety
OPPs	Organophosphorus pesticides
PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated biphenyls
PID	Photoionisation detector
PQL	Practical quantitation level (or limit)
PSH	Phase Separated Hydrocarbon
QA/QC	Quality Assurance/Quality Control
RAP	Remedial Action Plan
RPD	Relative Percent Difference

General Terms	
SAQP	Sampling, Analytical ad Quality Plan
SMP	Soil or Site Management Plan
SVOC	Semi-volatile Organic Compound
SWL	Standing Water level
TPH	Total petroleum hydrocarbons
UCL	Upper Confidence Limit (on mean)
USEPA	United States Environment Protection Agency
VOC	Volatile Organic Compound
AES	Atomic emission spectrometry
CV-AAS	Cold vapour atomic absorption spectrometry
GC/ECD	Gas chromatography/electron capture detector
GC/FID	Gas chromatography/flame ionisation detector
GC/NPD	Gas chromatography/nitrogen/phosphorus detector
CG/MS	Gas chromatography/mass spectrometry
GC/PID	Gas chromatography/photoionisation detector
ICP	Inductively coupled plasma
OES	Optical emission spectrometry
P&T	Purge and trap

Units				
ha	hectare		µg/kg	micrograms/kilogram
km	kilometre		µg/L	micrograms/litre
m	metre		ppb	parts per billion
mg/kg	milligrams/kilogram		ppm	parts per million
mg/L	milligrams/litre		t	tonne

Executive Summary

Introduction

AECOM Australia Pty Ltd (AECOM) was commissioned by Port Kembla Outer Harbour Development (PKPC) to undertake a Land Based Investigation (LBI) within the western New Road Link Corridor (the Site), from Christy Drive to the multi-purpose terminal, proposed as part of the Port Kembla Outer Harbour development, Port Kembla NSW. Other land to be used for the proposed port development will include an eastern New Road Link Corridor to the Container Terminal (off Foreshore Road) and an extension of the railway sidings at the Pacific National South Yard (refer to **Figure F2**) and the new road link from Darcy Road. These sites were not assessed as part of this LBI.

Objectives

The objective of this LBI is to respond to the following contamination management requirements issued by the NSW Department of Environment, Climate Change and Water (DECCW[1], dated 19 December 2008 and clarified at the meeting of 17 July 2009) in relation to the proposed redevelopment:

- Delineate soil and groundwater contamination in the proposed land based excavation area (specifically the materials that it is anticipated will be disturbed by the proposed new road link); and
- Delineation of contaminants in groundwater (noting that harbour water quality will be addressed separately as part of the Sediment Investigation Report, (AECOM 2009a).

Scope of Works

To achieve the objective, the following scope of works was undertaken:

- Review of historical environmental investigation reports relating to the Site;
- Completion of a limited intrusive soil sampling and analysis program to supplement previous investigations and targeted on the materials that will be disturbed by the proposed road construction; and
- Preparation of this report.

Site History Summary

Based on a review of previous environmental investigations and available anecdotal information, the Site appears to have been historically used since 1 September 1900 when it was resumed by the Public Works Department. An electricity power station was constructed immediately west of the Site and the land was transferred to the Electricity Commission of New South Wales when it was formed in 1950 under an Act of Parliament which brought all power stations under one jurisdiction. The power station was subsequently decommissioned and demolished and the Site was acquired by the Maritime Services Board on 18 November 1986.

Conclusions

The Site has been assessed in general accordance with the guidelines endorsed by the DECCW. The key findings of this LBI are summarised as follows:

Soil Contamination

- Fill materials containing some (<20%) anthropogenic inclusions of ash, gravels, glass and slag were encountered across the Site to the maximum investigation depth of 1.5 m bgs which is also expected to be the maximum depth of excavation required by the proposed link road construction and utility infrastructure;
- COPC in all samples were less than the adopted site assessment criteria with the exception of:
  - An elevated copper concentration (12 900 mg/kg relative to the SAC of 5 000 mg/kg) reported in one sample from borehole BH08 at 0.2-0.3 m bgs (collected from dark brown and black sand and coarse gravel fill with ash); and

[1] Previously known as the NSW Department of Environment, Climate Change and Water.

  - Chrysotile asbestos fibres were identified in one sample from borehole BH10 from 0.5 -0.6 m bgs (collected from dark brown and black sand and coarse gravel fill with ash).

- If disposed of to an off-site landfill, the fill materials (including 'hotspots') encountered by the investigation (excepting those containing asbestos) would likely be classified as '*General Solid Waste'* in accordance with NSW DECC (2008) Waste Classification Guidelines;
- Historic environmental assessment results, together with anecdotal evidence associated with fill materials in industrial precincts including at Port Kembla, suggest that there is a high risk of isolated 'hotspots' of contamination being identified during the course of excavation activities within fill material across the Site. Potential impacts associated with these identified hotspots include:
  - Mobilisation of contaminated soils from excavation works and the movement of construction vehicles which could result in the generation of new hot spots.
  - Mobilisation of contaminants into surface water bodies which could ultimately impact the receiving waters of Darcy Road Drain, Salty Creek and the Outer Harbour.

  These hotspot areas can be managed with the preparation and implementation of a Construction Environmental Management Plan.
- The greatest potential for contaminated soil mobilisation would likely occur during excavation and construction activities associated with the new road link from Christy Drive to the multi-purpose terminal.
- Disturbance of fill materials would be controlled by a Site Management Plan (SMP) as part of relevant CEMPs for the project. The SMP would establish a suitable management framework for excavation works, which would include identifying contamination hotspots based on visual and odour observations and through detailed soil sampling analysis, if required. Appropriate management of contamination 'hotspots' could include selective excavation, stockpiling, characterisation and disposal (either within the reclamation area or to an offsite soil remediation facility).
- Construction workers who may come into contact with material that is suspected of being contaminated would employ appropriate hygiene procedures and wear proper personal protective equipment to minimise the risk of human health impact through accidental ingestion, inhalation and dermal exposure pathways.
- Due to the proposed likely depth of excavations (approximately 1.5 m bgs), acid sulphate soils are not likely to be excavated during the proposed road construction works and, consequently, these materials will not require management.
- The fill materials encountered by the investigation are generally considered suitable for re-use as part of the proposed new road link development (ie. commercial / industrial land use) with the exception of: (a) a hotspot of copper contamination located at 0.2 to 0.3 m bgs in borehole BH08; (b) a hotspot of asbestos fibres detected at 0.5-0.6 m bgs at BH10; and (c) other contamination 'hotspots' that might be encountered during the development works. These hotspot areas can be managed with the preparation and implementation of a Construction Environmental Management Plan.
- Based on available information, it appears that no site investigations have been conducted on the proposed site for the extension of the railway siding at the Pacific National South Yard. However there is low potential for identifying contaminants other than those typically found within rail corridors and such contaminants can be easily managed during construction and are unlikely to result in significant environmental risk.

Groundwater Contamination

- The Douglas Partner (2009) investigation concluded that the depth to groundwater in the area of the proposed western New Road Link Corridor ranged between 4.26 and 4.3 m bgs while groundwater in the area of the proposed eastern New Road Link Corridor leading to the Container Terminal ranged between 2.6 and 2.65 m bgl. Consequently, any excavations to a depth of less than or equal to 1.5 m bgs are not likely to encounter groundwater. Therefore, management of groundwater is not expected to be required as part of the land based redevelopment works;
- Historical groundwater results indicate heavy metal (specifically arsenic, copper, zinc, lead, cadmium and nickel) contamination exceeding the adopted groundwater assessment criteria have been reported within the vicinity of the Site and the surrounding Outer Harbour foreshore area, with the highest historical concentrations identified between the Darcy Road Drain and the No. 3 Jetty. Consequently, groundwater contamination in the vicinity of the Site is considered to be a regional issue that is not specific to the Site.
- PAH, PCB and OCP groundwater contamination exceeding the adopted groundwater assessment criteria have not been historically identified within groundwater, although there is potential for PAH and PCB impact due to contamination identified within fill and natural soils.

- TPH and BTEX contamination has not been historically identified in groundwater but there is potential for groundwater impact due to several known TPH impacted fill and natural soils identified in historical investigations.
- The proposed reclamation area in the Outer Harbour has the potential to impact on the groundwater flow regime in this area, particularly if the reclamation area was of a significantly different hydraulic conductivity to the naturally permeable soil profile of the Outer Harbour shoreline. It would be important to ensure that the reclamation would be designed to ensure the existing groundwater flow regimes are not significantly altered and that there is no increased risk of harm associated with the groundwater contamination.

Imported Fill Material

PKPC has made application to DECCW for a Specific Resource Recovery Exemption under the POEO (Waste) Regulations 2005 to utilise blast furnace slag from the Mount Prosser stockpile area in Port Kembla for reclamation purposes as part of the Outer Harbour development. This stockpile area contains approximately 1.5 Mt and is located in relatively close proximity to the Outer Harbour. The stockpile was generated by Australian Steel Mill Services (ASMS) as a by product of the iron making process during separation of the molten iron from impurities in iron making blast furnaces.

The blast furnace slag is generally inert material which is similar in composition to basalt. Samples of the material contained in the Mount Prosser stockpile area has been tested and certified by a NATA accredited laboratory. Similar material has already been approved for use in reclamation areas within parts of the Inner Harbour.

At this stage PKPC have received draft approval from DECCW for the Specific Resource Recovery Exemption application for blast furnace slag. PKPC will be required to address any specific requirements contained in the approval.

At the 17 June 2009 meeting with DECCW it was noted that slag often has contamination concerns (for example ammonia and tar) as a result of other waste streams being disposed of with the “clean” slag. Construction methods for the proposed development will therefore need to include protocols for verifying that other waste streams were not being disposed of in the reclamation area with the slag. PKPC has been proactive on this matter and is proposing to implement Quality Assurance controls to ensure that the fill material would be suitable for reclamation purposes which would include visual screening of all slag material imported to site and associated waste tracking measures which would include:

- Weighing of all vehicles on a calibrated weighbridge at source before they leave the ASMS with a weighbridge docket being issued for each vehicle leaving the site. The docket will detail truck registration number, time, date, material code and the intended destination of the material. This information will be stored on a database by ASMS;
- PKPC will keep copies of all weighbridge dockets and will visually screen the material for the presence of foreign or suspect materials; and
- The slag recieval site will be secured by fencing and gates will be locked at night to prevent illegal dumping of waste at night.

In addition to the Specific Resource Recovery Exemption for the blast furnace slag from Mount Prosser, PKPC has applied for a Specific Resource Recovery Exemption under the POEO (Waste) Regulations 2005 to utilise coal wash sourced from Illawarra Coal. At this stage the Specific Resource Recovery Exemption application for coal wash is under consideration by DECCW but has not yet been approved.

Other fill reclamation material (the source of which is currently unknown), that will need to be imported to the Site will be required to: (a) meet the NEPM Health Based Investigation Levels (HIL F) for commercial/industrial land use; and, (b) have contaminant leachability that is protective of receiving water bodies. Alternatively, an additional source recovery exemption application(s) will be required and the relevant conditions of the exemption met.

Concept Plan

The results of historic investigations in the area of the eastern New Road Link Corridor to the Container Terminal and to the multi-purpose terminal (both off Foreshore Road) indicates that similar soil contamination issues are likely to be present in this area as those encountered at the Site during this LBI; and

The greatest potential for contaminated soil mobilisation would likely occur during excavation and construction activities associated with the new road and rail links during Stage 2 and 3 of the Concept Plan in the following areas:

- from Foreshore Road to both the container terminals and multi-purpose terminals.

- from Darcy Road to the boat harbour carpark.

Based on the findings of this LBI, it is considered that potentially impacted material excavated during development works in the above areas can be managed either through further investigation as part of project applications in the future and/or with the preparation and implementation of a Construction Environmental Management Plan.

Recommendations

Based on the findings of this LBI, AECOM recommends that:

- Disturbance of fill materials within the site as part of the development works be controlled by a Construction Environmental Management Plan to manage any excavation works and to facilitate:
  - Identification of contamination 'hotspots' based on visual and odour observations and soil sample analysis, if required. Where hotspots are identified, excavation works should be supervised by an appropriately experienced environmental scientist or engineer; and
  - Appropriate management of contamination including selective excavation (to minimise quantities), stockpiling, characterisation and disposal – likely to an off-site licensed landfill assuming that the material is not suitable for inclusion within the reclamation area.
- Background groundwater monitoring should be conducted at the Site prior the Stage 1 works and annually thereafter. The monitoring program should include analysis of samples for the COPC identified in this report.
- It is recommended the reclamation area be designed to ensure the existing groundwater flow regimes are not significantly altered and that there is no increased risk of harm associated with the groundwater contamination.
- A Limited Phase 2 Environmental Site Investigation be undertaken at the proposed site for the extension of the railway siding at the Pacific National South Yard to assess potential contamination issues in this area. Assuming that the additional Phase 2 Environmental Site Investigation demonstrates that the railway siding has similar contaminant characteristics to those identified at the Site, it is likely that the contamination could be managed with the preparation of a Construction Environmental Management Plan as detailed above.

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) was commissioned by Port Kembla Outer Harbour Development (PKPC) to undertake a Land Based Investigation within the western New Road Link Corridor (the Site), from Christy Drive to the multi-purpose terminal, proposed as part of the Port Kembla Outer Harbour Redevelopment, Port Kembla NSW.

Other land to be used for the proposed port development will include:

- an eastern New Road Link Corridor to the Container Terminal located to the east of the Site (off Foreshore Road);
- a new road link between Darcy Road and the boat harbour car park; and
- an extension of the railway sidings at the Pacific National South Yard southwest of the Site (refer to **Figure F2**).

These sites were not specifically assessed as part of this LBI.

The Concept Plan for the proposed Outer Harbour development is to develop the Outer Harbour in discrete stages reflecting market demand. Once completed the development would comprise dredging, reclamation of the land, construction and operation of a multi-purpose terminal and associated berthing facilities, construction and operation of container terminals and associated berthing facilities, landward pavement to extend to the rail siding west of the Outer Harbour and to Foreshore Road in the south, roads and rail infrastructure to service the port terminal facilities.

Concurrent approval for the Concept Plan and Major Project is being sought for the development of the Outer Harbour.

1.1 Concept Plan

The Outer Harbour development is to be constructed in three discrete stages over the next 30 years with an anticipated completion date of 2037. Concept Plan approval is being sought for the total development. Construction of the Concept Plan would be staged to meet the needs of prospective customers, to cater for growing port needs and regional development, and to increase the potential to address the needs of new industry for 30 plus years into the future.

The Concept Plan provides a framework for the progressive completion of the Outer Harbour development and comprises creation of land dedicated to port activity. The reclaimed land would be divided into two main areas, one devoted to the import and export of dry bulk, break bulk and bulk liquid cargoes (multi-purpose terminals) and one devoted to container trade (container terminals).

Once the Concept Plan is completed, the reclamation footprint of the development would extend from the existing Port Kembla Gateway jetty in the north to Foreshore Road in the south, the boat harbour to the east and existing rail sidings to the west.

Physical features of the Concept Plan include the following:

- At least 42 hectares of hard stand, to accommodate new multi-purpose terminals and new container terminals
- Dredging would be completed over a series of dredging campaigns for:
  - Berth boxes and basins between multi-purpose terminals and container terminals;
  - Basins east of the container terminals; and
  - Container berth boxes and approach channels.
- 1770 metres total new berth length.
- A total of seven new berths, including:
  - Four container berths with a total length of 1,150 metres;
  - Two multi-purpose berths designed to handle dry bulk, break bulk and bulk liquid with a total berth length of 620m; and
  - A multi-purpose berth at the site of the existing No. 6 Jetty.
- Retention of the existing oil berth on the northern breakwater of the Outer Harbour.

- Berthing basins and approaches with up to -16.5 metres water depth below Port Kembla Harbour Datum for new berths.
- Road and rail infrastructure to support the expansion, including:
  - New road link from Christy Drive to the multi-purpose and container terminals;
  - Rail infrastructure upgrade in the South Yard;
  - A new road link connecting Darcy Road; and
  - An extension of existing sidings to connect to a rail siding on the container terminals.

PKPC is seeking Concept Plan approval for the total development of the Outer Harbour with the understanding that separate Major Project applications would be made for approval to construct and operate facilities on the site. PKPC would construct the reclamation, road and rail infrastructure and basic services for the site as a whole. Development of specific facilities may be undertaken by PKPC or third party operators who would lease part of the site from PKPC for a specific purpose. It is initially intended that the first stage of the multi-purpose terminals, including utilities and amenities, would be developed, operated and maintained by PKPC as a common user facility.

Stage 1 of the Concept Plan would be constructed between 2010 and 2018, Stage 2 between 2014 and 2025 and Stage 3 between 2026 and 2037.

1.2 Major Project

Major Project approval is being sought to construct and operate Stage 1 of the Concept Plan. Construction of the Major Project would be divided into three sub-stages, identified as Stage 1a, Stage 1b and Stage 1c. Construction elements of Stage 1 comprise demolition of No.3 and No.4 Jetties, and reclamation and dredging for the footprint of the total development, with the following exceptions:

An area in the vicinity of the Port Kembla Gateway; and

Expansion of the current swing basin area (ship turning circle).

At the completion of Stage 1 the central portion of the multi-purpose terminals would be operational. Road and rail infrastructure to support the first multi-purpose berth would also be constructed, and would comprise:

Upgrade of rail infrastructure in the South Yard.

A new road link from Christy Drive to the central portion of the multi-purpose terminals.

A temporary road to facilitate construction of the container terminals.

The Major Project application sits within, and is part of, the overarching Concept Plan. Stage 1 is proposed to be constructed between 2010 and 2018. Major Project approval would allow PKPC to commence reclamation and dredging for the multi-purpose and container terminals and construct and commence operations for the first multi-purpose berth. Major Project approval for Stages 2 and 3 of the Concept Plan would be subject to separate applications for Project approval made at a later date.

1.3 Objective

The objective of this land based investigation is to respond to the following contamination management requirements issued by the DECCW (dated 19 December 2009 and clarified at the meeting of 17 July 2009) in relation to the proposed redevelopment:

- Delineate soil and groundwater contamination in the proposed land based excavation area (specifically the materials that it is anticipated will be disturbed by the proposed new road link); and
- Delineation of contaminants in groundwater (noting that harbour water quality will be addressed separately as part of the Sediment investigation Report, (AECOM 2009a).

1.4 Director Generals Requirements

The Minister of Planning approved the lodgment of the concept plan for the project on 7 January 2009. An EA for the Project is required under section 75F of the EP&A Act (1979). The DG provided “General Requirements” (dated 27 January 2009) that are to be considered as part of the EA which include the following requirements that are specific to ‘Contamination’:

- Consideration of potential contaminated land, sediments and groundwater and their disturbance, future emplacement, re-use and identification for the need for remediation;
- Characterisation of the distribution of contamination (illustrated on maps) in accordance with the Handbook for Sediment Quality Assessment (CSIRO, 2000); and
- Where remediation is required, presentation of a Remedial Action Plan (RAP) in accordance with relevant DECCW (EPA) guidelines.

1.5 Scope of Works

The scope of work undertaken was as follows:

- Review of Site history including historical environmental investigation reports relating to the Site;
- Underground service location including the marking and clearing of proposed intrusive works locations.
- Advancing of a total of 11 boreholes (BH01 to BH11) across the Site at the locations shown on **Figure F2** and collection of soil samples from each borehole location;
- Laboratory analysis of samples for contaminants of potential concern (COPC) by National Association of Testing Authorities (NATA) certified methods using NATA accredited laboratories (LabMark and ALS).
- Survey of approximate soil sampling locations using a handheld GPS unit; and
- Preparation of this report, discussing the methodologies used and the investigation results and conclusions regarding the requirements for management and/or remediation of the Site during the proposed development works.

1.6 Sampling Analysis and Quality Plan

The sampling analysis and quality plan (SAQP) (AECOM, 2009b) for the investigation including sampling pattern, frequency and analysis was developed based on the objectives of the investigation and the potential contaminants of concern identified on the Site.

The number and location of boreholes on the Site was determined with regard to the following considerations:

- Guidelines endorsed by the DECCW including:
  - NSW EPA (1994). Sampling Design Guidelines;
  - NSW DEC (2006). Guidelines for the NSW Site Auditor Scheme (2nd Edition) April 2006;
  - NSW DEC (2007). Guidelines for the Assessment and Management of Groundwater Contamination; and
  - NSW DECC (2008). Waste Classification Guidelines.
- Previous intrusive environmental investigation works, including previous reporting of fill material quality and contaminant characterisation.
- Site accessibility constraints.
- The location of underground services.

A plan showing borehole locations is presented as **Figure F5**.

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2.0 Site Identification

The Site for the LBI is identified in the following table:

Table 1: Site Identification

Item	Description
Site Owner	Port Kembla Outer Harbour Development (PKPC)
Site Address	Port Kembla Gateway, Christy Drive, Port Kembla NSW 2505
Legal Description (Lot and DP)	Lot 101 DP 1013971
County and Parish	County of Camden, Parish of Wollongong
Local Government Authority	Wollongong City Council
Current Zoning	5a Port Special Uses
Current Land Use	Active railway corridor used for the transport of bulk goods
Proposed Land Use	New road link corridor from Christy Drive to the multi-purpose terminal proposed as part of the Port Kembla Outer Harbour Redevelopment
Geographical Coordinates (MGA56)[1]	307230.68E 6183546.08 S
Site Elevation	Approximately 2-3 (m AHD)
Site Area (approximate)	8,250 m²
Port Kembla Gateway Location	**Figure F1**
Port Kembla Gateway including Site Layout and Sampling Locations	**Figure F5**

Notes:
AHD – Australian Height Datum
MGA56- Map Grid of Australia, Zone 56
[1](coordinates are approximate to centre of Site)

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3.0 Site Condition and Surrounding Environment

3.1 Current Land Use

At the time that this investigation was completed (August, 2009), the Site was owned by the Port Kembla Outer Harbour Development of NSW. The Site occupies one portion of a 3.5 hectare parcel of foreshore land located immediately east of a State Rail Authority rail corridor. The rail corridor is currently active and used for the transport of bulk goods via rail. The area immediately east of the Site is currently used for the storage of pipes for the Sydney desalination plant and is leased by Sydney Water.

3.2 Surrounding Land Use

Current land uses surrounding the Site, comprise the following:

- North – Christy Drive and the Blue Scope Steel Industrial Facility;
- East – Sydney Water desalination plant storage area, Port Kembla Outer Harbour and Jetty No. 6;
- South – State Rail Authority rail corridor, vacant foreshore land and Old Port Road / Foreshore Road; and
- West – State Rail Authority railway corridor, Old Port Road and CMA Metals.

Based on the local and regional topography, the potential for impact to the subject Site from the current uses of surrounding properties is considered to be high.

3.3 Topography and Hydrology

The Site was observed to be generally flat, with a gentle slope to the east towards Port Kembla Outer Harbour.

Surface water is expected to drain to the north-east towards the Port Kembla Outer Harbour. A small area of surface water was observed on the Site during the investigation. This surface water is considered a result of uneven surfaces and rainfall over the days prior to the Site inspection.

The closest major surface water body to the Site is the Port Kembla Outer Harbour, which at the closest point is located directly to the north-east of the Site. The potential for flooding under normal rainfall conditions is considered to be moderate based on the Site elevation, local drainage and geological conditions.

3.4 Regional Meteorology

The climatic data recorded by the University of Wollongong Weather Station (068188), the closest operational station to Site, indicates that the area has a generally temperate climate as follows:

- Average maximum temperature of 21.8^{o}C, ranging from 25.6^{o}C in January and February to 17.0^{o}C in July;
- Average minimum temperature of 13.3^{o}C, ranging from 18.2^{0}C in February to 8.3^{o}C in July; and
- Average annual rainfall of 1,320.9 mm, with February and March typically the wetter months (>150 mm per month), with the remaining months experiencing an average of 100 mm (per month).

3.5 Geology

According to Wollongong - Port Hacking 1:100 000 Geological Sheet 9029-9129 (Geological Survey of NSW, 1985) the region of Port Kembla is underlain by melanocratic, coarse-grained to porphyritic latites of the Shoalhaven Group which are overlain by Quaternary sediments consisting of alluvium, gravel and beach and dune sand.

Since the early 1900s, extensive reclamation and filling activities have been conducted within the Port Kembla Harbour region with much of the original shoreline buried under various fill materials and dredged sediments from the bed of the harbour.

3.6 Hydrogeology

Based on local topography and geology, both regional and local groundwater would be expected to flow in a north-easterly direction through the Site, towards Port Kembla Outer Harbour.

A registered groundwater bore search was performed using the NSW Government Water Information Website (http://waterinfo.nsw.gov.au/). Seven registered groundwater bores were identified within a 5 km radius of the Site (**Appendix A)** and are summarised in the following table.

Table 2: Registered Groundwater Bores within a 5 km radius of the Site

Bore ID	Depth of Bore (m)	Standing Water Level (m bgs)	Distance from Site	Purpose	Comments
GW100678	**65.00**	**8.20**	**2.5 km North-West**	**Monitoring Bore**	**Topsoil; Basalt; Shale; Sandstone**
GW100524	11.21	-	2.0 km North-West	Monitoring Bore	Slag/Fill; Sand; Estuarine Clay
GW101272	14.00	1.27	0.75 km South South-East	Monitoring Bore - Dewatering	Sandy Clay; Silty Clay; Latite
GW101271	14.50	1.30	0.75 km South South-East	Monitoring Bore - Dewatering	Sandy Clay; Silty Clay; Latite
GW101268	14.60	1.72	0.75 km South South-East	Monitoring Bore - Dewatering	Sand and Clay; Silty Clay; Latite
GW101269	14.45	2.09	0.75 km South South-East	Monitoring Bore - Dewatering	Sandy Clay and Gravel; Silty Clay; Latite
GW101267	15.00	1.72	0.75 km South South-East	Monitoring Bore - Dewatering	Organics and Silty Clay; Silty Clay; Latite

Based on the above information, the proximity to surrounding water bodies and Site observations, it is anticipated that Site perched groundwater table exists at shallow depths of approximately 1 to 2 m bgs in the local area. However, it is noted that groundwater was not encountered at the Site during the LBI and therefore is deeper than 1.5 m bgs. Bore information indicates that wells within a 5 km radius are used for a variety of purposes including monitoring bores and de-watering.

3.7 Proximity to Local Sensitive Environments

The local receptor of groundwater from the Site is Port Kembla Outer Harbour, which is located approximately 250 m to the northeast of the Site.

Although investigations undertaken by the Port Kembla Outer Harbour Development and various other organisations have concluded that the quality of water within the Outer Harbour is improving over time, the waters are still considered to be “highly degraded” based on the classification criteria in ANZECC (2000).

3.8 Proposed Land Use

The proposed land use for the Site comprises a new road link corridor from Christy Drive to the multi-purpose terminal proposed as part of the Outer Harbour redevelopment. It is understood that the land footprint of the proposed new road link will extend over a length of approximately 500 m.

Concurrent Concept Plan and Major Project approval is being sought for the development of the Outer Harbour. Activities associated with each of the approvals are illustrated in **Figures F2** and **F4** respectively. Specific components of each of the approvals are detailed in **Table 2Error! Reference source not found.**.

4.0 Historical Site Information

4.1 Previous Environmental Investigations

A number of historical environmental investigations have been completed in areas that adjacent to and associated with the proposed new road corridor link to Christie Road. The findings of these historical investigations are summarised below.

It should be noted that based on available information, it appears that no site investigations have been conducted on the proposed site for the extension of the railway siding at the Pacific National South Yard.

4.1.1 CMPS&F Environmental - Site Assessment Investigation, Former Electricity Commission Site (August 1993)

Camp Scott and Furphy (CMPS&F) Environmental carried out a Site Assessment Investigation for the Illawarra Ports Authority (IPA), on the property located at the intersection of Old Port Road and Christy Drive (adjacent to Jetty No. 6) in August 1993 (shown on **Figure F5**). A summary of the report is provided below.

The objective of the investigation was to identify the type and extent of potential soil contamination. The following scope of work was performed:

- Excavation of 28 test pits and soil sampling from two depth intervals (0.0 to 0.5 m bgs and 0.5 to 1.0 m bgs);
- Chemical analysis of all soil samples for selected metals, pH and petroleum hydrocarbons; and
- Chemical analysis of selected soil samples for polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs).

The following results were reported:

- Relatively uniform subsurface conditions existed at the site. The site geology comprised of up to 2.5 metres of fill material which was underlain by poorly graded coarse sand;
- The direction of regional groundwater flow was estimated to be from south-west to north-east and the overall hydraulic gradient was likely to be quite flat, contributing to the low rate of groundwater flow;
- Heavy metal soil contamination exceeding the adopted assessment criteria, was observed in samples taken from the top 0.5 m bgs of test pits TP3 and TP18, located near the State Rail Authority rail corridor in the middle of the study area;
- Elevated concentrations of PCBs (60 mg/kg) were found in samples take from fill materials (0.5 mbgs) in test pit TP21, located within the former power station site, near the Old Port Road railway bridge;
- Samples taken from test pit TP25 (0.5 m bgs), also located within the former power station site near the Old Port Road railway bridge, contained concentrations of heavy metals and petroleum hydrocarbons (TPH C15-C28 fractionn-1300 mg/kg and TPH C29-C36 fraction – 800 mg/kg) that exceeds the current NSW EPA (1994) guidelines. PCBs were also detected but the concentrations were below the guidelines; and
- Total PAHs were detected at concentrations greater than the Limit of Reporting (LOR) in three locations collected from 0.5 m bgs, TP01 (7.78 mg/kg), TP04 (6.21 mg/kg) and TP05 (8.75 mg/kg).These concentrations did not exceed the current NSW DECC (2006) SIL 4 (commercial/industrial) guidelines.

The report made the following conclusions and recommendations:

- There was insufficient data to define the physical extent of soil contamination. Deeper samples were taken during this investigation for further chemical testing, if required. Analysis of these samples and the collection of additional samples in the vicinity of known contaminated fill materials was recommended to provide additional data required to delineate the extent of soil contamination; and
- An assessment of the most appropriate options available to remediate the contaminated soil, which were both practicable and suited to the site specific characteristics, should be undertaken.

4.1.2 CMPS&F Environmental. MSB – Illawarra Ports Authority Contamination Assessment of Port Kembla Outer Harbour Vacant Land Parcels (October 1994)

CMPS&F Environmental was commissioned by MSB Illawarra Ports Authority (IPA) to complete a ‘baseline’ contamination study of three parcels of land on the southern shores of the Port Kembla Outer Harbour. An additional portion of land adjacent to one of properties was later included in the study area. For the purpose of the

study the portions of land were divided into three separate sites (A, B and C) (shown on **Figure F5**). A summary of the report is provided below.

The objectives of the assessment were to:

- To assess the type and extent of contamination, if any, associated with the vacant portions of land; and
- To present the results in a form which would facilitate comparison with any future assessments, which may be conducted as a result of changes in future land use.

The following scope of work was carried out:

- A review of background information including site history;
- Excavation of 41 test pits across the site with collection of soil samples; and
- Laboratory analysis of selected samples for heavy metals, petroleum hydrocarbons (TPH), and polycyclic aromatic hydrocarbons (PAHs).

The following results were reported:

- Subsurface conditions generally encountered during the study comprised a layer of fill overlying alluvial/dune sands. The fill materials generally comprised of three major types;
    - Fill Type 1 (distributed over sites A, B and C): sand and clay fill containing significant amounts of slag, rubble and building waste what was generally contaminated with heavy metals and localised areas of TPH contamination;
    - Fill Type 2 (distributed over site B): black coal wash fill which generally contained contaminant concentrations below the adopted guidelines; and
    - Fill Type 3 (distributed over site B): fill containing slag nodules which contained isolated heavy metals and PAH contamination;
- Other minor fill containing ash was also identified;
- The results indicate that heavy metal contamination can be attributed to and is closely related to fill type, although some other minor fill types were also contaminated with heavy metals;
- TPH contamination was identified in surface samples at site A in one location and in the deeper natural soils (near groundwater) at another location; and
- PAH contamination was identified in an area adjacent to an area of known contamination already identified in a previous investigation therefore suggesting that this contamination may be more extensive.

The following conclusions and recommendations were provided:

- No significant contamination impact was attributed to Elcom's occupation of the small portion of land on the southern boundary of site B, or from recent activities in the barge demolition area;
- Considering the sampling plan and the highly variable nature of fill material encountered it is possible that isolated zones of contamination may not have been identified;
- There is potential for off-site migration of contaminants (particularly heavy metals and TPH), however the study did not include an assessment of groundwater quality;
- If site soils were to be excavated and or disposed to landfill they may require some form of pre-treatment (e.g. stabilisation);
- Any concrete or steel structures in contact with the site soils may be susceptible to sulphate attack, owing to high sulfate levels; and
- Further investigation of the identified contamination was recommended to ensure that there is no off-site migration or associated human risks.

4.1.3 CMPS&F - Groundwater Study of the Former Electricity Commission Site (No. 6 Jetty) for the Port Kembla Outer Harbour Development (October 1995)

Camp Scott and Furphy (CMPS&F) Environmental was engaged by the Port Kembla Outer Harbour Development to undertake a groundwater study of the former Electricity Commission site located adjacent to the No. 6 Jetty, Port Kembla Outer Harbour (shown on **Figure F5**). The investigation was undertaken as a result of

recommendations presented in the report "Additional Stage 2 Investigation of the Former Electricity Commission Site", prepared by CMPS&F Environmental in June 1994[2]. A summary of the report is provided below.

The objective of the groundwater study was to determine if previously identified polychlorinated biphenyl (PCB) and heavy metal soil contamination was adversely impacting groundwater on the site and/or migrating offsite.

The following scope of works were undertaken:

- Installation of five groundwater monitoring wells located to monitor groundwater quality associated with zones of contaminated soil and establish baseline data for groundwater entering and leaving the site;
- Two rounds of groundwater sampling after different hydrological events (e.g. a dry period and heavy rainfall); and
- Analysis of groundwater samples from each monitoring well (where possible) for heavy metals and PCBs.

The following results were reported:

- Surface soils contained predominantly fill comprising black and white ash, coal fragments and high sand content;
- Deeper soils comprised predominantly medium to coarse grained natural sands and sandy clay with no obvious evidence of contamination;
- Groundwater levels ranged from 1.326 m bgs to 2.984 m bgs and were expected to be dominated by tidal influences rather than hydrological conditions (e.g. heavy rainfall);
- Results for dry and wet monitoring rounds reported concentrations of all COPC in all monitoring wells below the laboratory LOR and Clean Waters Regulation Guidelines (1972);
- Results during the dry and wet monitoring round reported concentrations of all COPC concentrations in all monitoring wells below the laboratory LOR and the ANZECC (1992) Summary Guidelines for the Protection of Aquatic (Marine) Ecosystems, with the following exceptions:
  - MW1: Copper concentration of 0.01 mg/L exceeded the criteria of 0.005 mg/L;
  - MW1: Lead concentration of 0.02 mg/L exceeded the criteria of 0.005 mg/L;
  - MW1: Zinc concentration of 0.05 mg/L exceeded the criteria of 0.05 mg/L; and
  - MW4: Lead concentration of 0.02 mg/L exceeded the criteria of 0.005 mg/L.

The report provided the following conclusions and recommendations:

- There was no evidence of groundwater contamination resulting from the soil contamination previously identified by CMPS&F Environmental; and
- Ongoing annual groundwater monitoring was recommended for a period of two years after which time the results should be reviewed to determine whether there is a potential of adverse impact due to future site redevelopment.

4.1.4 Absolute Environmental - Groundwater Monitoring Well Installation & Groundwater Monitoring Program, Proposed Hyrock Site, Eastern Corner Old Port Road & Christy Drive Port Kembla, NSW (May 2004)

Hyrock commissioned Absolute Environmental to install four groundwater monitoring wells and undertake two groundwater monitoring events (GME's) at the proposed Hyrock site at the eastern corner, Old Port Road and Christy Drive (shown on **Figure F5**), prior to redevelopment. The site was a former public works depot and, prior to that, was part of the Port Kembla Power Station Site. Originally the site belonged to the Maritime Service Board. A summary of the report is provided below.

The objective of the program was to assess current groundwater conditions in the area of the site down hydraulic gradient of a previously identified area of heavy metals and PCB soil contamination.

The following scope of works was undertaken:

- Installation of four groundwater monitoring wells;
- Two groundwater monitoring events (GME's); and

[2] Additional Stage 2 Investigation of the Former Electricity Commission Site"(CMPS&F Environmental, June 1994) was not provided to AECOM for review.

- Reporting.

The following results were reported:

- The groundwater flow direction was from west to east; with a hydraulic gradient of approximately 1.5m across the site in dry weather periods and 2.0m during wet weather periods;
- Arsenic concentrations above laboratory EQL were detected in all wells and ranged between 2 -75 µg/l. Arsenic concentrations in groundwater for the Port Kembla area range between 100-200µg/l with a maximum peak of 500 µg/l. Background regional concentrations of arsenic vary between 1 and 50 µg/l;
- Zinc concentrations above laboratory EQL were detected in all wells and ranged between 39 -120 µg/l;
- Background concentrations of zinc in soils, as reported by NEPC, are between 10-300 mg/kg. Previous investigations undertaken by CMPS&F (1993) reported zinc concentrations in soil ranging between 26-4790 mg/kg;
- OCPs and PCBs were not detected at concentrations greater than the LOR in groundwater samples.

The following conclusions and recommendations were reported:

- The arsenic concentrations in the groundwater were thought to be due to background levels resulting from natural sedimentary soils in the Outer Harbour area;
- Arsenic had not been analysed in previous GME's at the Hyrock Site and it was recommended that it should be analysed in future monitoring rounds undertaken by PKPC;
- The zinc concentrations in groundwater were attributed to both background levels (natural soils), sediments and fill materials at the Site; and
- It was recommended that based on the mixed origin of zinc groundwater impact and the distance to the Port Kembla Outer Harbour, zinc concentrations in groundwater did not warrant remediation. However, it was recommended that future groundwater monitoring undertaken by PKPC include the Hyrock Site and wells located along the foreshore between No. 3 and No. 6 Jetties along, Old Port Road, Christie Drive and Foreshore Road.

4.1.5 URS – Phase 2 Environmental Site Assessment, Inner and Outer Harbour, Port Kembla NSW (June 2004)

PKPC commissioned URS Australia Pty Ltd (URS) to undertake a Phase 2 Environmental Site Assessment (ESA) at parts of the Port Kembla Inner and Outer Harbour foreshore areas (URS, June 2004). A summary of the report is provided below and the Outer Harbour investigation area is shown on **Figure F5**.

The objective was to provide a consistent approach to the assessment and investigation of soil and groundwater within Port Kembla Harbour and allow the development of an appropriate regime of monitoring.

The scope of works included the following:

- Drilling of 20 bore holes in the Inner and Outer Harbour;
- Installation of groundwater monitoring wells at all borehole locations;
- Soil and groundwater sampling;
- Laboratory analysis consisting of:
  - Soils: Metals, PAH, TPH, BTEX, OCP, OPP, PCB and VOCs; and
  - Groundwater: Metals and PAH's.

Site history - the land between Jetty No. 3 and Jetty No. 6 was used for at least 60 years for a range of industrial uses including:

- power station;
- coke works;
- ship building companies;
- material stockpiling;
- electrical equipment storage;
- rubbish dumping;
- metal fabrication, etc; and
- Fertiliser production.

The following results were reported for the outer harbour groundwater monitoring wells:

- Groundwater elevations ranged between 0.182 m AHD and 0.970 m AHD;
- Groundwater field parameters collected from wells in the Outer Harbour indicated groundwater conditions were saline, neutral and oxidising;
- Concentrations of zinc, copper, nickel and lead in groundwater at the site variably exceeded the adopted assessment criteria (ANZECC 95% marine);
- Zinc concentrations ranged between <0.005 mg/L and 1.57 mg/L and were generally highest in the area between the Darcy Road Drain and the No. 3 Jetty (former Area A);
- Copper concentrations ranged between 0.001 µg/L and 0.468 mg/L and were generally highest in the former Area A;
- Nickel concentrations ranged between <0.01 mg/L and 0.470 mg/L and were generally highest in the former Area A;
- Lead concentrations ranged between <0.001 mg/L and 0.065 mg/L and were generally highest in the former Area A;
- Arsenic concentrations ranged between 0.001 mg/L and 0.329 mg/L and were generally highest in the former Area A;
- Concentrations of PAHs were not detected above the LOR in any sample analysed.

The following conclusions were reported for both the inner and Outer Harbour sites:

- The lithology consisted of a sequence of fill, comprising slag, gravel, rock fragments and sand and varying layers of silty clay and sands;
- Groundwater quality was highly saline and unlikely to be utilised for drinking water;
- No soil analytical results exceeded the nominated investigation criteria. However, slightly elevated concentrations were recorded for chromium, copper, lead and zinc.
- Comparison of groundwater results with ANZECC (2000) guidelines indicated that copper, nickel, zinc and lead were detected above the relevant investigation criteria in groundwater beneath the site; and
- Leaching of metal contaminants into the groundwater appeared to be minimal, based on the elevated levels of chromium in the soil analytical results and the groundwater analytical results being below or near the LOR.

The following specific conclusions for the Outer Harbour site were reported:

- The area in the Outer Harbour bound by No 3 Jetty to the east and the Darcy Road Drain to the west, formerly known as Area A had the highest proportion of groundwater samples which exceeded the nominated investigation criteria;
- The assessment of historical data for the existing groundwater monitoring wells in the Outer Harbour area indicated that there appeared to have been a pulse of metal/metalloid contaminated groundwater, which appeared to have diluted and dispersed as it approached the harbour shoreline;
- Impacted groundwater is likely to be regional rather than localised to the site due to the industrialised nature of the region; and
- Impacted groundwater has the potential to migrate into and impact the Port Kembla Harbour.

The report recommended an initial groundwater monitoring round in six months time and followed by annual monitoring.

4.1.6 Coffey – Draft Report, Groundwater Assessment, Corner of Old Port Road and Christy Drive, Port Kembla (October 2006)

Coffey Geotechnics Pty Ltd (Coffey) was commissioned by PKPC to undertake groundwater assessment for a portion of land located on the corner of Old Port Road and Christy Drive, Port Kembla, NSW (shown on **Figure F5**) in October 2006. At the time of the investigation the site had recently been redeveloped into a copper concentrate storage facility comprising a large storage building and a conveyor. A summary of the report is provided below.

The objectives of the assessment were to assess the quality of groundwater at the site, assess potential for adverse impacts to receiving waters in Port Kembla Harbour through comparison to relevant guideline criteria and provide recommendations on the need for further investigations (if required).

The following scope of work was undertaken:

- Installation, development, sampling and surveying of eight monitoring wells;
- Groundwater samples were analysed for TPH, BTEX, PAH, heavy metals, PCBs and hardness as calcium carbonate; and
- Assessment of groundwater results against ANZECC (2000) 95% trigger values for marine water species for the majority of contaminants, and 99% of marine water species for bio-accumulative contaminants.

The following results were reported:

- Fill was encountered to depths between 1.1 and 3.2 m bgs with the depth of fill increasing to the east;
- Groundwater depth ranged between 2.108 and 4.357 m bgs and the groundwater was estimated to flow in an easterly direction towards Port Kembla Harbour;
- Arsenic concentrations in groundwater ranged between 0.01 µg/L to 21 µg /L and exceeded the adopted assessment criteria in five out of the eight wells;
- The up-gradient or background monitoring wells reported concentrations of arsenic less than adopted assessment criteria;
- Copper concentrations ranged between <1 µg /L to 4 µg /L and exceeded the adopted assessment criteria in all six shallow monitoring wells;
- Copper concentrations were not detected above the LOR in the two deeper monitoring wells;
- Zinc was detected at a concentration (90 µg /L) greater than the adopted assessment criteria in the background well located closest to Christy Drive;
- TPH, BTEX, PAH and PCB compounds were not detected at concentrations greater than the LOR;
- pH ranged between 6.75 and 7.41; and
- Hardness ranged between 250 mg/L to 830 mg/L.

The following conclusions were reported:

- The results generally indicated that the groundwater below the area assessed was not impacted with industrial contaminants;
- Some slightly elevated arsenic, copper and zinc concentrations were noted in the monitoring wells and could be attributed to the fill which is present across the area; and
- The results were generally comparable to previous monitoring results with these recent results typically having lower concentrations for arsenic and zinc.

The report recommended that to better assess trends in contaminant concentrations, further monitoring would be required and advised PKPC to consider including these wells into their monitoring program for the foreshore lands.

The report also recommended that it would be beneficial to test for arsenic (III and V) in the following monitoring round to better assess potential risks associated with the elevated total arsenic.

4.1.7 Port Kembla Outer Harbour Development Outer Harbour Groundwater Monitoring Event Port Kembla NSW (URS 2006)

URS was commissioned by PKPC to further assess groundwater conditions in the areas surrounding the PKOH (refer to **Figure F5**).

The primary objectives of the investigation were to:

- Further assess groundwater conditions;
- Ensure that there were no immediate risks to human health and the environment; and
- Communicate to interested parties whether there were significant risks associated with the property and whether it was suitable for the relevant land use.

The scope of work undertaken comprised the following elements:

- Groundwater gauging;
- Collection of groundwater samples from 19 monitoring wells;
- Laboratory analysis of groundwater and surface water samples for heavy metals and PAH's;
- Reporting of investigation results; and

- Recommendations for future monitoring.

A summary of the results is as follows:

- Groundwater elevations ranged between 0.158 and 0.804 m AHD;
- Groundwater seepage velocity was calculated to be approximately 29m/year;
- Groundwater is impacted with cadmium, copper, lead, nickel and zinc all of which exceed the ANZECC (2000) 95% level of species protection for marine waters;
- The highest concentrations of metals reported in groundwater were from the area around Jetty No. 3 and to the west of the Darcy Road Drain; and
- Up hydraulic monitoring wells on Foreshore Road also recorded concentrations of copper, nickel and zinc above the adopted assessment criteria.

Conclusions

- Up hydraulic gradient groundwater is a possible source of the metal contamination at the investigation area;
- Concentrations of dissolved metals in the eastern portion of the PKOH foreshore had remained relatively constant since the commencement of monitoring in 1996 with some zinc fluctuations;
- Concentration of cadmium above the adopted assessment criteria were detected above the adopted assessment criteria in a single monitoring well located in the central portion of the PKOH foreshore;
- Possible sources of contamination could include leaching from in situ soil / fill and migration from up gradient off site sources;
- Groundwater impacts in the Port Kembla region are a regional issue, rather than a local issue. Impacted shallow groundwater appears to be migrating towards the PKOH from up gradient and off site sources;
- Due to the proximity of the Outer Harbour, the potential exists for impacted groundwater to migrate into the surface water body of the PKOH; and
- Groundwater monitoring results suggest that concentrations decrease adjacent to the shore line, most likely due to dispersion and dilution.

Recommendations

- Monitoring should continue to monitor trends in groundwater contamination;
- Nickel, PAHs and selenium should be included in the analytical suite for future monitoring rounds;
- Repair or replace up-hydraulic gradient monitoring wells and continue monitoring off site groundwater conditions;
- Install 2 additional wells in up-hydraulic gradient locations;
- Should an increase in metal concentrations become apparent during future monitoring rounds, PKPC should consider steps to try and identify the source; and
- Surface water sampling should be considered to assess contaminant contribution to harbour water from up stream sources could be determined.

4.1.8 Report on Soil and Groundwater Investigation, Outer Harbour Lands, Port Kembla (Douglas Partners 2009)

Douglas Partners (DP) was commissioned by PKPC to undertake a groundwater investigation in the Outer Harbour Lands (OHLs) of the Port Kembla Harbour. The aim of the investigation was to collect updated information for environmental and occupational health and safety purposes during re-development and reclamation of the OHL. The report is summarised below.

The objectives of the report were to:

- Provide an up to date data set for groundwater in the OHL;
- Maintain and enhance the existing OHL monitoring networks to provide adequate coverage of areas of potential groundwater contamination;
- Assess the concentration of potential contaminants of concern in groundwater for existing and accessible groundwater monitoring wells; and
- Assessment of soil contamination at new well locations.

The scope of work included the following:

- Site and well inspection;
- Reinstallation of wells MW16 and OHMW28 using a trailer-mounted drill rig;
- Installation and development of two additional monitoring wells (MW31 and MW32);
- Collection of soil samples from new and reinstalled boreholes and laboratory analysis for metals (lead, mercury, cadmium, arsenic, copper, zinc, selenium, chromium and nickel), TPH, BTEX, PAHs, OCP, OPP, PCB and asbestos;
- Measurement of groundwater levels to provide information on the flow regime;
- Purging of 16 wells prior to sampling using low flow micro purge technique and measurement of field parameters (electrical conductivity, temperature, pH, dissolved oxygen and oxidation-reduction potential);
- Laboratory analysis of groundwater samples for metals (lead, mercury, cadmium, total arsenic, copper, zinc, selenium, chromium and nickel) , speciated arsenic, TPH, BTEX and PAHs.

The following results were reported:

- The depth to groundwater in the area of the proposed western New Road Link Corridor for the multi-purpose terminal was reported to range between 4.26 and 4.3 m bgs (CGMW2 and CGMW5 respectively);
- The depth to groundwater in the area of the proposed eastern New Road Link Corridor leading to the Container Terminal was reported to range between 2.6 and 2.65 m bgs (MW16 and OHMW27 respectively);
- Groundwater results indicated several exceedances of the Groundwater Investigation Levels (GILs) for copper and zinc and some exceedences of arsenic III, arsenic V, cadmium, lead and nickel. AECOM notes that the adopted assessment criteria (GIL's) for metal and metalloid concentrations in groundwater have been derived from the Port Kembla Environmental Group Trigger values provided to DP by PKPC. AECOM also notes that the report makes an assessment of the potential risk of harm to the environment using the ANZECC (2000) 95% trigger values of protection for Marine Quality;
- Arsenic V concentrations (ranging between 7-154 µg/L) exceeded the GIL's for all samples submitted for laboratory analysis;
- Soils collected and analysed during the installation of wells indicated the contaminant concentrations are less than the commercial/industrial land use criteria with the exception of one location where asbestos was detected between 0.5-1.0m bgs;

The report provides a summary and comparison of current and previous groundwater results from up and down gradient wells which suggested the following:

- Arsenic concentrations in MW15 (located close to Foreshore Rd) were consistently higher than at any other well in the network and this trend has continued through monitoring in the OHL;
- Cadmium, copper, nickel and zinc concentrations were generally higher in the up-gradient wells;
- Chromium and lead concentrations were generally consistent with down gradient wells;
- TPH, BTEX and PAH concentrations were not considered to pose a risk to the receiving waters of the Site;
- Arsenic III concentrations that exceeded the adopted site assessment criteria may bioaccumulate to some extent in some marine organisms. However, the report also states that its toxicity may be reduced by Iron III, chromium III and barium. Reference is also made to the fact that sulphides may also remove arsenic III;
- Arsenic V concentrations that exceeded the adopted site assessment criteria may bioaccumulate to some extent in some marine organisms. However, the report also states that its presence may also be reduced by clay; and
- Cadmium, copper and lead concentrations marginally exceeding the guideline were not considered to be significant in terms of risk.

The following conclusions were made:

- Whilst the well network within the OHL was considered to be extensive, some of the wells had been destroyed or damaged or lost and could no longer be sampled and many wells had been sampled for 2 or less rounds;
- Heavy metal concentrations are generally higher in up-gradient wells than down gradient wells with the exception of chromium and lead;
- The exceedances of the GILs and other reference values, and comparison to Port Kembla water quality results, indicated that there may be a potential risk to the environment;

- Nickel concentrations in wells, where detected, had generally increased from previous sampling events; and
- The number of sampling events varies between wells, and as such the limited data set restricts the interpretation of clear trends.

The report recommended continued sampling of groundwater wells to monitor trends in groundwater contamination and that additional monitoring from all wells should be undertaken to allow better characterisation of groundwater quality and variation over time.

4.2 Site History

Based on a review of previous environmental investigations and available anecdotal information, the Site appears to have been historically used since 1 September 1900 when it was resumed by the Public Works Department. An electricity power station was constructed immediately west of the Site and the land was transferred to the Electricity Commission of New South Wales when it was formed in 1950 under an Act of Parliament which brought all power stations under one jurisdiction. The power station was subsequently decommissioned and demolished and the Site was acquired by the Maritime Services Board on 18 November 1986 (which later became the Port Kembla Outer Harbour Development).

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5.0 Field Investigation

The sampling program was undertaken in accordance with the SAQP (AECOM, 2009) and the NSW EPA (1995) *Sampling Design Guidelines*.

5.1 Contaminants of Potential Concern

Based on the available historical information and observations of the surrounding land uses, potentially contaminating activities which may have been and/or are currently being undertaken with the potential to impact on soil and groundwater at the Site include:

- The former historical electrical power station located immediately west of the Site;
- The Blue Scope Steel (former BHP) facility located immediately north of the Site;
- The CMA Metals facility located immediately south-west of the Site;
- Use of the Site by the State Rail Authority as a bulk transport and rail facility; and
- The historic use of potentially contaminated imported fill materials for historic reclamation and ground levelling of the Site.

Contaminants of potential concern (COPC) in soil and groundwater derived from activities conducted at and in the vicinity of the Site and, in some cases confirmed by historical environmental investigations, include the following:

- Heavy Metals - may occur in fill originating from industrial Sites, including slag based fill materials. Common metal contaminants include arsenic (As), cadmium (Cd), chromium (Cr total), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni) and zinc (Zn). Heavy metal contamination has been identified within fill and groundwater by historic investigations (refer **Section 4.1**).
- Petroleum Hydrocarbons - occur in fuels, solvents and oils etc. Petroleum hydrocarbons are generally quantified by analytical laboratories as total petroleum hydrocarbons (TPH), and as four fractions of hydrocarbons grouped into ranges of volatility. TPH contamination has been identified by historic investigations (refer **Section 4.1.2**).
- Monocyclic Aromatic Hydrocarbons - including benzene, toluene, ethylbenzene and xylenes (BTEX) are found in fuels and used as solvents. BTEX contamination was not been identified in previous investigations reviewed;
- Polycyclic Aromatic Hydrocarbons (PAHs) - related to some petroleum hydrocarbon use including asphalt and bitumen, waste and lubricating oils. PAHs are also potentially present in fill (dependant on the origin of the fill material). PAH contamination has been identified by historic investigations (refer **Section 4.1**).
- Phenols – produced as a by product of the manufacture of herbicides and synthetic resins and also as a product of coal production;
- Organochlorine Pesticides (OCPs) and Organophosphorus pesticides (OPPs) – both used as common insecticides, can also be used in industries involving the production of chlorinated hydrocarbons;
- Polychlorinated Biphenyls (PCBs) – used as insulating fluids in transformers, coolants and capacitors in industries backdating their prohibition. PCB contamination has been identified by historic investigations within fill materials (refer **Section 4.1.1**); and
- Asbestos – Asbestos is applicable to soil contamination only and is commonly associated with demolition waste and fragments from asbestos containing building materials that may be present in imported fill materials or disposed of on-site.

5.2 Soil Investigation

5.2.1 Sampling Rationale

The footprint of the proposed new road link corridor that makes up the Site is approximately 500 m long and 30 m wide. The depth of the investigation was limited to 1.5 m bgs which is the maximum expected depth of excavation works associated with the roadway construction.

AECOM completed 11 borehole locations, at approximately 30m spacing, along the length of the corridor to obtain adequate coverage across the Site. The borehole locations were necessarily biased toward the eastern side of Site as the western portion of the site is occupied by an active railway.

Twenty two soil samples collected from the 11 borehole locations were selected and submitted for laboratory testing. The laboratory testing program was based on analysis of an average of two soil samples per borehole.

Based on the sampling density completed and subsequent laboratory testing program, AECOM considers that the investigation is suitable for delineating the presence and extent of soil contamination at the site and any associated contamination issues that may require management as part of the proposed development.

5.2.2 Soil Assessment Methodology

The soil sampling program was undertaken on 6 July, 2009 by Miss Kate Pigram, an AECOM Environmental Scientist, who is trained and experienced in the collection of environmental samples. Soil sampling techniques followed AECOM's specific written standard field and quality assurance/control procedures and were conducted with reference to the SAQP (AECOM, 2009) and relevant guidelines endorsed by the DECCW.

The soil assessment methodology is described in the **Table 5** below.

Table 3: Summary of Soil Assessment Methodology

Activity	Details
Service Location and Clearance	Prior to any intrusive works, all borehole locations were cleared for subsurface utilities by AECOM personnel and Abitek Locating Services as follows: • Dial-Before-You-Dig and any relevant Site utility representatives were contacted to obtain plans for known subsurface utility infrastructure and to confirm, to the extent possible, that proposed investigation locations were clear of subsurface utilities; • Proposed investigation locations were physically marked out based on the previously obtained subsurface utility maps and advice from local site stakeholders; and • Each sampling location was cross-checked for underground services by Abitek Locating Services Pty Ltd, a Telstra accredited service location contractor.
Drilling of Boreholes	A bobcat mounted drill rig equipped with solid flight augers was used to excavate boreholes to depths up to 1.5 metres below ground surface (m bgs). All boreholes achieved the target depth, with the exception of one which refused on concrete rubble. It is noted that push tubes were not used due to the hard nature of the fill materials.
Soil logging	Soil logging was undertaken by suitably qualified and experienced AECOM field staff in general accordance with the Unified Soil Classification System (USCS) and the AECOM documented standard field procedures. Samples were logged and information was recorded in the field (e.g. soil/rock type, colour, grain size, inclusions, moisture conditions, staining and odour etc). Borelogs are provided in **Appendix A.**
Soil Samples	Soil samples were generally collected as grab samples at the surface, 0.5 m, 1.0 m and at the base (1.5 m bgs unless prior refusal was encountered) or at significant changes in lithology. Samples were collected in laboratory supplied and prepared 250mL glass jars with Teflon lids and were stored in eskies with ice for transport to the laboratory. Details of soil samples are provided in the Borelogs provided in **Appendix A**.
QC samples	Intra-laboratory duplicate samples and inter-laboratory triplicate samples were collected at an approximate rate of 1 per 10 primary samples and 1 per 20 samples, respectively. Data Quality Objectives and Indicators are presented in **Appendix B.**
Field Screening	Duplicate soil sub-samples were placed in snap-lock plastic bags and the vapour headspace screened in the field for volatile organic compounds (VOCs) using a calibrated Photoionisation Detector (PID) with a 10.2 eV lamp. PID calibration details are provided in **Appendix C.**

Activity	Details
Decontamination	All samples were collected by disposable nitrile gloved hand from the undisturbed bulk of soil directly from the auger head. Augers were decontaminated between boreholes.

5.3 Analytical Plan

Samples were scheduled for analysis of the identified CoPC based on visual and olfactory field observations and PID field screening. The soil sample analysis program is summarised in **Table 6** below:

Table 4: Summary of analysis program

Matrix	Analytes	Primary Samples
Soil	TPH	24
	BTEX	24
	Heavy metals[1]	24
	PAH	24
	Phenols	24
	OCP	24
	OPP	24
	PCB	24
	Asbestos	12

Notes:

1. Heavy metals = As, Cd, Cr, Cu, Pb, Ni, Zn, Hg

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6.0 Quality Assurance and Quality Control (QA/QC)

Analytical data validation is the process of assessing whether data are in compliance with method requirements and project specifications. The primary objectives of this process are to ensure that data of known quality are reported, and to identify if the data can be used to fulfil the overall project objectives.

The data validation guidelines are based upon data validation guidance document published by the United States Environmental Protection Agency (USEPA, 1999, 2002) and the National Environment Protection Council (NEPC,1999). The process involves the checking of analytical procedure compliance and an assessment of the accuracy and precision of analytical data from a range of quality assurance and quality control (QA/QC) measures, generated from both the sampling and analytical programs.

6.1 Field Quality Assurance and Quality Control

The field QA/QC procedures utilised for the soil sampling included:

- Use of standard procedures for soil sampling that were in compliance with the AECOM documented standard field procedures;
- Use of a new pair of disposable nitrile gloves for each sample collection event;
- Use of laboratory prepared and supplied sampling containers appropriate for each CoPC investigated;
- Intra laboratory field duplicates at a rate of one in 10 primary samples;
- Inter laboratory field duplicates at a rate of one in 20 primary samples; and
- Use of appropriate sample Chain of Custody (COC) documentation. Copies of the COCs are included in the laboratory reports in **Appendix D**.

6.2 Laboratory Quality Control

The Data Quality Indicators (DQIs) defined for the assessment of the laboratory analytical data included:

- Maximum acceptable sample holding times are 14 days for organic analyses and six months for metal analyses;
- Samples to be appropriately preserved and handled;
- Limit of Reporting (LORs) to be below the adopted assessment criteria;
- Laboratory method blank analyses required to be below the laboratory LORs;
- Laboratory duplicate samples to be analysed at a rate of one in 20 samples or one per batch where there are more than five samples;
- Matrix spike recoveries to be conducted by the laboratory at a rate of one in twenty samples;
- Laboratory control sample analysis to be conducted at a rate of one in twenty samples;
- Matrix and Surrogate recoveries; and
- The occurrence of apparently unusual or anomalous results (for example laboratory results that appear to be inconsistent with field observations or measurements).

6.3 Overall assessment of Data Quality

A review of field and laboratory QA/QC is summarised in **Appendix B**.

Following review of the QA/QC results by AECOM it can be concluded that the QA/QC procedures were satisfactory and that the results can be relied upon for the purposes of this land based investigation.

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7.0 Site Assessment Criteria

7.1 Soil Investigation Criteria

The assessment criteria currently endorsed by the DECCW to evaluate soil analytical results is based on the following guidelines:

- NSW EPA, 1994. Guidelines for Assessing Service Station Sites;
- NSW DEC, 2006. Guidelines for the NSW Site Auditor Scheme (2nd Edition);
- NEPC, 1999. NEPM National Environment Protection (Assessment of Site Contamination) Measure; and
- NSW DECC (2008) Waste Classification Guidelines.

The soil assessment criteria (or SAC) adopted for this investigation, and the soil analytical results, are presented in **Table 7** in **Section 7.1.5** below. The origin of the SAC is described following.

7.1.1 Metals, PAHs, OCPs, OPPs, Phenol and PCBs

The assessment criteria adopted for metals, PAHs, OCPs, OPPs, phenol, and PCBs in soil are based on the NSW DEC (2006) guidelines which are, in turn, based on guidance provided in NEPC (1999). These guidelines present a range of Health-Based Soil Investigation Levels (SILs) and Provisional Phytotoxicity-based Investigation Levels (PILs) for soils which are considered to be appropriate for a range of land uses on urban sites in NSW.

- SIL_1 Residential with gardens and accessible soil
- SIL_2 Residential with minimal access to soil including high-rise apartments and flats
- SIL_3 Parks, recreational open space, playing fields (including secondary schools).
- SIL_4 Commercial or industrial.

The proposed future land use of site is as a link road within an industrial precinct used for access to a multi-purpose terminal. Therefore, the SIL_4 criteria have been adopted as the site assessment criteria.

It is noted that the PILs are based on sandy loams with a pH 6 to 8. The soils on the Site are generally characterised as clay Fill, overlying clayey Sand to sandy Clay, overlying sandstone bedrock. The application of the PILs has significant limitations as phytotoxicity depends on soil and species parameters in ways that are not fully understood. As such, the PILs are intended for use as a screening guide only.

7.1.2 TPH and BTEX

The assessment criteria adopted for TPH and BTEX in soil are based on the NSW EPA (1994) *Guidelines for Assessing Service Station Sites.* These guidelines provide investigation criteria for TPH and BTEX compounds that have been developed for sensitive land use scenarios and are the only DECCW endorsed criteria for environmental impacts from these types of compounds.

7.1.3 VOCs

There are no current DECCW endorsed assessment criteria for a number of VOCs in soil. In consideration of this, the assessment criteria adopted for VOCs in soil are based on the USEPA (2009) *Regional Screening Levels (RSLs)* which provide screening levels for a range of VOCs in soil. The RSLs are risk-based criteria adopted for use as screening investigation criteria only where Australian-based guidelines are not available.

7.1.4 Asbestos

There are currently no DECCW endorsed guidelines relating to human health or environmental investigation of material containing asbestos on sites. The NSW DEC (2006) guidelines require that auditors exercise their "*professional judgement when assessing whether a site is suitable for a specific use in light of evidence that asbestos may be a contaminant of concern*".

The enHealth Council (2005) guidelines provide some guidance on the assessment and management of asbestos in soil and recommend that, where fragments of asbestos cement are found, that the type of asbestos present should be confirmed by microscopy and that the whole area where fragments are located should be regarded as contaminated and action taken. The enHealth Council (2005) guidelines also state that, depending on where fragments are located and the proportion of fragments present, it may not be necessary to measure the actual concentration present.

The assessment criteria adopted for asbestos in soil for this investigation is based on the WA Department of Health (DOH) (2009) *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia.* The WA DOH has reviewed the criterion for asbestos in soil of 0.001% weight for weight (w/w) asbestos as cited in enHealth (2005), in light of extensive research by Swartjes and Tromp in The Netherlands (2008). The Netherlands consequently introduced general regulatory criteria of 0.01% w/w asbestos for friable asbestos and 0.1% w/w asbestos for non-friable asbestos containing materials (ACM).

WA DOH used the Dutch figures divide by a factor of 10 to derive investigation criteria for WA, taking account of the greater dryness and dust generating potential of local soils. The fibrous asbestos criterion applies to fibrous asbestos (FA) and asbestos fines (AF) due to their ability to generate asbestos fibre. WA DOH applies higher criteria for ACM, depending on site use which mirror NEPM (1999) site uses and associated default exposure ratios. The soil asbestos investigation criteria are summarised and criteria applicable to the Site are shaded in **Table 7** below.

Table 5: WA DOH Assessment Criteria for Asbestos in Soil

Land Use	Criteria
All site uses	**0.001% w/w asbestos for FA and AF**
Residential use, day care centres, preschools, etc.	0.01% w/w asbestos for ACM
Residential, minimal soil access	0.04% w/w asbestos for ACM
Parks, public open spaces, playing fields etc	0.02% w/w asbestos for ACM
Commercial/Industrial	**0.05% w/w asbestos for ACM**

Notes: Shading indicates assessment criteria applicable to the Site.
ACM – Asbestos Containing Material (products that contain asbestos in an inert bound matrix like cement or resin)
FA – fibrous asbestos (friable asbestos material, such as severely weathered ACM and loose fibrous material such as insulation)
AF- asbestos fines (free asbestos fibres, small fibre bundles and ACM fragments that can pass through 7 x 7 mm sieve)

7.1.5 Adopted Soil Assessment Criteria

The adopted soil assessment criteria (SAC) are presented in **Table 8** below.

Table 6: Adopted Soil Assessment Criteria

Analyte	Units	NSW DEC (2006) SIL_4
Metals		
Cadmium	mg/kg	100
Chromium (VI+III)	mg/kg	600 000
Copper	mg/kg	5000
Lead	mg/kg	1500
Mercury	mg/kg	75
Nickel	mg/kg	3000
Zinc	mg/kg	35 000
Metalloids		
Arsenic	mg/kg	500
Polycyclic Aromatic Hydrocarbons		
PAH (total)	mg/kg	100
Benzo(a)pyrene	mg/kg	5

Analyte	Units	NSW DEC (2006) SIL_4
Phenol	mg/kg	42 500
PCBs (total)	mg/kg	50
OCPs		
Aldrin+Dieldrin	mg/kg	50
DDT+DDE+DDD	mg/kg	1000
Heptachlor	mg/kg	50
Analyte	**Units**	**NSW EPA (1994)**
BTEX		
Benzene	mg/kg	1
Ethylbenzene	mg/kg	50
Toluene	mg/kg	130
Xylene Total	mg/kg	25
TPH		
C_6-C_9 Fraction	mg/kg	65
C_{10}-C_{36} Fraction	mg/kg	1000

7.2 Aesthetic Conditions

In the decision-making process for assessing urban sites presented in NSW DEC (2006), the assessment of sites that are to be used for purposes other than commercial/industrial requires the consideration of aesthetic issues in the assessment of contamination. Aesthetic issues include the generation of odours and any discolouration of the soil as a result of contamination.

The proposed future land use of site is as a link road within an industrial precinct used for access to a multi-purpose terminal. Therefore, and in accordance with NSW DEC (2006) guidelines, aesthetic issues such as odour and discolouration have not been considered as assessment criteria.

7.3 Waste Criteria

The current criteria used in NSW to characterise waste materials for off-site disposal is provided in the NSW DECC (2008) Waste Classification Guidelines. The guidelines set different maximum total concentrations and leachable concentrations for specific contaminants in order for waste to be classified as ‘general solid’, ‘restricted solid’ or ‘hazardous’ waste. This resultant waste classification then affects the way in which the waste is handled and where the waste is able to be disposed.

7.4 Groundwater Investigation Criteria

The assessment criteria for groundwater currently endorsed by the DECCW are based on the ANZECC (2000) *Guidelines for Fresh and Marine Water Quality*.

The groundwater assessment criteria adopted for this investigation, and the historic groundwater analytical results, are presented in **Table 9** in **Section 7.4.3**. The origin of the groundwater assessment criteria is described below.

7.4.1 Metals, PAHs, OCPs, OPPs, Phenol, PCBs and VOCs

ANZECC (2000) provides ‘Trigger’ levels for chemicals within water, which represent the best current estimates of the concentrations of chemicals that should have no significant adverse effects on the aquatic ecosystem. The ANZECC (2000) guidelines indicate that an exceedence of a trigger level does not necessarily imply that there is

an inherent risk, but that further assessment and monitoring may be required prior to implementing appropriate management actions. It is noted that according to ANZECC (2000), low reliability Trigger Levels are Interim Levels only because "*low reliability guideline trigger values were derived, in the absence of a data set of sufficient quantity, using larger assessment factors to account for greater uncertainty*", and "*low reliability values should not be used as default guidelines*". ANZECC (2000) stipulates that the identification of the receiving environment or the likely beneficial use of the water is essential for selection of the most applicable criteria.

For the purpose of this assessment, the 95% protection level trigger value for protection of marine ecosystems has been adopted based on the likely receiving water of the Port Kembla Outer Harbour. Although a higher level of protection (99%) is recommended for several analytes, the 95% Trigger Level will be adopted due to the known disturbed nature of the Site and the wider area surrounding the Outer Harbour.

7.4.2 TPH

There are no current NSW DEC or nationally endorsed assessment criteria for TPH in groundwater and surface water. In consideration of this, the Dutch Intervention Values 2000 (DIV) for mineral oil have been used as the assessment criteria for the TPH C_{10} to C_{36} fractions.

7.4.3 Adopted Groundwater Assessment Criteria

The adopted groundwater assessment criteria (GAC) are presented in Table 7 below.

Table 7: Adopted Groundwater Assessment Criteria

Analyte	Units	ANZECC 95% level of species protection for marine water
Metals		
Cadmium	µg/L	5.5
Chromium (VI)	µg/L	4.4
Copper	µg/L	1.3
Lead	µg/L	4.4
Mercury	µg/L	0.4
Nickel	µg/L	70
Zinc	µg/L	15
Metalloids		
Arsenic (V)	µg/L	4.5 (LR)
Polycyclic Aromatic Hydrocarbons		
Anthracene	µg/L	0.4 (MR)
Benzo(a)pyrene	µg/L	0.2 (LR)
Fluoranthene	µg/L	1.4 (LR)
Naphthalene	µg/L	70 (MR)
Phenanthrene	µg/L	2 (LR)

Notes:
LR Low reliability trigger level
MR Moderate reliability trigger level
IIWL Indicative interim working level

8.0 Investigation Results

8.1 Site Stratigraphic Conditions

The lithology encountered in all boreholes to the maximum investigation depth of 1.5 m bgs was Fill. The Fill materials consisted of varying compositions of dark brown/black sand, gravel, silt and clay. The fill generally contained some to trace (5-20%) inclusions of ash, slag, gravel and glass fragments. Natural soil or bedrock was not encountered in any of the boreholes.

Bore logs describing the shallow subsurface profile encountered during the investigation are included in **Appendix A.** Borehole locations are shown on **Figure F5**.

8.2 VOC Screening

Concentrations of volatile organic compounds (VOCs) in soil sub-samples were measured in the field using a calibrated PID, as a means of screening for potentially contaminated soils.

PID readings ranged from 0.3 to 5.5 parts per million (ppm), which were slightly greater than background readings which ranged between 0.0 to 0.2 ppm.

No unusual odours, potentially associated with the presence of VOCs, were noted in Site soils.

8.3 Soil Analytical Results

The soil analytical results are compared against the adopted SAC in **Table T1**. Laboratory analytical reports are provided in **Appendix D**.

8.3.1 TPH and BTEX

Concentrations of TPH and BTEX for all soil samples analysed were less than both the SAC and laboratory LOR.

Notwithstanding the results of the soil analytical program, historical environmental assessments (CMPS&F, 1994) of fill materials on adjacent sites reported TPH concentrations in excess of the contemporary guidelines. The identified TPH impacted areas were located within both shallow fill and natural deeper soils east of the Darcy Road Drain.

8.3.2 Heavy Metals

Concentrations of heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn and Hg) for all soil samples analysed were less than the SAC (SIL_4) with the exception of:

- BH08_0.2-0.3 which reported a copper concentration of 12 900 mg/kg relative to a SAC of 5 000 mg/kg.

Copper concentrations in excess of contemporary guidelines were also reported by historical environmental assessments (Douglas Partners, 2009). Historical environmental assessments (CMPS&F, 1994) of fill materials on adjacent sites have also reported heavy metals concentrations in excess of the contemporary guidelines.

8.3.3 PAH

Concentrations of PAH for all soil samples analysed were less than the SAC (SIL_4). Samples with PAH concentrations less than the SAC, but greater than the laboratory LOR, were:

- BH05_0.5-0.6 reported a total PAH concentration of 13 mg/kg;
- BH08_0.2-0.3 reported a total PAH concentration of 6.9 mg/kg;
- BH10_0.5-0.6 reported a total PAH concentration of 4.2 mg/kg; and
- BH10_1.4-1.5 reported a total PAH concentration of 3.9 mg/kg.

PAH concentrations were detected at similar concentrations (6.21 mg/kg to 8.75 mg/kg) within fill, immediately to the west of the Site, between the railway and Old Port Road (CMPS&F, 1993).

Notwithstanding the results of the soil analytical program, historical environmental assessments (CMPS&F, 1994) of fill materials on other adjacent sites reported PAH concentrations in excess of the contemporary guidelines. The impacted PAH area was identified on the west side of the Darcy Road Drain.

8.3.4 OCP & PCB

Concentrations of OCP and PCB for all soil samples analysed were less than the SAC (SIL_4) and the laboratory LOR.

Notwithstanding the results of the soil analytical program, historical environmental assessments (CMPS&F, 1993) of fill materials on adjacent sites reported PCB concentrations in excess of the contemporary guidelines.

8.3.5 Asbestos

Chrysotile type asbestos fibres were identified in sample BH10_0.5-0.6. Asbestos was not identified in any other sample analysed, however unidentified mineral fibres were found in sample BH11_0.5-0.6. It is noted that the concentration of chrysotile asbestos was not determined in sample BH10_0.5-0.6.

8.4 Waste Classification

Assessment of TCLP laboratory analysis results, together with total concentration analysis results, based on the Waste Criteria (per **Section 7.3**), indicated the materials would be classified as '*General Solid Waste'* if it required disposal to an off-site DECCW licensed landfill.

8.5 Groundwater Analytical Results

Historic groundwater analytical results, taken from previous environmental site assessments, are compared against the adopted groundwater assessment criteria in **Table T3**. A summary of historical environmental site assessments is presented in **Section 4.1**.

8.5.1 TPH and BTEX

TPH and BTEX were analysed in two monitoring rounds (September 2006 and January 2006) and were not detected at concentrations greater than the LOR.

8.5.2 Heavy Metals

A summary of historical heavy metals results (Douglas Partners, 2009) are provided below:

- Arsenic
  - Historical arsenic concentrations ranged between <0.001 mg/L and 0.473 mg/L.
  - The minimum historical concentration of arsenic exceeded the adopted groundwater assessment criteria (GAC) in six out of thirteen monitoring wells.
- Copper
  - Historical copper concentrations ranged between <0.001 mg/L and 0.5 mg/L.
  - The minimum historical concentration of copper exceeded the adopted GAC in ten out of thirteen monitoring wells.
- Zinc
  - Historical zinc concentrations have ranged between <0.0001 mg/L and 6.51 mg/L.
  - The minimum historical concentration of zinc exceeded the adopted GAC in seven out of thirteen monitoring wells.
- Nickel
  - Historical nickel concentrations have ranged between <0.001 mg/L and 0.394 mg/L.
  - The minimum historical concentration of nickel exceeded the adopted GAC in three out of thirteen monitoring wells.
- Cadmium
  - Historical cadmium concentrations ranged between <0.0001 mg/L and 0.0104 mg/L.
  - Only one out of thirteen monitoring wells has reported concentrations of cadmium greater than the GAC.

- Lead
  - Historical lead concentrations ranged between <0.001 mg/L and 0.47 mg/L.
  - The minimum historical concentration of lead exceeded the adopted GAC in one out of thirteen monitoring wells.
- Mercury and Chromium were not detected at concentrations greater than the GAC.
- The highest concentrations of heavy metals were generally detected in the monitoring wells within the area between the Darcy Road Drain and Jetty No. 3 (formerly known as Area A).

8.5.3 PAH

A summary of historical heavy metals results is provided below:

- PAHs were not detected at concentrations greater than the LOR in the GMEs of the Outer Harbour monitoring wells in September 2006 and January 2006 (Douglas Partners, 2009).
- PAHs were not detected in Outer Harbour monitoring wells in the November 2003 GME (URS Phase 2 ESA, June 2004).

8.5.4 OCP & PCB

OCPs and PCBs were not detected above the LOR in the monitoring wells located in the vicinity of the Hyrock No. 6 Jetty in the GME's undertaken in September 1995 and April 2004 (Absolute Environmental, May 2004).

8.6 Acid Sulfate Soils

AECOM conducted a review of the Acid Sulfate Soil Risk Map (Edition 2) for Wollongong, published by the Department of Natural Resources (DNR 2002). The plan indicates that there is a 'High Probability' ASS is present in the vicinity of the Site. However, given the maximum depth of 1.5 m bgl required for the development, these materials are not expected to be intercepted during the excavation works.

8.7 Imported Fill

As part of the reclamation works for the multi-purpose terminal and the container terminal, it is proposed to import substantial quantities of fill to the site primarily from available sources in the local and wider regional area.

In normal circumstances imported fill would be required to be of an appropriate quality to meet the NEPM Health Based Investigation Levels (HIL F) for commercial and industrial land use.

In this case PKPC has made application to DECCW for a Specific Resource Recovery Exemption under the POEO (Waste) Regulations 2005 to utilise blast furnace slag from the Mount Prosser stockpile area in Port Kembla for reclamation purposes as part of the Outer Harbour development. This stockpile area contains approximately 1.5 Mt and is located in relatively close proximity to the Outer Harbour. The stockpile was generated by Australian Steel Mill Services (ASMS) as a by product of the iron making process during separation of the molten iron from impurities in iron making blast furnaces.

The blast furnace slag is generally inert material which is similar in composition to basalt. Samples of the material contained in the Mount Prosser stockpile area has been tested and certified by a NATA accredited laboratory. Similar material has already been approved for use in reclamation areas within parts of the Inner Harbour.

PKPC has received draft approval from the DECCW for the Specific Resource Recovery Exemption for blast furnace slag. PKPC will be required to address any specific requirements contained in the approval.

At the 17 June 2009 meeting with DECCW it was noted that slag often has contamination concerns (for example ammonia and tar) as a result of other waste streams being disposed of with the "clean" slag. Construction methods for the proposed development will therefore need to include protocols for verifying that other waste streams were not being disposed of in the reclamation area with the slag. PKPC has been proactive on this matter and is proposing to implement Quality Assurance controls to ensure that the fill material would be suitable for reclamation purposes which would include visual screening of all slag material imported to site and associated waste tracking measures which would include:

- Weighing of all vehicles on a calibrated weighbridge at source before they leave the ASMS with a weighbridge docket being issued for each vehicle leaving the site. The docket will detail truck registration

number, time, date, material code and the intended destination of the material. This information will be stored on a database by ASMS;

- PKPC will keep copies of all weighbridge dockets and will visually screen the material for the presence of foreign or suspect materials; and
- The slag recieval site will be secured by fencing and gates will be locked at night to prevent illegal dumping of waste at night.

In addition to the Specific Resource Recovery Exemption for the blast furnace slag from Mount Prosser, Port Kembla Outer Harbour Development has applied for a Specific Resource Recovery Exemption under the POEO (Waste) Regulations 2005 to utilise coal wash sourced from Illawarra Coal. At this stage the Specific Resource Recovery Exemption application for coal wash is under consideration by DECCW but has not yet been approved.

Other fill reclamation material (the source of which is currently unknown), that will need to be imported to the Site will be required to: (a) meet the NEPM Health Based Investigation Levels (HIL F) for commercial/industrial land use; and, (b) have contaminant leachability that is protective of receiving water bodies. Alternatively, an additional source recovery exemption application(s) will be required and the relevant conditions of the exemption met.

It would be important to ensure that the reclamation would be designed to ensure the existing groundwater flow regimes are not significantly altered and that there is no increased risk of harm associated with the groundwater contamination.

8.8 Impact of Reclamation Works on Groundwater Flow

The proposed reclamation area has the potential to impact on the groundwater flow regime in this area of the Outer Harbour, particularly if the hydraulic conductivity of the reclamation area was significantly different to that of the natural soil profile of the Outer Harbour shoreline. It is likely that that majority of groundwater discharge is along the current shoreline, with a small density driven flow component at the bottom of the harbour. The rate limiting factor will be the hydraulic conductivity of the shore-side material.

The hydraulic conductivity of the compacted dredged sediments or blast furnace slag fill (or other similar material) that will be placed as part of the reclamation is likely to be similar or greater than the existing foreshore, therefore the change in the flow regime is likely to be insignificant. The density driven base flow, if occurring, will likely be reduced given the additional material that will be placed during the reclamation.

The rate limiting factor of the groundwater discharge will be the hydraulic conductivity of the shore-side material. From a contamination standpoint the flux of contamination migrating into the harbour will not change due to the placement of material in the reclamation area, in that the hydraulic conductivity of the existing foreshore material will not change significantly. In the unlikely case the hydraulic conductivity of the placed material is significantly less than the existing material, the groundwater flux and hence the contaminant flux will be reduced in the reclamation area.

9.0 Conclusions and Recommendations

Key outcomes of this land based investigation are summarised below together with recommendations for how potential contamination issues should be managed and addressed during the detailed design and construction phase of the Outer Harbour Redevelopment.

9.1 Conclusions

Based on the findings of this LBI, AECOM concludes the following:

9.1.1 Soil Contamination

- Fill materials containing some (<20%) anthropogenic inclusions of ash, gravels, glass and slag were encountered across the Site to the maximum investigation depth of 1.5 m bgs which is also expected to be the maximum depth of excavation required by the proposed link road construction and utility infrastructure;
- COPC in all samples were less than the adopted site assessment criteria with the exception of:
  - An elevated copper concentration (12 900 mg/kg relative to the SAC of 5 000 mg/kg) reported in one sample from borehole BH08 at 0.2-0.3 m bgs (collected from dark brown and black sand and coarse gravel fill with ash); and
  - Chrysotile asbestos fibres were identified in one sample from borehole BH10 from 0.5 -0.6 m bgs (collected from dark brown and black sand and coarse gravel fill with ash).
- If disposed of to an off-site landfill, the fill materials encountered by the investigation (excepting those containing asbestos) would likely be classified as '*General Solid Waste'* in accordance with NSW DECC (2008) Waste Classification Guidelines;
- Historic environmental assessment results, together with anecdotal evidence associated with fill materials in industrial precincts including at Port Kembla, suggest that there is a high risk of isolated 'hotspots' of contamination being identified during the course of excavation activities within fill material across the Site. Potential impacts associated with these identified hotspots include:
  - Mobilisation of contaminated soils from excavation works and the movement of construction vehicles which could result in the generation of new hot spots; and
  - Mobilisation of contaminants into surface water bodies which could ultimately impact the receiving waters of Darcy Road Drain, Salty Creek and the Outer Harbour.

These hotspot areas can be managed with the preparation and implementation of a Construction Environmental Management Plan.

- The greatest potential for contaminated soil mobilisation would likely occur during excavation and construction activities associated with the new road link from Christy Drive to the multi-purpose terminal.
- Disturbance of fill materials would be controlled by a Site Management Plan (SMP) as part of relevant CEMPs for the project. The SMP would establish a suitable management framework for excavation works, which would include identifying contamination hotspots based on visual and odour observations and through detailed soil sampling analysis, if required. Appropriate management of contamination 'hotspots' could include selective excavation, stockpiling, characterisation and disposal (either within the reclamation area or to an offsite soil remediation facility).
- Construction workers who may come into contact with material that is suspected of being contaminated would employ appropriate hygiene procedures and wear proper personal protective equipment to minimise the risk of human health impact through accidental ingestion, inhalation and dermal exposure pathways.
- Due to the proposed likely depth of excavations (approximately 1.5 m bgs), acid sulphate soils are not likely to be excavated during the proposed road construction works and, consequently, these materials will not require management.
- The fill materials encountered by the investigation are generally considered suitable for re-use as part of the proposed new road link development (ie. commercial / industrial land use) with the exception of: (a) a hotspot of copper contamination located at 0.2 to 0.3 m bgs in borehole BH08; (b) a hotspot of asbestos fibres detected at 0.5-0.6 m bgs at BH10; and (c) other contamination 'hotspots' that might be encountered during the development works; and
- Based on available information, it appears that no site investigations have been conducted on the proposed site for the extension of the railway siding at the Pacific National South Yard. However there is low potential

for identifying contaminants other than those typically found within rail corridors and such contaminants can be easily managed during construction and are unlikely to result in significant environmental risk.

9.1.2 Groundwater Contamination

- The Douglas Partner (2009) investigation concluded that the depth to groundwater in the area of the proposed western New Road Link Corridor ranged between 4.26 and 4.3 m bgs while groundwater in the area of the proposed eastern New Road Link Corridor leading to the Container Terminal ranged between 2.6 and 2.65 m bgl. Consequently, any excavations to a depth of less than or equal to 1.5 m bgs are not likely to encounter groundwater. Therefore, management of groundwater is not expected to be required as part of the land based redevelopment works.
- Historical groundwater results indicate heavy metal (specifically arsenic, copper, zinc, lead, cadmium and nickel) contamination exceeding the adopted groundwater assessment criteria have been reported within the vicinity of the Site and the surrounding Outer Harbour foreshore area, with the highest historical concentrations identified between the Darcy Road Drain and the No. 3 Jetty. Consequently, groundwater contamination in the vicinity of the Site is considered to be a regional issue that is not specific to the Site.
- PAH, PCB and OCP groundwater contamination exceeding the adopted groundwater assessment criteria have not been historically identified within groundwater, although there is potential for PAH and PCB impact due to contamination identified within fill and natural soils.
- TPH and BTEX contamination has not been historically identified in groundwater but there is potential for groundwater impact due to several known TPH impacted fill and natural soils identified in historical investigations.
- The proposed reclamation area in the Outer Harbour has the potential to impact on the groundwater flow regime in this area, particularly if the reclamation area was of a significantly different hydraulic conductivity to the naturally permeable soil profile of the Outer Harbour shoreline. It would be important to ensure that the reclamation would be designed to ensure the existing groundwater flow regimes are not significantly altered and that there is no increased risk of harm associated with the groundwater contamination.
- Management of groundwater is not expected to be required as part of the land-based works. Despite this, it is recommended that the existing groundwater monitoring programme undertaken for the Outer Harbour continues to identify trends and any impact on the regional groundwater arising from the Outer Harbour development.

9.1.3 Imported Fill Material

PKPC has made application to DECCW for a Specific Resource Recovery Exemption under the POEO (Waste) Regulations 2005 to utilise blast furnace slag from the Mount Prosser stockpile area in Port Kembla for reclamation purposes as part of the Outer Harbour development. This stockpile area contains approximately 1.5 Mt and is located in relatively close proximity to the Outer Harbour. The stockpile was generated by Australian Steel Mill Services (ASMS) as a by product of the iron making process during separation of the molten iron from impurities in iron making blast furnaces.

The blast furnace slag is generally inert material which is similar in composition to basalt. Samples of the material contained in the Mount Prosser stockpile area has been tested and certified by a NATA accredited laboratory. Similar material has already been approved for use in reclamation areas within parts of the Inner Harbour.

At this stage, draft approval has been received from DECCW for a Specific Resource Recovery Exemption application for blast furnace slag. PKPC will be required to address any specific requirements contained in the approval.

At the 17 June 2009 meeting with DECCW it was noted that slag often has contamination concerns (for example ammonia and tar) as a result of other waste streams being disposed of with the “clean” slag. Construction methods for the proposed re-development will therefore need to include protocols for verifying that other waste streams were not being filled with the slag. PKPC has been proactive on this matter and is proposing to implement Quality Assurance controls to ensure that the fill material would be suitable for reclamation purposes which would include visual screening of all slag material imported to site and associated waste tracking measures which would include:

- Weighing of all vehicles on a calibrated weighbridge at source before they leave the ASMS with a weighbridge docket being issued for each vehicle leaving the site. The docket will detail truck registration number, time, date, material code and the intended destination of the material. This information will be stored on a database by ASMS;

- PKPC will keep copies of all weighbridge dockets and will visually screen the material for the presence of foreign or suspect materials; and
- The slag recieval site will be secured by fencing and gates will be locked at night to prevent illegal dumping of waste at night.

In addition to the Specific Resource Recovery Exemption for the blast furnace slag from Mount Prosser, PKPC has applied for a Specific Resource Recovery Exemption under the POEO (Waste) Regulations 2005 to utilise coal wash sourced from Illawarra Coal. At this stage the Specific Resource Recovery Exemption application for coal wash is under consideration by DECCW but has not yet been approved.

Additional fill reclamation material (the source of which is currently unknown), that will need to be imported to the Site will be required to: (a) meet the NEPM Health Based Investigation Levels (HIL F) for commercial/industrial land use; and, (b) have contaminant leachability that is protective of receiving water bodies. Alternatively, an additional source recovery exemption application(s) will be required and the relevant conditions met.

9.1.4 Stage 2 and 3 of Concept Plan

- The results of historic investigations in the area of the eastern New Road Link Corridor to the Container Terminal and to the multi-purpose terminal (both off Foreshore Road) indicates that similar soil contamination issues are likely to be present in this area as those encountered at the Site during this LBI.
- The greatest potential for contaminated soil mobilisation would likely occur during excavation and construction activities associated with the new road links in the following areas:
  - from Foreshore Road to both the container terminals and multi-purpose terminals.
  - from Darcy Road to the boat harbour carpark.

Based on the findings of this LBI, it is considered that potentially impacted material excavated during development works in the above areas can be managed either through further investigation as part of project applications in the future and/or with the preparation and implementation of a Construction Environmental Management Plan.

9.2 Recommendations

Based on the findings of this LBI, AECOM recommends that:

- Disturbance of fill materials within the site as part of the development works be controlled by a Construction Environmental Management Plan to manage any excavation works and to facilitate:
  - Identification of contamination ‘hotspots’ based on visual observations and soil sample analysis, if required. Consequently, excavation works should be supervised by an appropriately experienced environmental scientist or engineer.
  - Appropriate management of contamination including selective excavation (to minimise quantities), stockpiling, characterisation and disposal – likely to an off-site licensed landfill assuming that the material is not suitable for inclusion within the reclamation area.
- Background groundwater monitoring should be conducted at the Site prior the Stage 1 works and annually thereafter. The monitoring program should include analysis of samples for the COPC identified in this report.
- If is also recommended the reclamation area be designed to ensure the existing groundwater flow regimes are not significantly altered and that there is no risk of harm associated with the groundwater contamination.
- AECOM also recommends that a Limited Phase 2 Environmental Site Investigation be undertaken at the proposed site for the extension of the railway siding at the Pacific National South Yard to assess potential contamination issues in this area. Assuming that the additional Phase 2 Environmental Site Investigation demonstrates that the railway siding has similar contaminant characteristics to those identified at the Site, it is likely that the contamination could be managed with the preparation of a Construction Environmental Management Plan.

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10.0 Limitations

This document was prepared for the sole use of Port Kembla Outer Harbour Development (PKPC) the only intended beneficiary of our work. Any advice, opinions or recommendations contained in this document should be read and relied upon only in the context of the document as a whole and are considered current to the date of this document. Any other party should satisfy themselves that the scope of work conducted and reported herein meets their specific needs. AECOM cannot be held liable for third party reliance on this document, as AECOM is not aware of the specific needs of the third party.

From a technical perspective, the subsurface environment at any Site may present substantial uncertainty. It is a heterogeneous, complex environment, in which small subsurface features or changes in geologic conditions can have substantial impacts on water and chemical movement. Uncertainties may also affect source characterisation assessment of chemical fate and transport in the environment, assessment of exposure risks and health effects, and remedial action performance.

AECOM's professional opinions are based upon its professional judgement, experience, and training. These opinions are also based upon data derived from the testing and analysis described in this document. It is possible that additional testing and analysis might produce different results and/or different opinions. AECOM has limited its investigation to the scope agreed upon with its client. AECOM believes that its opinions are reasonably supported by the testing and analysis that have been done, and that those opinions have been developed according to the professional standard of care for the environmental consulting profession in this area at this time. That standard of care may change and new methods and practices of exploration, testing, analysis and remediation may develop in the future, which might produce different results. AECOM’s professional opinions contained in this document are subject to modification if additional information is obtained, through further investigation, observations, or validation testing and analysis during remedial activities.

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11.0 References

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Tables

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TABLE T1
Analytical Results
Land Based Investigation
Part of EA for PKPC Outer Harbour Redevelopment
Port Kembla NSW

	ChemName	Units	EQL	NSW EPA (1994)	NSW DECC	NSW DECC (2008) Waste Classification Guidelines						LocCode	BH01	BH01	BH01	BH01	BH02	BH02	BH02	BH03	BH03	BH03	BH03	BH04	BH04	BH04
						General Solid Waste (GSW)			Restricted Solid Waste (RSW)			Sample Depth	0.5-0.6	0.5-0.6	1.4-1.5	1.4-1.5	0.2-0.3	1.0-1.1	1.0-1.1	0.2-0.3	0.2-0.3	1.0-1.1	1.0-1.1	0.2-0.3	0.2-0.3	1.4-1.5
					SIL_4	CT1	SCC1	TCLP1	CT2	SCC2	TCLP2	Sample Date	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009
					(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)	(mg/kg)	(mg/kg)	(mg/L)	Matrix	FILL	TCLP	FILL	TCLP	FILL	FILL	TCLP	FILL	TCLP	FILL	TCLP	FILL	TCLP	FILL
BTEX	Benzene	mg/kg	0.2	1		10	18	0.5	40	72	2		<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2
BTEX	Ethylbenzene	mg/kg	0.5	50		600	1080	30	2400	4320	120		<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
BTEX	Toluene	mg/kg	0.5	130		288	518	14.4	1152	2073	57.6		<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
BTEX	Xylene (m & p)	mg/kg	0.5										<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
BTEX	Xylene (o)	mg/kg	0.5										<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
BTEX	Xylene Total	mg/kg	1	25		1000	1800	50	4000	7200	200		<1	-	<1	-	<1	<1	-	<1	-	<1	-	<1	-	<1
	Hexachlorobenzene	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
Metals	Arsenic	mg/kg (mg/L*)	5		500	100	500	5	400	2000	20		<5	<0.1	<5	<0.1	<5	<5	<0.1	6	<0.1	<5	<0.1	<5	<0.1	<5
Metals	Cadmium	mg/kg (mg/L*)	1		100	20	100	1	80	400	4		<1	<0.05	<1	<0.05	6	<1	<0.05	<1	<0.05	<1	<0.05	<1	<0.05	<1
Metals	Chromium (III+VI)	mg/kg (mg/L*)	2		600000								2	<0.1	4	<0.1	12	7	<0.1	286	<0.1	9	<0.1	144	<0.1	7
Metals	Copper	mg/kg (mg/L*)	5		5000								<5	<0.1	32	<0.1	3890	37	<0.1	3800	12.9	53	<0.1	1690	0.6	45
Metals	Lead	mg/kg (mg/L*)	5		1500	100	1500	5	400	6000	20		<5	<0.1	12	<0.1	21	20	<0.1	33	<0.1	11	<0.1	57	<0.1	16
Metals	Mercury	mg/kg (mg/L*)	0.1		75	4	50	0.2	16	200	0.8		<0.1	<0.001	<0.1	<0.001	<0.1	<0.1	<0.001	<0.1	<0.001	<0.1	<0.001	<0.1	<0.001	<0.1
Metals	Nickel	mg/kg (mg/L*)	2		3000	40	1050	2	160	4200	8		<2	<0.1	12	<0.1	14	6	<0.1	3	<0.1	11	<0.1	8	<0.1	8
Metals	Zinc	mg/kg (mg/L*)	5		35000								5	<0.1	50	0.3	377	82	0.5	82	1	30	0.3	148	0.7	57
OCP	4,4-DDE	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	a-BHC	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Aldrin	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Aldrin + Dieldrin	mg/kg	0.1		50								<0.1	-	<0.1	-	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1
OCP	b-BHC	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Chlordane (cis)	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Chlordane (trans)	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	d-BHC	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	DDD	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	DDT	mg/kg	0.2										<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2
OCP	DDT+DDE+DDD	mg/kg	0.3		1000								<0.3	-	<0.3	-	<0.3	<0.3	-	<0.3	-	<0.3	-	<0.3	-	<0.3
OCP	Dieldrin	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Endosulfan I	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Endosulfan II	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Endosulfan sulphate	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Endrin	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Endrin aldehyde	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Endrin ketone	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	g-BHC (Lindane)	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Heptachlor	mg/kg	0.05		50								<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Heptachlor epoxide	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OCP	Methoxychlor	mg/kg	0.2										<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2
OP	Chlorpyrifos	mg/kg	0.05			4	7.5	0.2	16	30	0.8		<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OP	Chlorpyrifos-methyl	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OP	Diazinon	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OP	Dimethoate	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
OP	Ethion	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
PAH/Phenols	PAH (total, NSW Waste 2008)	mg/kg	-				200			800			-	-	-	-	-	-	-	-	-	-	-	-	-	-
PAH/Phenols	2,4,5-trichlorophenol	mg/kg	0.5			8000	14400	400	32000	57600	1600		<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
PAH/Phenols	2,4-dichlorophenol	mg/kg	0.5										<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
PAH/Phenols	2,4-dimethylphenol	mg/kg	0.5										<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
PAH/Phenols	2-chlorophenol	mg/kg	0.5										<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
PAH/Phenols	2-methylphenol	mg/kg	0.5										<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
PAH/Phenols	3-&4-methylphenol	mg/kg	1										<1	-	<1	-	<1	<1	-	<1	-	<1	-	<1	-	<1
PAH/Phenols	Acenaphthene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Acenaphthylene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Anthracene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Benz(a)anthracene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Benzo(a) pyrene	mg/kg (µg/L*)	0.5		5	0.8	10	0.04	3.2	23	0.16		<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
PAH/Phenols	Benzo(b)fluoranthene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Benzo(g,h,i)perylene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Benzo(k)fluoranthene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Chrysene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Dibenz(a,h)anthracene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Fluoranthene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Fluorene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Indeno(1,2,3-c,d)pyrene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Naphthalene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Phenanthrene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
PAH/Phenols	Phenol	mg/kg (µg/L*)	0.5		42500	288	518	14.4	1152	2073	57.6		<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
PAH/Phenols	Pyrene	mg/kg (µg/L*)	0.5										<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5
	PCBs (Sum of total)	mg/kg	0.1		50		50			50			<0.1	-	<0.1	-	<0.1	<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1
Pesticides	Pesticides (total, NSW Waste 2008)	mg/kg	1				250			1000			<1	-	<1	-	<1	<1	-	<1	-	<1	-	<1	-	<1
Pesticides	Azinophos methyl	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
Pesticides	Carbophenothion	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
Pesticides	Chlorfenvinphos	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
Pesticides	Demeton-S-methyl	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
Pesticides	Dichlorvos	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
Pesticides	Fenamiphos	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
Pesticides	Fenthion	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
Pesticides	Malathion	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
Pesticides	Methyl parathion	mg/kg	0.2										<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2
Pesticides	Monocrotophos	mg/kg	0.2										<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2
Pesticides	Parathion	mg/kg	0.2										<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2
Pesticides	Pirimphos-ethyl	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
Pesticides	Prothiofos	mg/kg	0.05										<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05
SVOC	2,4,6-trichlorophenol	mg/kg	0.5			40	72	2	160	288	8		<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
SVOC	2,6-dichlorophenol	mg/kg	0.5										<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
SVOC	2-nitrophenol	mg/kg	0.5										<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
SVOC	4-chloro-3-methylphenol	mg/kg	0.5										<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5
SVOC	Pentachlorophenol	mg/kg	2										<2	-	<2	-	<2	<2	-	<2	-	<2	-	<2	-	<2
TPH	TPH C 6 - C 9 Fraction	mg/kg	10	65			650			2600			<10	-	<10	-	<10	<10	-	<10	-	<10	-	<10	-	<10
TPH	TPH C10 - C14 Fraction	mg/kg	50										<50	-	<50	-	<50	<50	-	<50	-	<50	-	<50	-	<50
TPH	TPH C15 - C28 Fraction	mg/kg	100										<100	-	<100	-	<100	<100	-	<100	-	<100	-	<100	-	<100
TPH	TPH C29-C36 Fraction	mg/kg	100										<100	-	<100	-	<100	<100	-	<100	-	<100	-	<100	-	<100
TPH	TPH+C10 - C36 (Sum of total)	mg/kg	250	1000			10000			40000			<250	-	<250	-	<250	<250	-	<250	-	<250	-	<250	-	<250
	Asbestos	-	ND		ND	ND			ND				ND	-	-	-	ND	ND	-	ND	-	-	-	ND	-	-

Notes

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
EQL: Estimated Quantitation Limit
< : result less than EQL
- OR *nc* : not analysed or non calcuable

CT1 / CT2: Contaminant Threshold Values
SCC: Specific Contaminant Concentration
NEPM: National Environment Protection Measure
No Shading = Classified as General Solid Waste (GSW)
Shading = Classified as Restricted Solid Waste (RSW)

TCLP: Toxicity Characteristic Leaching Procedure
* Units for TCLP analysis
UMF = Unidentified Mineral Fibres
Shading = result > NSW DECC SIL_4 (commercial/industrial land use)

Assessment Criteria
NSW DECC (2008) Waste Classification Guidelines

NEPM (1999) HIL F

Data Entry: KP/KOB
Checked: MJ
ENSR Australia Pty Ltd. (trading as AECOM)

TABLE T1
Analytical Results
Land Based Investigation
Part of EA for PKPC Outer Harbour Redevelopment
Port Kembla NSW

	ChemName	Units	EQL	NSW EPA (1994)	NSW DECC	NSW DECC (2008) Waste Classification Guidelines						BH04	BH05	BH05	BH05	BH05	BH06	BH06	BH06	BH06	BH07	BH07	BH07	BH07	BH08	BH08
						General Solid Waste (GSW)			Restricted Solid Waste (RSW)			1.4-1.5	0.5-0.6	0.5-0.6	1.4-1.5	1.4-1.5	0.2-0.3	1-1.1	1-1.1	1.4-1.5	0.2-0.3	0.2-0.3	1-1.1	1-1.1	0.2-0.3	0.2-0.3
					SIL_4	CT1	SCC1	TCLP1	CT2	SCC2	TCLP2	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009
					(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)	(mg/kg)	(mg/kg)	(mg/L)	TCLP	FILL	TCLP	FILL	TCLP	FILL	FILL	TCLP	FILL	FILL	TCLP	FILL	TCLP	FILL	TCLP
BTEX	Benzene	mg/kg	0.2	1		10	18	0.5	40	72	2	-	<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-
	Ethylbenzene	mg/kg	0.5	50		600	1080	30	2400	4320	120	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	Toluene	mg/kg	0.5	130		288	518	14.4	1152	2073	57.6	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	Xylene (m & p)	mg/kg	0.5									-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	Xylene (o)	mg/kg	0.5									-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	Xylene Total	mg/kg	1	25		1000	1800	50	4000	7200	200	-	<1	-	<1	-	<1	<1	-	<1	<1	-	<1	-	<1	-
	Hexachlorobenzene	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
Metals	Arsenic	mg/kg (mg/L*)	5		500	100	500	5	400	2000	20	<0.1	<5	<0.1	<5	<0.1	<5	<5	<0.1	<5	<5	<0.1	<5	<0.1	6	<0.1
	Cadmium	mg/kg (mg/L*)	1		100	20	100	1	80	400	4	<0.05	<1	<0.05	<1	<0.05	<1	<1	<0.05	<1	<1	<0.05	<1	<0.05	2	<0.05
	Chromium (III+VI)	mg/kg (mg/L*)	2		600000							<0.1	18	<0.1	9	<0.1	504	16	<0.1	23	502	<0.1	27	<0.1	480	<0.1
	Copper	mg/kg (mg/L*)	5		5000							<0.1	138	<0.1	57	<0.1	52	85	<0.1	183	135	<0.1	122	<0.1	12900	<0.1
	Lead	mg/kg (mg/L*)	5		1500	100	1500	5	400	6000	20	<0.1	7	<0.1	5	<0.1	10	37	<0.1	19	11	<0.1	14	<0.1	579	0.2
	Mercury	mg/kg (mg/L*)	0.1		75	4	50	0.2	16	200	0.8	<0.001	<0.1	<0.001	<0.1	<0.001	<0.1	<0.1	<0.001	14	<0.1	<0.001	0.2	<0.001	0.2	<0.001
	Nickel	mg/kg (mg/L*)	2		3000	40	1050	2	160	4200	8	<0.1	7	<0.1	27	0.1	11	12	<0.1	<0.1	7	<0.1	18	<0.1	423	2
	Zinc	mg/kg (mg/L*)	5		35000							1.2	39	0.2	93	0.8	23	42	0.2	61	37	<0.1	67	0.2	703	5.2
OCP	4,4-DDE	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	a-BHC	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Aldrin	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Aldrin + Dieldrin	mg/kg	0.1		50							-	<0.1	-	<0.1	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	-	<0.1	-
	b-BHC	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Chlordane (cis)	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Chlordane (trans)	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	d-BHC	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	DDD	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	DDT	mg/kg	0.2									-	<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-
	DDT+DDE+DDD	mg/kg	0.3		1000							-	<0.3	-	<0.3	-	<0.3	<0.3	-	<0.3	<0.3	-	<0.3	-	<0.3	-
	Dieldrin	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Endosulfan I	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Endosulfan II	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Endosulfan sulphate	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Endrin	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Endrin aldehyde	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Endrin ketone	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	g-BHC (Lindane)	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Heptachlor	mg/kg	0.05		50							-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Heptachlor epoxide	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Methoxychlor	mg/kg	0.2									-	<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-
OP	Chlorpyrifos	mg/kg	0.05			4	7.5	0.2	16	30	0.8	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Chlorpyrifos-methyl	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Diazinon	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Dimethoate	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Ethion	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
PAH/Phenols	PAH (total, NSW Waste 2008)	mg/kg	-				200			800		-	13.0	-	-	-	-	-	-	-	-	-	-	-	6.9	-
	2,4,5-trichlorophenol	mg/kg	0.5			8000	14400	400	32000	57600	1600	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	2,4-dichlorophenol	mg/kg	0.5									-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	2,4-dimethylphenol	mg/kg	0.5									-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	2-chlorophenol	mg/kg	0.5									-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	2-methylphenol	mg/kg	0.5									-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	3-&4-methylphenol	mg/kg	1									-	<1	-	<1	-	<1	<1	-	<1	<1	-	<1	-	<1	-
	Acenaphthene	mg/kg (µg/L*)	0.5									<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Acenaphthylene	mg/kg (µg/L*)	0.5									<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Anthracene	mg/kg (µg/L*)	0.5									<1	0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Benz(a)anthracene	mg/kg (µg/L*)	0.5									<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	0.8	<1
	Benzo(a) pyrene	mg/kg (µg/L*)	0.5		5	0.8	10	0.04	3.2	23	0.16	<0.5	2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5
	Benzo(b)fluoranthene	mg/kg (µg/L*)	0.5									<1	2.4	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	1.2	<1
	Benzo(g,h,i)perylene	mg/kg (µg/L*)	0.5									<1	3.3	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	0.6	<1
	Benzo(k)fluoranthene	mg/kg (µg/L*)	0.5									<1	0.8	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Chrysene	mg/kg (µg/L*)	0.5									<1	0.6	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	0.8	<1
	Dibenz(a,h)anthracene	mg/kg (µg/L*)	0.5									<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Fluoranthene	mg/kg (µg/L*)	0.5									<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	1.2	<1
	Fluorene	mg/kg (µg/L*)	0.5									<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Indeno(1,2,3-c,d)pyrene	mg/kg (µg/L*)	0.5									<1	2.3	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Naphthalene	mg/kg (µg/L*)	0.5									<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Phenanthrene	mg/kg (µg/L*)	0.5									<1	0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	0.6	<1
	Phenol	mg/kg (µg/L*)	0.5		42500	288	518	14.4	1152	2073	57.6	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	Pyrene	mg/kg (µg/L*)	0.5									<1	0.6	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	1.1	<1
	PCBs (Sum of total)	mg/kg	0.1		50		50			50		-	<0.1	-	<0.1	-	<0.1	<0.1	-	<0.1	<0.1	-	<0.1	-	<0.1	-
Pesticides	Pesticides (total, NSW Waste 2008)	mg/kg	1				250			1000		-	<1	-	<1	-	<1	<1	-	<1	<1	-	<1	-	<1	-
	Azinophos methyl	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Carbophenothion	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Chlorfenvinphos	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Demeton-S-methyl	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Dichlorvos	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Fenamiphos	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Fenthion	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Malathion	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Methyl parathion	mg/kg	0.2									-	<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-
	Monocrotophos	mg/kg	0.2									-	<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-
	Parathion	mg/kg	0.2									-	<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-
	Pirimphos-ethyl	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Prothiofos	mg/kg	0.05									-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
SVOC	2,4,6-trichlorophenol	mg/kg	0.5			40	72	2	160	288	8	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	2,6-dichlorophenol	mg/kg	0.5									-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	2-nitrophenol	mg/kg	0.5									-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	4-chloro-3-methylphenol	mg/kg	0.5									-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	Pentachlorophenol	mg/kg	2									-	<2	-	<2	-	<2	<2	-	<2	<2	-	<2	-	<2	-
TPH	TPH C 6 - C 9 Fraction	mg/kg	10	65			650			2600		-	<10	-	<10	-	<10	<10	-	<10	<10	-	<10	-	<10	-
	TPH C10 - C14 Fraction	mg/kg	50									-	<50	-	<50	-	<50	<50	-	<50	<50	-	<50	-	<50	-
	TPH C15 - C28 Fraction	mg/kg	100									-	<100	-	<100	-	<100	<100	-	<100	<100	-	<100	-	<100	-
	TPH C29-C36 Fraction	mg/kg	100									-	<100	-	<100	-	<100	<100	-	<100	<100	-	<100	-	<100	-
	TPH+C10 - C36 (Sum of total)	mg/kg	250	1000			10000			40000		-	<250	-	<250	-	<250	<250	-	<250	<250	-	<250	-	<250	-
	Asbestos	-	ND		ND	ND			ND			-	ND	-	-	-	-	ND	-		ND	-	-	-	ND	-

Notes
mg/kg: milligrams per kilogram
mg/L: milligrams per litre
EQL: Estimated Quantitation Limit
< : result less than EQL
- OR *nc* : not analysed or non calcuable
Assessment Criteria
NSW DECC (2008) Waste Classification Guidelines

CT1 / CT2: Contaminant Threshold Values
SCC: Specific Contaminant Concentration
NEPM: National Environment Protection Measure
No Shading = Classified as General Solid Waste (GSW)
Shading = Classified as Restricted Solid Waste (RSW)

NEPM (1999) HIL F

TCLP: Toxicity Characteristic Lea
* Units for TCLP analysis
UMF = Unidentified Mineral Fibres
Shading = result > NSW DECC S

Data Entry: KP/KOB
Checked: MJ
ENSR Australia Pty Ltd. (trading as AECOM)

TABLE T1
Analytical Results
Land Based Investigation
Part of EA for PKPC Outer Harbour Redevelopment
Port Kembla NSW

	ChemName	Units	EQL	NSW EPA (1994)	NSW DECC	NSW DECC (2008) Waste Classification Guidelines						BH08	BH08	BH09	BH09	BH09	BH09	BH10	BH10	BH10	BH10	BH10	BH11	BH11	BH11	BH11
						General Solid Waste (GSW)			Restricted Solid Waste (RSW)			1.4-1.5	1.4-1.5	0.2-0.3	0.2-0.3	0.5-0.6	0.5-0.6	0.5-0.6	0.5-0.6	1.0-1.1	1.4-1.5	1.4-1.5	0.5-0.6	0.5-0.6	1.4-1.5	1.4-1.5
					SIL_4	CT1	SCC1	TCLP1	CT2	SCC2	TCLP2	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009	6/07/2009
					(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)	(mg/kg)	(mg/kg)	(mg/L)	FILL	TCLP	FILL	TCLP	FILL	TCLP	FILL	TCLP	FILL	FILL	TCLP	FILL	TCLP	FILL	TCLP
BTEX	Benzene	mg/kg	0.2	1		10	18	0.5	40	72	2	<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-
	Ethylbenzene	mg/kg	0.5	50		600	1080	30	2400	4320	120	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	Toluene	mg/kg	0.5	130		288	518	14.4	1152	2073	57.6	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	Xylene (m & p)	mg/kg	0.5									<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	Xylene (o)	mg/kg	0.5									<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	Xylene Total	mg/kg	1	25		1000	1800	50	4000	7200	200	<1	-	<1	-	<1	-	<1	-	<1	<1	-	<1	-	<1	-
	Hexachlorobenzene	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
Metals	Arsenic	mg/kg (mg/L*)	5		500	100	500	5	400	2000	20	6	<0.1	<5	<0.1	5	<0.1	13	<0.1	22	10	<0.1	6	<0.1	<5	<0.1
	Cadmium	mg/kg (mg/L*)	1		100	20	100	1	80	400	4	<1	<0.05	<1	<0.05	1	<0.05	10	<0.05	3	2	<0.05	<1	<0.05	<1	<0.05
	Chromium (III+VI)	mg/kg (mg/L*)	2		600000							52	<0.1	506	<0.1	73	<0.1	49	<0.1	35	28	<0.1	6	<0.1	2	<0.1
	Copper	mg/kg (mg/L*)	5		5000							422	0.2	90	<0.1	398	<0.1	436	0.4	3300	1770	14.3	95	<0.1	7	<0.1
	Lead	mg/kg (mg/L*)	5		1500	100	1500	5	400	6000	20	51	<0.1	48	<0.1	97	<0.1	284	<0.1	1080	382	<0.1	55	<0.1	<5	<0.1
	Mercury	mg/kg (mg/L*)	0.1		75	4	50	0.2	16	200	0.8	<0.1	<0.001	<0.1	<0.001	<0.1	<0.001	0.3	<0.001	0.1	0.1	<0.001	<0.1	<0.001	<0.1	<0.001
	Nickel	mg/kg (mg/L*)	2		3000	40	1050	2	160	4200	8	58	0.3	17	<0.1	16	<0.1	13	<0.1	11	245	0.5	15	<0.1	<2	<0.1
	Zinc	mg/kg (mg/L*)	5		35000							154	0.6	48	<0.1	291	0.7	578	3.7	537	457	2.9	110	0.5	6	0.1
OCP	4,4-DDE	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	a-BHC	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Aldrin	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Aldrin + Dieldrin	mg/kg	0.1		50							<0.1	-	<0.1	-	<0.1	-	<0.1	-	<0.1	<0.1	-	<0.1	-	<0.1	-
	b-BHC	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Chlordane (cis)	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Chlordane (trans)	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	d-BHC	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	DDD	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	DDT	mg/kg	0.2									<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-
	DDT+DDE+DDD	mg/kg	0.3		1000							<0.3	-	<0.3	-	<0.3	-	<0.3	-	<0.3	<0.3	-	<0.3	-	<0.3	-
	Dieldrin	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Endosulfan I	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Endosulfan II	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Endosulfan sulphate	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Endrin	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Endrin aldehyde	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Endrin ketone	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	g-BHC (Lindane)	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Heptachlor	mg/kg	0.05		50							<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Heptachlor epoxide	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Methoxychlor	mg/kg	0.2									<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-
OP	Chlorpyrifos	mg/kg	0.05			4	7.5	0.2	16	30	0.8	<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Chlorpyrifos-methyl	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Diazinon	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Dimethoate	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Ethion	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	PAH (total, NSW Waste 2008)	mg/kg	-				200			800		-	-	-	-	-	-	4.2	-	-	3.9	-	-	-	-	-
PAH/Phenols	2,4,5-trichlorophenol	mg/kg	0.5			8000	14400	400	32000	57600	1600	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	2,4-dichlorophenol	mg/kg	0.5									<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	2,4-dimethylphenol	mg/kg	0.5									<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	2-chlorophenol	mg/kg	0.5									<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	2-methylphenol	mg/kg	0.5									<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	3-&4-methylphenol	mg/kg	1									<1	-	<1	-	<1	-	<1	-	<1	<1	-	<1	-	<1	-
	Acenaphthene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Acenaphthylene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Anthracene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Benz(a)anthracene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Benzo(a) pyrene	mg/kg (µg/L*)	0.5		5	0.8	10	0.04	3.2	23	0.16	<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
	Benzo(b)fluoranthene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	0.6	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Benzo(g,h,i)perylene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Benzo(k)fluoranthene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Chrysene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	0.6	<1	<0.5	0.7	<1	<0.5	<1	<0.5	<1
	Dibenz(a,h)anthracene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Fluoranthene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	0.7	<1	<0.5	0.8	<1	<0.5	<1	<0.5	<1
	Fluorene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Indeno(1,2,3-c,d)pyrene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Naphthalene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	0.8	<1	<0.5	<0.5	<1	<0.5	<1	<0.5	<1
	Phenanthrene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	0.9	<1	<0.5	1.5	<1	<0.5	<1	<0.5	<1
	Phenol	mg/kg (µg/L*)	0.5		42500	288	518	14.4	1152	2073	57.6	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	Pyrene	mg/kg (µg/L*)	0.5									<0.5	<1	<0.5	<1	<0.5	<1	0.6	<1	<0.5	0.9	<1	<0.5	<1	<0.5	<1
	PCBs (Sum of total)	mg/kg	0.1		50		50			50		<0.1	-	<0.1	-	<0.1	-	<0.1	-	0.23	<0.1	-	<0.1	-	<0.1	-
Pesticides	Pesticides (total, NSW Waste 2008)	mg/kg	1				250			1000		<1	-	<1	-	<1	-	<1	-	<1	<1	-	<1	-	<1	-
	Azinophos methyl	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Carbophenothion	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Chlorfenvinphos	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Demeton-S-methyl	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Dichlorvos	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Fenamiphos	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Fenthion	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Malathion	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Methyl parathion	mg/kg	0.2									<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-
	Monocrotophos	mg/kg	0.2									<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-
	Parathion	mg/kg	0.2									<0.2	-	<0.2	-	<0.2	-	<0.2	-	<0.2	<0.2	-	<0.2	-	<0.2	-
	Pirimphos-ethyl	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
	Prothiofos	mg/kg	0.05									<0.05	-	<0.05	-	<0.05	-	<0.05	-	<0.05	<0.05	-	<0.05	-	<0.05	-
SVOC	2,4,6-trichlorophenol	mg/kg	0.5			40	72	2	160	288	8	<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	2,6-dichlorophenol	mg/kg	0.5									<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	2-nitrophenol	mg/kg	0.5									<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	4-chloro-3-methylphenol	mg/kg	0.5									<0.5	-	<0.5	-	<0.5	-	<0.5	-	<0.5	<0.5	-	<0.5	-	<0.5	-
	Pentachlorophenol	mg/kg	2									<2	-	<2	-	<2	-	<2	-	<2	<2	-	<2	-	<2	-
TPH	TPH C 6 - C 9 Fraction	mg/kg	10	65			650			2600		<10	-	<10	-	<10	-	<10	-	<10	<10	-	<10	-	<10	-
	TPH C10 - C14 Fraction	mg/kg	50									<50	-	<50	-	<50	-	<50	-	<50	<50	-	<50	-	<50	-
	TPH C15 - C28 Fraction	mg/kg	100									<100	-	<100	-	<100	-	<100	-	<100	<100	-	<100	-	<100	-
	TPH C29-C36 Fraction	mg/kg	100									<100	-	<100	-	<100	-	<100	-	<100	<100	-	<100	-	<100	-
	TPH+C10 - C36 (Sum of total)	mg/kg	250	1000			10000			40000		<250	-	<250	-	<250	-	<250	-	<250	<250	-	<250	-	<250	-
	Asbestos	-	ND		ND	ND			ND			-	-	-	-	ND	-	Chrysotile	-		-	-	UMF	-	-	-

Notes

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
EQL: Estimated Quantitation Limit
< : result less than EQL
- OR *nc* : not analysed or non calcuable

CT1 / CT2: Contaminant Threshold Values
SCC: Specific Contaminant Concentration
NEPM: National Environment Protection Measure
No Shading = Classified as General Solid Waste (GSW)
Shading = Classified as Restricted Solid Waste (RSW)

TCLP: Toxicity Characteristic Lea
* Units for TCLP analysis
UMF = Unidentified Mineral Fibre
Shading = result > NSW DECC S

Assessment Criteria
NSW DECC (2008) Waste Classification Guidelines
NEPM (1999) HIL F

Data Entry: KP/KOB
Checked: MJ
ENSR Australia Pty Ltd. (trading as AECOM)

Table T2
Quality Assurance and Quality Control Analytical Results
Land Based Investigation
Part of EA for PKPC Outer HArbour Redevelopment

		Field_ID			BH06_1.4-1.5	QC105	RPD	BH10_1.0-1.1	QC107	RPD	QC108	RPD
		LocCode			BH06	BH06		BH10	BH10		BH10	
		Sample_Depth_Range			1.4-1.5	1.4-1.5		1.0-1.1	0.5-0.6		0.5-0.6	
		Sampled_Date-Time			6/07/2009	6/07/2009		6/07/2009	6/07/2009		6/07/2009	
		Matrix_Description			FILL	FILL	%	FILL	FILL	%	FILL	%
ChemName		Units	EQL	SIL_4 (mg/kg)								
BTEX	Benzene	mg/kg	0.2		<0.2	<0.2	nc	<0.2	<0.2	nc	<0.2	nc
	Ethylbenzene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Toluene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Xylene (m & p)	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Xylene (o)	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Xylene Total	mg/kg	1		<1	<1	nc	<1	<1	nc	<1	nc
	Hexachlorobenzene	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
Metals	Arsenic	mg/kg	5	**500**	<5	<5	nc	22	20	10	16	32
	Cadmium	mg/kg	1	**100**	<1	<1	nc	3	4	29	3.2	6.452
	Chromium (III+VI)	mg/kg	2	**600000**	23	29	23	35	31	12	28	22
	Copper	mg/kg	5	**5000**	183	190	4	3300	3820	15	2270	37
	Lead	mg/kg	5	**1500**	19	23	19	1080	1040	4	805	29
	Mercury	mg/kg	0.1	**75**	14	<0.1	nc	0.1	0.2	67	0.45	127.3
	Nickel	mg/kg	2	**3000**	<0.1	15	nc	11	11	0	9	20
	Zinc	mg/kg	5	**35000**	61	70	14	537	502	7	317	52
OCP	4,4-DDE	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	a-BHC	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Aldrin	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Aldrin + Dieldrin	mg/kg	0.1	**50**	<0.1	<0.1	nc	<0.1	<0.1	nc	<0.1	nc
	b-BHC	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Chlordane (cis)	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Chlordane (trans)	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	d-BHC	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	DDD	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	DDT	mg/kg	0.2		<0.2	<0.2	nc	<0.2	<0.2	nc	<0.2	nc
	DDT+DDE+DDD	mg/kg	0.3	**1000**	<0.3	<0.3	nc	<0.3	<0.3	nc	<0.3	nc
	Dieldrin	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Endosulfan I	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Endosulfan II	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Endosulfan sulphate	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Endrin	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Endrin aldehyde	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Endrin ketone	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	g-BHC (Lindane)	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Heptachlor	mg/kg	0.05	**50**	<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Heptachlor epoxide	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Methoxychlor	mg/kg	0.2		<0.2	<0.2	nc	<0.2	<0.2	nc	<0.2	nc
OP	Chlorpyrifos	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Chlorpyrifos-methyl	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Diazinon	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Dimethoate	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Ethion	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
PAH/Phenols	PAH (total, NSW Waste 2008)	mg/kg	-		-	-	-	-	-	nc	-	-
	2,4,5-trichlorophenol	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	2,4-dichlorophenol	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	2,4-dimethylphenol	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	2-chlorophenol	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	2-methylphenol	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	3-&4-methylphenol	mg/kg	1		<1	<1	nc	<1	<1	nc	<1	nc
	Acenaphthene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Acenaphthylene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Anthracene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Benz(a)anthracene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Benzo(a) pyrene	mg/kg	0.5	**5**	<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Benzo(b)fluoranthene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Benzo(g,h,i)perylene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Benzo(k)fluoranthene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Chrysene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Dibenz(a,h)anthracene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Fluoranthene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Fluorene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Naphthalene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Phenanthrene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Phenol	mg/kg	0.5	**42500**	<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Pyrene	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	PCBs (Sum of total)	mg/kg	0.1	**50**	<0.1	<0.1	nc	0.23	<0.1	nc	0.9	nc
Pesticides	Pesticides (total, NSW Waste 2008)	mg/kg	1		<1	<1	nc	<1	<1	nc	<1	nc
	Azinophos methyl	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Carbophenothion	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Chlorfenvinphos	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Demeton-S-methyl	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Dichlorvos	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Fenamiphos	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Fenthion	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Malathion	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Methyl parathion	mg/kg	0.2		<0.2	<0.2	nc	<0.2	<0.2	nc	<0.2	nc
	Monocrotophos	mg/kg	0.2		<0.2	<0.2	nc	<0.2	<0.2	nc	<0.2	nc
	Parathion	mg/kg	0.2		<0.2	<0.2	nc	<0.2	<0.2	nc	<0.2	nc
	Pirimphos-ethyl	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
	Prothiofos	mg/kg	0.05		<0.05	<0.05	nc	<0.05	<0.05	nc	<0.05	nc
SVOC	2,4,6-trichlorophenol	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	2,6-dichlorophenol	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	2-nitrophenol	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	4-chloro-3-methylphenol	mg/kg	0.5		<0.5	<0.5	nc	<0.5	<0.5	nc	<0.5	nc
	Pentachlorophenol	mg/kg	2		<2	<2	nc	<2	<2	nc	<2	nc
TPH	TPH C 6 - C 9 Fraction	mg/kg	10		<10	<10	nc	<10	<10	nc	<10	nc
	TPH C10 - C14 Fraction	mg/kg	50		<50	<50	nc	<50	<50	nc	<50	nc
	TPH C15 - C28 Fraction	mg/kg	100		<100	<100	nc	<100	<100	nc	<100	nc
	TPH C29-C36 Fraction	mg/kg	100		<100	<100	nc	<100	<100	nc	<100	nc
	TPH+C10 - C36 (Sum of total)	mg/kg	250		<250	<250	nc	<250	<250	nc	<250	nc

Notes
mg/kg: milligrams per kilogram
EQL: Estimated Quantitation Limit
RPD: Relative Percentage Difference
< : result less than EQL
- OR *nc* : not analysed or non calcuable
Italics and **Bold** = RPD > 10 x EQL
Assessment Criteria
Shading = result > NSW DECC SIL_4
Data Entry:KOB
Data Review: MJ
ENSR Australia Pty Ltd (trading as AECOM)

Table T3
Historical Groundwater Results
Land Based Investigation
Part of EA for PKPC Outer Harbour Redevelopment
Port Kembla NSW

Well ID	No. of Sampling Rounds	METALS	Arsenic			Cadmium			Chromium			Copper			Lead			Mercury			Nickel			Zinc		
		Range	2009*	Min	Max	2009*	Min	Max	2009*	Min	Max	2009*	Min	Max	2009*	Min	Max	2009*	Min	Max	2009*	Min	Max	2009*	Min	Max
		ANZECC (2000	0.0045 (As (V) - LR)			0.0055			0.0044 (Cr VI)			0.0013			0.0044			0.0004			0.07			0.015		
		Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
CGMW2	2		0.0015	0.001	0.0015	0.001	<0.0002	0.0001	0.0021	0.0021	0.004	0.022	0.002	0.022	0.0023	<0.001	0.0023	<LOR	<LOR	<LOR	0.29	0.003	0.29	0.7	<0.0001	0.7
CGMW5	2		0.0088	0.007	0.0088	0.0002	<0.0002	0.0002	0.0011	0.0011	0.002	0.0054	0.004	0.0054	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.022	0.003	0.022	0.046	<0.001	0.046
MW3	12		0.036	<0.001	0.036	0.0015	<0.001	0.004	<LOR	<LOR	<LOR	0.055	0.009	0.5	<0.001	<0.001	0.082	<LOR	<LOR	<LOR	0.15	0.12	0.307	0.17	0.17	6.51
MW6	11		0.0056	0.028	0.1	<0.0001	<0.0001	<0.001	<0.001	<0.001	0.002	0.0044	0.0044	0.029	<0.001	<0.001	0.47	<LOR	<LOR	<LOR	0.002	0.002	<0.1	0.0061	0.0061	0.19
MW15	10		0.075	0.075	0.473	0.0006	0.0006	0.003	<LOR	<LOR	<LOR	0.031	0.031	0.086	<0.001	<0.001	0.003	<LOR	<LOR	<LOR	0.11	0.11	0.47	0.09	0.09	0.55
MW16	7		0.024	<0.001	0.059	0.0061	<0.001	0.0104	<LOR	<LOR	<LOR	0.078	0.011	0.113	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.28	0.12	0.394	1	0.072	1.48
OHMW21	4		<0.001	<0.001	0.006	0.0054	<0.0001	0.0054	0.0011	<0.001	0.0011	0.017	<0.001	0.017	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.18	<0.001	0.18	0.18	0.005	0.18
OHMW22	4		0.061	0.061	0.072	<0.0001	<0.0001	<0.0001	<LOR	<LOR	<LOR	0.0031	0.001	0.0031	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.0019	0.0019	<0.1	0.0067	<0.005	0.009
OHMW23	4		0.0019	0.001	0.002	0.0027	0.0005	0.0027	<LOR	<LOR	<LOR	0.0023	0.002	0.0023	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.025	0.01	0.025	1	0.309	1
OHMW25	4		0.0023	0.002	0.004	0.0005	<0.0001	0.0005	<LOR	<LOR	<LOR	0.021	0.002	0.021	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.038	0.002	0.038	0.11	0.005	0.11
OHMW26	4		0.003	0.003	0.009	0.0004	0.0004	0.002	<LOR	<LOR	<LOR	0.0089	0.0089	0.013	<0.001	<0.001	0.002	<LOR	<LOR	<LOR	0.11	0.11	0.163	0.42	0.42	1.41
OHMW27	4		0.042	0.042	0.051	0.0014	0.0008	0.0014	<LOR	<LOR	<LOR	0.1	0.057	0.1	0.007	0.007	0.015	<LOR	<LOR	<LOR	0.23	0.06	0.23	1.4	0.294	1.4
OHMW28	4		0.094	0.039	0.094	0.0002	<0.001	0.0018	<LOR	<LOR	<LOR	<0.001	<0.001	0.15	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	0.023	0.023	0.312	0.096	0.096	1.23

Source: Douglas Partners (April 2009)

Notes
2009* - most recent GME conducted by Douglas Partners 7-9 January 2009
LR - Low reliability Trigger level
LOR - Limit of Reporting
mg/L - milligrams per litre
Shading - Result exceedsANZECC (2000) 95% Trigger values for Marine Waters

Data Entry: KOB
Data Review: AR
ENSR Australia Pty Ltd (trading as AECOM)