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Barangaroo - VMP/Block 4 RAP
Lend Lease (Millers Point) Pty Limited
24-Jul-2013
Doc No. RPT 099

FINAL

Remedial Action Plan

NSW EPA Declared Remediation Site 21122 and Block 4 (Stage 1b) Development Works, Barangaroo, Millers Point, NSW

Remedial Action Plan

NSW EPA Declared Remediation Site 21122 and Block 4 (Stage 1b) Development Works, Barangaroo, Millers Point, NSW

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24-Jul-2013

Job No.: 60247139

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Quality Information

Document Remedial Action Plan

Ref 60247139

Date 24-Jul-2013

Prepared by Andrew Rolfe

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Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A	20-Sept-2012	Final Draft	Michael Jones Technical Director	
B	19-Oct-2012	Final Draft – revised to reflect comments from Lend Lease and the Authority	Michael Jones Technical Director	
C	6-Nov-2012	Draft – revised to reflect comments from Lend Lease and the Authority	Michael Jones Technical Director	
D	19-March-2013	Draft to Lend Lease - revised to reflect comments from Site Auditor and NSW EPA	Michael Jones Technical Director	
E	21-March-2013	Final Draft to Site Auditor - revised to reflect comments from Lend Lease	Michael Jones Technical Director	
F	19-June-2013	Draft to Lend Lease - revised to reflect comments from Site Auditor, Lend Lease and the BDA	Michael Jones Technical Director	
G	27-June-2013	Final Draft to Lend Lease and Site Auditor	Michael Jones Technical Director	
H	11-July-2013	Final Draft to Lend Lease, Site Auditor and the BDA	Michael Jones Technical Director	
I	12-July-2013	Final Draft to Lend Lease, Site Auditor and the BDA	Michael Jones Technical Director	
J	23-July-2013	Final Draft to Lend Lease, Site Auditor and the BDA	Michael Jones Technical Director	
K	24-July-2013	Final to Lend Lease, Site Auditor and the BDA	Michael Jones Technical Director	M.A.J.

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Glossary of Terms

Term	Description
ACM	asbestos containing material
AECOM	AECOM Australia Pty Limited
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASLP	Australian Standard Leaching Procedure
ASSMAC	New South Wales Acid Sulfate Soils Management Advisory Committee
As	Arsenic
Ba	Barium
BaP/ B(a)P	Benzo(a)pyrene
BDA	Barangaroo Delivery Authority (the Authority)
BH	Borehole location
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
BTOC	Below Top of Casing
CBD	Central Business District
Cd	Cadmium
CIM	Confirmed Impacted Material
CLM	Contaminated Land Management
Co	Cobalt
CoC	Chain of Custody
CO_2	Carbon Dioxide
Cr	Chromium
CoPC	Chemicals of Potential Concern
cPAHs	carcinogenic Polycyclic Aromatic Hydrocarbons
Cr 6+/ Cr VI	Hexavalent Chromium
Cu	Copper
CUTEP	Clean Up to the Extent Practicable
DEC	Department of Environment and Conservation NSW (superseded)
DECC	Department of Environment and Climate Change NSW (superseded)
DECCW	Department of Environment, Climate Change and Water NSW (superseded)
DGI	Data Gap Investigation
DO	Dissolved Oxygen
DoPI	NSW Department of Planning and Infrastructure
DP	Deposited Plan
DQO	Data Quality Objectives

Term	Description
Declaration Site	As defined by the NSW EPA Declaration
DSI	Detailed Site Investigation
EC	electrical conductivity
ECS	Emission Control Systems
EE	Excavation Enclosure
EIA	Environmental Impact Assessment
EMP	Environment Management Plan
ESCO	*Ex situ* Chemical Oxidation
EPA	Environment Protection Authority
ESA	Environmental Site Assessment
ESD	Ecologically Sustainable Development
Fe-TAML	Iron - tetra-amido macrocyclic ligand (catalyst)
Fe-EDTA	Iron - Ethylenediaminetetraacetic acid (activated persulfate)
GDS	Groundwater Discharge Study
GMP	Groundwater Management Plan
GRC	Groundwater Remediation Criteria
HDPE	high-density polyethylene
Hg	Mercury
HHERA	Human Health and Ecological Risk Assessment
HI	Hazard Index
HIL	Health Investigation Level
ISCO	*In situ* Chemical Oxidation
IFT	Interfacial Tension
JBS	JBS Environmental Pty Limited
m bgl	metres below ground level
Mn	Manganese
MW	Monitoring Well Location
MSDS	Material Safety Data Sheets
MWQC	Marine Water Quality Criteria
LOR	Limit of Reporting
Lend Lease	Lend Lease (Millers Point) Pty Limited
MEP	Multiple Extraction Procedure
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environmental Protection (Assessment of Site Contamination) Measure (1999)
NEPAM	National Environmental Protection (Assessment of Site Contamination) Amendment Measure (2013, No. 1)

Term	Description
Ni	Nickel
NHMRC	National Health and Medical Research Council
NSW	New South Wales
OCPs	Organochlorine Pesticides
OEH	Office of Environment and Heritage
OHS/OH&S	Occupational Health and Safety
OHSP	Occupational Health and Safety Plan
OPPs	Organophosphate Pesticides
ORP	Oxygen Reduction Potential
ORWN	Other Remediation Works (North) Area
ORWS	Other Remediation Works (South) Area
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulfate Soils
PCBs	Polychlorinated Biphenyls
PDA	Project Delivery Agreement
PID	Photoionisation Detector
Pb	Lead
POEO	Protection of the Environment Operations Act 1997 (NSW)
PPE	Personal Protective Equipment
PSI	Preliminary Site Assessment
QA/QC	Quality Assurance/Quality Control
RAP	Remedial Action Plan
RBC	Risk Based Concentrations
RL	Relative Level
RE	Remediation Enclosure
SAQP	Sampling Analysis and Quality Plan
SAS	Site Audit Statement
SCC	Specific Contaminant Concentration
SEPP	State Environmental Planning Policy
SEPR™	Surfactant Enhanced Product Recovery
SHFA	Sydney Harbour Foreshore Authority
SIL	Soil Investigation Level
S-ESCO™	Surfactant Enhanced *Ex situ* Chemical Oxidation
S-ISCO®	Surfactant-enhanced In Situ Chemical Oxidation
SPGWT	Separated Phase Gasworks Waste and Tar
SPOCAS	Suspension Peroxide Oxidation Combined Acidity & Sulfate
$SSTC^{VMP}$	Site Specific Target Criteria (for VMP Remediation Works)

Term	Description		
$SSTC^{DEV}$	Site Specific Target Criteria (for Block 4 Development Remediation Works)		
SWL	Standing Water Level		
SVE	Soil vapour extraction		
SVM	Site Validation Manager		
SVOC	Semi Volatile Organic Compound		
TBT	Tributyltin		
TCM	Tar Containing Material		
TOC	Top of Casing		
TPH	Total Petroleum Hydrocarbons		
TTM	Total Toxicity of Mixtures		
UCS	Unconfined Compressive Strength		
VENM	Virgin Excavated Natural Material		
VMP	Voluntary Management Proposal		
VOC	Volatile Organic Compound		
VPD	Validation Project Director		
UCL	Upper Confidence Level		
UCS	Unconfined Compressive Strength		
USCS	Unified Soil Classification System		
US EPA	United States Environment Protection Agency		
WPTMP	Work Plan and Trial Management Plan		
Zn	Zinc		
Units of Measurement			
°C	degrees Celsius	mg	milligrams
cm	Centimetre	mS	milli-Siemens
ha	Hectare	mV	millivolts
kg	Kilogram	ppm	parts per million
km	Kilometre	µg	microgram
m	Metres	%	percent

Executive Summary

AECOM Australia Pty Limited (AECOM) has been commissioned by Lend Lease (Millers Point) Pty Ltd (Lend Lease) to develop a Remedial Action Plan (RAP) for the NSW Environment Protection Authority (EPA) Declared Remediation Site 21122 (referred to as the 'Declaration Area') and Block 4 (Stage 1b) Development Works, Barangaroo, located at Hickson Road, Millers Point, NSW (refer to **Figure F1** in **Appendix B**).

In May 2009, the NSW EPA (then part of the DECCW, and later the NSW Office of Environment and Heritage, OEH), determined that part of the Barangaroo site and part of Hickson Road (corresponding with part of the site of a former gas works) was contaminated in such a way as to present a significant risk of harm (SROH) to human health and the environment. As a consequence, the NSW EPA declared this area to be a Remediation Site (Declaration Number 21122; Area Number 3221) under the then section 9 of the *Contaminated Land Management* (CLM) *Act* (1997), hereafter referred to as the 'Declaration Area').

The area considered by this RAP includes (refer to **Figure F2** in **Appendix B**):

1) The Declaration Area which comprises:
    - a part of Hickson Road;
    - part of Barangaroo South (within 'Block 4'); and
    - part of Barangaroo Central ('Block 5'). It is noted that as Block 5 is located within Barangaroo Central, detailed design works are yet to be undertaken in this area; and
2) The remainder of Barangaroo Block 4 outside of the Declaration Area (i.e. located immediately west and south of the Declaration Area boundary).

These two areas will hereafter collectively be referred to as 'the Site' (as defined **Figure F2** in **Appendix B**). This RAP is hereafter referred to as the 'Voluntary Management Proposal [VMP]/Block 4 RAP'.

It is noted that the Site includes the narrow portion of Block 4 located directly adjacent to and south of the Declaration Area boundary (refer to **Figure F2**). Due to the small area (approximately 85 m^2) and its location relative to the Declaration Area, gasworks contamination in this area will be addressed by this RAP as part of the VMP Remediation Works.

It is noted that the term 'Block' in this RAP relates to nominated remediation areas, and is not related to State Environmental Planning Policy (SEPP) block boundaries.

This RAP has generally been prepared to meet the requirements of the Department of Urban Affairs and Planning (DUAP) and NSW EPA (1998) *Managing Land Contamination - Planning Guidelines SEPP 55 - Remediation of Land* and relevant NSW EPA endorsed guidelines including the NSW EPA (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*.

Remediation Objectives

The key remediation objectives for the Site are:

- To enable the NSW EPA's declaration of the Declaration Area as a Remediation Site to be revoked; and
- To ensure that Block 4 is remediated to a standard that is suitable for the proposed development in Block 4.

Additional objectives of the remediation works are:

- Ensure that NSW EPA policy requirements are met, specifically:
    - the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination* which incorporate the requirements for removal or treatment of Light[1] or Dense Non-Aqueous Phase Liquids (NAPLs) to the extent practicable and consideration of Clean-up to the extent practicable (CUTEP);
    - the principle of Ecologically Sustainable Development (ESD) as required by Section 9 of the *CLM Act* (1997); and

[1] It is noted that LNAPLs have not been identified at the Site and, as such, are not discussed further.

- The *Waste Avoidance and Resource Recovery Act* (2001);

- To ensure the remediated Declaration Area is protective of human health in the context of its current form and land use;
- To ensure the remediated Block 4 is protective of human health in the context of the proposed development;
- Ensure that the remediated Site is, to the extent practicable, protective of the environment (specifically groundwater within fill material at the down hydraulic gradient Declaration Area (and Site) boundary and ultimately surface water in Darling Harbour) by minimising the risk of ongoing contamination; and
- Comply with applicable legislative and policy requirements including the appropriate requirements of the NSW Department of Planning and Infrastructure (DoPI) and NSW EPA.

AECOM understands that removal of the NSW EPA Declaration would require demonstration that contamination within the Declaration Area is not *significant enough to warrant regulation* (as per the *CLM Act*, 1997) under the current or permitted land use allowable at the Declaration Area without consent. Based on the current zoning of the developable portion of the Declaration Area (Zone B4 Mixed Use under the *Environmental Planning Policy (Major Development) Amendment* (Barangaroo) 2010)), no development is allowable without planning consent. The soil and groundwater Remediation Goals to facilitate removal of the Declaration have therefore been derived (refer to AECOM, 2012c and AECOM, 2012d) based on the current Declaration Area land use with the majority of the Declaration Area being vacant, paved open space areas.

It is understood that the proposed Block 4 Development will comprise of a mixture of commercial, retail and high density residential and public open space (incorporating roads, community and related land uses) overlying basements constructed within a basement groundwater retention wall system.

As discussed above, for the purposes of this RAP:

- the remediation works required to facilitate removal of the NSW EPA Declaration will be referred to as **VMP Remediation Works**; and
- the remediation works required to ensure that Block 4 is suitable for future use as part of the Barangaroo Development Works will be referred to as the **Block 4 Development Remediation Works**.

RAP Objectives

The objective of this RAP is to detail the remediation works required to achieve the above mentioned remediation objectives. It is likely that the remediation works undertaken will be a combination of the VMP Remediation Works and the Block 4 Development Remediation Works. However, it is noted that:

- in the event that the proposed Block 4 Development Works do not occur, the VMP Remediation Works will be undertaken to enable the NSW EPA's declaration of the Declaration Area as a Remediation Site to be revoked;
- the VMP Remediation Works can be implemented independently of the Block 4 Development Remediation Works, if required, using this RAP; and
- the VMP Remediation Works, as described by this RAP, are not reliant on any future development at the Site.

For clarity, the Block 4 Development Remediation Works are not required to enable the NSW EPA's declaration of the Declaration Area to be revoked. However, completion of the Block 4 Development Remediation Works (if undertaken), which include construction of a basement groundwater retention wall system, will also achieve the objectives of the VMP Remediation Works and thereby also facilitate removal of the NSW EPA Declaration from Block 4. It is also noted that, any remediation of Separate Phase Gasworks Waste and Tar (SPGWT[2]) and/or

[2] For the purposes of this report, SPGWT refers to:

- Tar Containing Materials (TCM) which are defined as described below; and
- Dense Non Aqueous Phase Liquids (DNAPLs).

The presence or otherwise of TCM is based on comparison of observed site conditions and analytical data to the following criteria:

- Greater than 10% visible coal tar (where coal tar is a phase separated hydrocarbon by-product from coal gasification); and/or
- Contaminant concentrations exceeding the following limits:

Confirmed Impacted Material (CIM) undertaken as part of the Block 4 Development Remediation Works is considered VMP Remediation Works to the extent that it would have been required in any event to remove the NSW EPA Declaration.

The sequence of remediation works (i.e. VMP Remediation Works in each of the Block 4, Block 5 and Hickson Road portions of the Declaration Area relative to the Block 4 Development Remediation Works) may vary. Specific requirements for validation will similarly vary depending on the actual sequence of remediation works. As such, a validation Sampling Analysis and Quality Plan (SAQP) (refer to **Section 19.2.3**) will be prepared, based on the actual sequence of remediation works, to detail specific requirements for demonstrating that the remediation works have been undertaken in accordance with the requirements of this RAP.

Scope

The scope of work associated with the preparation of this RAP includes the following:

- Review of available data from previous environmental investigations undertaken at the Site to assess the potential for contamination at the Site;
- Identification of Remediation Goals and Remediation Extent for the 'VMP Remediation Works' (i.e. those remediation works required to facilitate removal of the NSW EPA Declaration [as determined by the NSW EPA]) based on the *VMP Remediation Extent* report (AECOM, 2013c). This included areas where contamination has been identified which requires remediation/management as part of the Voluntary Management Proposal and based on consideration of the outcomes of the *VMP Human Health and Ecological Risk Assessment (HHERA*, AECOM, 2012c);
- Identification of the Remediation Goals and Remediation Extent for the Block 4 Development Remediation Works (i.e. those required to facilitate the Block 4 development) based on the outcomes of the:
    - *Declaration Site HHERA* (AECOM, 2011a); and
    - *HHERA - Declaration Site, Barangaroo. Assessment of the Implications of the Revised Basement Design,* (Draft, AECOM, 2012d) – hereafter referred to as the '*Declaration Site HHERA Letter*';
- Undertake an assessment of the potential remediation approaches and technologies;
- Selection of preferred remediation methodology(s) to remediate the Site;
- Outline how the remediation works will be undertaken to meet the remediation objectives, taking into consideration the information review and technical assessment; and
- Develop procedures to demonstrate that the remediation works have been undertaken to satisfy the remediation objectives.

Remediation Extent - VMP Remediation Works

The Remediation Goals developed by the *VMP Remediation Extent* report (AECOM, 2013c) for the protection of human health and the environment based on the recommendations of the *VMP HHERA* (AECOM, 2012c) were derived to enable the NSW EPA Declaration to be revoked. The Remediation Goals are:

- As a primary goal, removal/remediation of SPGWT to the extent practicable as required by the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination* (refer to **Section 6.6.1**); and
- As a secondary goal, removal/remediation of soil, to the extent practicable:
    - That is representative of CIM, which is defined as:
        - Unsaturated soil concentrations exceeding the soil Site Specific Target Criteria ($SSTC^{VMP3}$); and/or

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- Polycyclic Aromatic Hydrocarbons (PAHs): 2,000 mg/kg; or
- Benzo(a)Pyrene (B(a)P): 150 mg/kg.

[3] The *VMP HHERA* (AECOM, 2012c) developed '$SSTC^{VMP}$' for soil and groundwater for use in defining the remediation end-point for the Declaration Area (refer to **Section 7.1**).

  - Unsaturated or saturated soil concentrations that are considered to be the source of groundwater concentrations exceeding the groundwater $SSTC^{VMP}$ in fill material; and
- Such that that groundwater quality within fill material leaving the Declaration Area (measured at the down hydraulic Declaration Area boundary) approaches the Marine Water Quality Criteria (MWQC).

The lateral extent of remediation required in the unsaturated and saturated zones for the protection of human health and the environment as recommended by the *VMP Remediation Extent* report (AECOM, 2013c) is presented on **Figure F10** and **Figure F11** in **Appendix B**, respectively. As detailed in the *VMP Remediation Extent* report (AECOM, 2013c), remediation to the extent practicable has been determined based on consideration of:

- The presence of historic gasworks infrastructure, the distribution of SPGWT and CIM within the respective Site areas; and
- The extent of remediation that can be practicably accomplished for the protection of the environment based on:
  - The standard of remediation that can be practically achieved by the remediation technologies that are most likely to be implemented; and
  - Regulatory policy requirements including: source removal, removal of NAPL to the extent practicable, and clean-up to the extent practicable as contemplated by the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*; the principles of ESD as required by Section 9 of the *CLM Act* (1997); and, the principles of the *Waste Avoidance and Resource Recovery Act* (2001).

The standard of remediation (as developed by the *VMP Remediation Extent* report [AECOM, 2013c]) to be achieved within the proposed Remediation Extent should equal the higher of:

- Removal of SPGWT to the extent practicable, for the protection of human health and the environment;
- Removal/remediation of soil and groundwater concentrations present within fill material exceeding the relevant $SSTC^{VMP}$, to the extent practicable; and
- Removal/remediation of contaminated fill materials such that the contaminant mass within the Remediation Extent fill material is reduced, on average, by 90%, to the extent practicable (calculated based on the estimated mass of naphthalene and TPH C_{10} - C_{14}).

  If the standard of remediation can not be practicably achieved, the Contingency measures detailed in **Section 23.7** of this RAP will be considered.

The vertical extent of remediation has been broadly defined as remediation to the depth of the underlying natural bedrock to a maximum depth of 10 m below ground level (bgl). The vertical extent of remediation is based on consideration of:

- locations where SPGWT has been reported;
- locations where exceedances of the groundwater SSTC and unsaturated soil SSTC have been reported;
- the footprint of historical gasworks structures and infrastructure; and
- the depth to bedrock (noting that the depth to bedrock steadily increases to the west beyond the 10 m bgl rock contour).

It is noted that SPGWT and CIM have been reported in the natural marine sediments both within the Site and in some hydraulically down gradient areas to the west of the Site. However, the negligible contaminant flux from these natural materials is not considered to pose a significant risk to human health or the environment. As such, the proposed extent of remediation works includes remediation of fill material and marine sediments to 10 m bgl (unless bedrock is encountered at shallower depths) and will generally exclude remediation of natural marine sediments which are present below a depth of 10 m bgl.

Remediation Extent - Block 4 Development Remediation Works

The Block 4 Development Works remediation criteria (as developed by the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d), to be achieved within the Block 4 basement area requires that remediation should be undertaken as follows:

- As a primary goal, removal/remediation of SPGWT to the extent practicable, for the protection of human heath; and
- As a secondary goal, removal/remediation of identified CIM, to the extent practicable based on remediation of soil contamination that is considered to be the source of groundwater concentrations exceeding the groundwater $SSTC^{DEV}$ [4].

It is noted that the proposed design for the Block 4 Development includes construction of a basement groundwater retention wall system around the perimeter of Block 4 that will extend to and be keyed into bedrock. In consideration of this, the development of remediation criteria for Block 4 (within the retention wall system) for ecological protection is therefore not required for the Block 4Development Remediation Works.

Preferred Remediation Option

The preferred remediation option for each of Block 4, Block 5 and Hickson Road (as appropriate) is summarised as follows:

- Block 4 VMP Remediation Works - excavation of contaminated materials as required to facilitate removal of the NSW EPA Declaration from Block 4, followed by on-site treatment (where required) and off-site landfill disposal;
- Block 4 Development Remediation Works - excavation of contaminated materials as required to make the site suitable for the proposed future land use including construction of the basement groundwater retention wall system;
- Block 5 and Hickson Road (within the Declaration Area) VMP Remediation Works:
    - Completion of a Surfactant-enhanced In Situ Chemical Oxidation (S-ISCO®) and Surfactant Enhanced Product Recovery (SEPR™) Proving Phase and Pilot Trial to demonstrate the effectiveness of the treatment processes and enable optimisation of the full scale treatment process; and
    - If the Proving Phase and Pilot Trial are successful - Option 1:
        - Full scale S-ISCO® and SEPR™ treatment of the SPGWT and CIM in accordance with the Remediation objectives; or
    - If the Proving Phase and/or the Pilot Trial are unsuccessful - Option 2:
        - Excavation of required contaminated materials, followed by on-site treatment (where required) and off-site landfill disposal.

    It is possible that, depending on the outcome of the S-ISCO® and SEPR™ Proving Phase and/or the Pilot Trial and project requirements, the preferred remediation option adopted for the Block 5 and Hickson Road VMP Remediation Works will be a combination of Option 1 (full scale S-ISCO® and SEPR™ treatment) and Option 2 (excavation and onsite treatment). Selection of the preferred remediation option that will be adopted in each part of Block 5 and Hickson Road will be undertaken in consultation with the NSW EPA Accredited Site Auditor.

The above strategy has been designed to achieve the objectives of either:

- Both the VMP Remediation Works and Block 4 Development Remediation Works in the event that the proposed Block 4 Development Works do occur; or
- The VMP Remediation Works alone, in the event that the proposed Block 4 Development Works do not occur.

[4] The *Declaration Site HHERA* (AECOM, 2011b) and *Declaration Site HHERA Letter* (AECOM, 2012d) developed '$SSTC^{DEV}$' for soil and groundwater that can be used as remediation criteria applicable to the proposed Block 4 Development Works (refer to **Section 7.2**).

It is also noted that, any remediation of SPGWT and/or CIM undertaken as part of the bulk excavation and development of Block 4 is considered VMP Remediation Works to the extent that it would have been required in any event to remove the NSW EPA Declaration.

It is possible that remediation of the various areas within the Site (i.e. Block 4, Block 5 and Hickson Road) may occur in separate stages. Consequently, the remediation strategies for Block 4 and Block 5 and Hickson Road are detailed individually in this RAP. It is intended that this approach will facilitate sequential remediation, validation and NSW EPA Accredited Site Auditor signoff of these site areas (if required). This RAP also demonstrates that both Option 1 (subject to the outcomes of the Proving Phase and Pilot Trial) and Option 2 are feasible approaches to remediation of the Block 5 and/or Hickson Road in accordance with the Remediation Objectives.

Conclusion

It is concluded that the preferred remediation strategy described by this RAP, upon successful implementation will:

- enable the NSW EPA's declaration of the Declaration Area as a Remediation Site to be revoked; and
- if the Block 4 Development Works proceed, ensure that Block 4 is remediated to a standard suitable for the proposed development (i.e. suitable for the proposed land uses including a mixture of commercial, retail and high density residential and public open space).

1.0 Introduction

AECOM Australia Pty Limited (AECOM) has been commissioned by Lend Lease (Millers Point) Pty Ltd (Lend Lease) to develop a Remedial Action Plan (RAP) for the NSW Environment Protection Authority (EPA) Declared Remediation Site 21122 (referred to as the 'Declaration Area') and Block 4 (Stage 1b) Development Works, Barangaroo, located at Hickson Road, Millers Point, NSW (refer to **Figure F1** in **Appendix B**).

In May 2009, the NSW EPA (then part of the DECCW, and later the NSW OEH[5]), determined that part of the Barangaroo site and part of Hickson Road (corresponding with part of the site of a former gas works) was contaminated in such a way as to present a significant risk of harm (SROH[6]) to human health and the environment. As a consequence, the NSW EPA declared this area to be a Remediation Site (Declaration Number 21122; Area Number 3221) under the then section 9 of the *Contaminated Land Management* (CLM) *Act* 1997.

The area considered by this RAP includes (refer to **Figure 1** below and **Figure F2** in **Appendix B**):

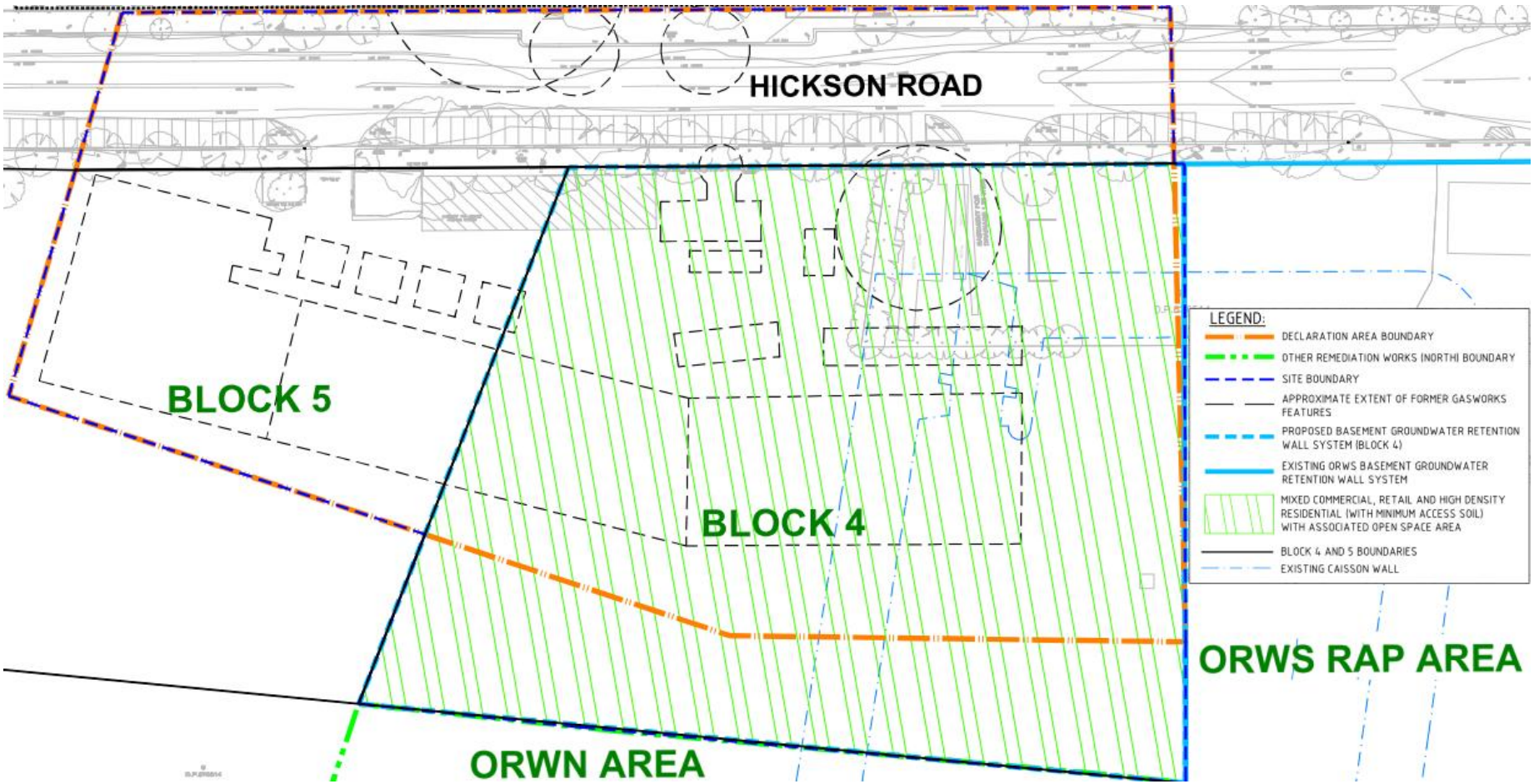
1) The Declaration Area which comprises:
   - a part of Hickson Road;
   - part of Barangaroo South (within 'Block 4'); and
   - part of Barangaroo Central ('Block 5'). It is noted that as Block 5 is located within Barangaroo Central, detailed design works are yet to be undertaken in this area; and
2) The remainder of Barangaroo Block 4 outside of the Declaration Area (i.e. located immediately west and south of the Declaration Area boundary).

These two areas will hereafter collectively be referred to as 'the Site' (refer to **Figure 1** below and **Figure F3** in **Appendix B**). This RAP is hereafter referred to as the 'VMP/Block 4 RAP'.

[5] The Office of Environment and Heritage (OEH) is a division of the NSW Department of Premier and Cabinet. OEH was formed on the 4 April 2011 following an announcement of new administrative arrangements for the public service in NSW. OEH was formerly known as the DECCW. The NSW EPA is an independent statutory authority.

[6] As an amendment to the CLM Act on 1 July 2009, reference to SROH was removed. *Significantly contaminated land* is now referred to as *land is contaminated and that the contamination is significant enough to warrant regulation*.

Figure 1 Site Layout (including the Declaration Area) - taken from Figure F3, Appendix B



It is noted that the term 'Block' in this RAP relates to nominated remediation areas, and is not related to State Environmental Planning Policy (SEPP) block boundaries.

This RAP has generally been prepared to meet the requirements of:

- *Contaminated Land Management Amendment (CLM) Act* (1997);
- Department of Environment and Conservation (DEC, 2006a) *Guidelines for the NSW Site Auditor Scheme* (2nd edition);
- Department of Urban Affairs and Planning (DUAP) and NSW EPA (1998) *Managing Land Contamination – Planning Guidelines State Environmental Planning Policy (SEPP) 55 - Remediation of Land*;
- National Environment Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Measure (NEPM,1999*);
- National Environment Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPAM,* 2013 [No. 1]); and
- NSW EPA (2011). *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*.

Appendix F details which sections of the RAP addresses the various requirements of the SEPP 55 (1998) and NSW EPA (2011) guidelines to confirm compliance.

1.1 Remediation Objectives

The key remediation objectives for the Site are:

- To enable the NSW EPA's declaration of the Declaration Area as a Remediation Site (Declaration Number 21122; Area Number 3221) to be revoked; and
- To ensure that Block 4 is remediated to a standard suitable for the proposed development in Block 4.

Additional objectives of the remediation works are:

- Ensure that NSW EPA policy requirements are met, specifically:
    - the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination* which incorporate the requirements for removal or treatment of Light or Dense Non-Aqueous Phase Liquids (NAPLs) to the extent practicable and consideration of Clean-up to the extent practicable (CUTEP);
    - the principle of Ecologically Sustainable Development (ESD) as required by Section 9 of the *Contaminated Land Management (CLM) Act* (1997); and
    - The *Waste Avoidance and Resource Recovery Act* (2001);
- To ensure the remediated Declaration Area is protective of human health in the context of its current form and land use;
- To ensure the remediated Block 4 is protective of human health in the context of the proposed development;
- Ensure that the remediated Site is, to the extent practicable, protective of the environment (specifically groundwater within fill material at the down hydraulic gradient Declaration Area (and Site) boundary and ultimately surface water in Darling Harbour) by minimising the risk of ongoing contamination; and
- Comply with applicable legislative and policy requirements including the appropriate requirements of the NSW Department of Planning and Infrastructure (DoPI) and NSW EPA.

For the purposes of this RAP:

- the remediation works required to facilitate removal of the NSW EPA Declaration will be referred to as **VMP Remediation Works**; and
- the remediation works required to ensure that Block 4 is suitable for future use as part of the Barangaroo Development Works will be referred to as the **Block 4 Development Remediation Works**.

1.1.1 VMP Remediation Works

A key focus of this RAP is describing the Voluntary Management Proposal (VMP) Remediation Works and the development of a remediation strategy that will facilitate removal of the NSW EPA Declaration based on potential risks to human health and the environment from the existing land uses within the Declaration Area.

AECOM understands that removal of the NSW EPA Declaration would require demonstration that contamination at the Declaration Area is not *significant enough to warrant regulation* (as per the *CLM Act*, 1997) under the current or permitted land use allowable at the Declaration Area without consent. Based on the current zoning of the developable portion of the Declaration Area (Zone B4 Mixed Use under the *Environmental Planning Policy (Major Development) Amendment* (Barangaroo) 2010)), no development is allowable without planning consent. The current Declaration Area land use comprises vacant and paved open space areas.

The extent of VMP Remediation Works required within the Declaration Area has been defined in the *VMP Remediation Extent* report*, VMP Remediation Works Area, (Parts of Barangaroo and Hickson Road), Millers Point, NSW* (AECOM, 2013c) (hereafter referred to as the *VMP Remediation Extent* report*)* which was based on the remediation goals derived in the *Human Health and Ecological Risk Assessment, VMP Remediation Works Area (Addressing the NSW EPA Remediation Site Declaration 21122, Millers Point)* (AECOM, 2012c) (hereafter referred to as the *VMP HHERA*). As such, in relation to those remediation works required to revoke the NSW EPA Declaration, this RAP should be read in conjunction with the *VMP Remediation Extent* report (AECOM, 2013c) and the *VMP HHERA* (AECOM, 2012c).

For clarity, the Block 4 VMP Remediation Works relate to works required to facilitate removal of the NSW EPA Declaration. As such, the Block 4 VMP Remediation Works are focused on works required in relation to that part of Block 4 that is within the Declaration Area. With the exception of contamination that would otherwise require remediation to facilitate removal of the NSW EPA Declaration, the Block 4 VMP Remediation Works do not include that part of Block 4 which is outside the Declaration Area. In contrast, the Block 4 Development Remediation Works relate to works required to make the entire Block 4 footprint (i.e. within the proposed basement boundary) suitable for the proposed future use.

1.1.2 Block 4 Development Remediation Works

The proposed Block 4 Development Works are likely to include construction of a basement across the entire footprint of Block 4 (i.e. including both the eastern portion of Block 4 within the Declaration Area and the western portion of Block 4 located outside the Declaration Area as shown in **Figure F3** in **Appendix B**), and overlying land uses (including commercial, retail, high density residential and public open space). Consequently, this RAP also considers the remediation works which are required to be protective of human health and the environment in the context of the proposed future land uses for the development.

Due to the basement groundwater retention wall system that will be constructed around Block 4, the development of ecological risk based criteria for within Block 4 (i.e. within the retention wall system) was not considered to be required for ecological protection as there will be negligible groundwater movement through the retention wall system.

In relation to the Block 4 Development Works, this RAP should be read in conjunction with the *Declaration Site Human Health and Ecological Risk Assessment (HHERA)* (AECOM, 2011a).

1.2 Remedial Action Plan Objectives

The objective of this RAP is to detail the remediation works required to achieve the above mentioned remediation objectives. It is likely that the remediation works undertaken will be a combination of the VMP Remediation Works and the Block 4 Development Remediation Works. However, it is noted that:

- in the event that the proposed Block 4 Development Works do not occur, the VMP Remediation Works will be undertaken to enable the NSW EPA's declaration of the Declaration Area as a Remediation Site to be revoked;
- the VMP Remediation Works can be implemented independently of the Block 4 Development Remediation Works, if required, using this RAP; and
- the VMP Remediation Works, as described by this RAP, are not reliant on any future development at the Site.

For clarity, the Block 4 Development Remediation Works are <u>not</u> required to enable the NSW EPA's declaration of the Declaration Area to be revoked. However, completion of the Block 4 Development Remediation Works (if

undertaken), which will include construction of a basement groundwater retention wall system, will also achieve the objectives of the VMP Remediation Works and thereby also facilitate removal of the NSW EPA Declaration from Block 4. It is also noted that, remediation of Separate Phase Gasworks Waste and Tar[7] (SPGWT) and/or Confirmed Impacted Material (CIM) undertaken as part of the Block 4 Development Remediation Works is considered VMP Remediation Works to the extent that it would have been required in any event to remove the NSW EPA Declaration.

The sequence of remediation works (i.e. VMP Remediation Works in each of the Block 4, Block 5 and Hickson Road portions of the Declaration Area relative to the Block 4 Development Remediation Works) may vary. Specific requirements for validation will similarly vary depending on the actual sequence of remediation works. As such, a validation Sampling Analysis and Quality Plan (SAQP) (refer to **Section 19.2.3**) will be prepared, based on the actual sequence of remediation works, to detail specific requirements for demonstrating that the remediation works have been undertaken in accordance with the requirements of this RAP.

1.3 Scope of Work

The scope of work associated with the preparation of this RAP included:

- Review of available data from previous environmental investigations undertaken at the Site to assess the potential for contamination at the Site;
- Identification of Remediation Goals and Remediation Extent for the 'VMP Remediation Works' (i.e. those remediation works required to facilitate removal of the NSW EPA Declaration [as determined by the NSW EPA]) based on the *VMP Remediation Extent* report (AECOM, 2013c). This included areas where contamination has been identified which requires remediation/management as part of the Voluntary Management Proposal and based on consideration of the outcomes of the *VMP HHERA* (AECOM, 2012c);
- Identification of the Remediation Goals and Remediation Extent for the Block 4 Development Remediation Works (i.e. those required to facilitate the Block 4 Development) based on the outcomes of the:
    - *Declaration Site Human Health and Ecological Risk Assessment (HHERA)* (AECOM, 2011a); and
    - Assessment of the Implications of the *Revised Basement Design, Human Health and Ecological Risk Assessment - Declaration Site, Barangaroo* (Draft, AECOM, 2012d) – hereafter referred to as the '*Declaration Site HHERA Letter*';
- Undertake an assessment of the potential remediation approaches and technologies;
- Selection of preferred remediation methodology(s) to remediate the Site;
- Outline how the remediation works will be undertaken to meet the remediation objectives, taking into consideration the information review and technical assessment; and
- Develop procedures to demonstrate that the remediation works have been undertaken to satisfy the remediation objectives.

[7] For the purposes of this report, SPGWT refers to:

- Tar Containing Materials (TCM) which are defined as described below; and
- Dense Non Aqueous Phase Liquids (DNAPLs).

The presence or otherwise of TCM is based on comparison of observed site conditions and analytical data to the following criteria:

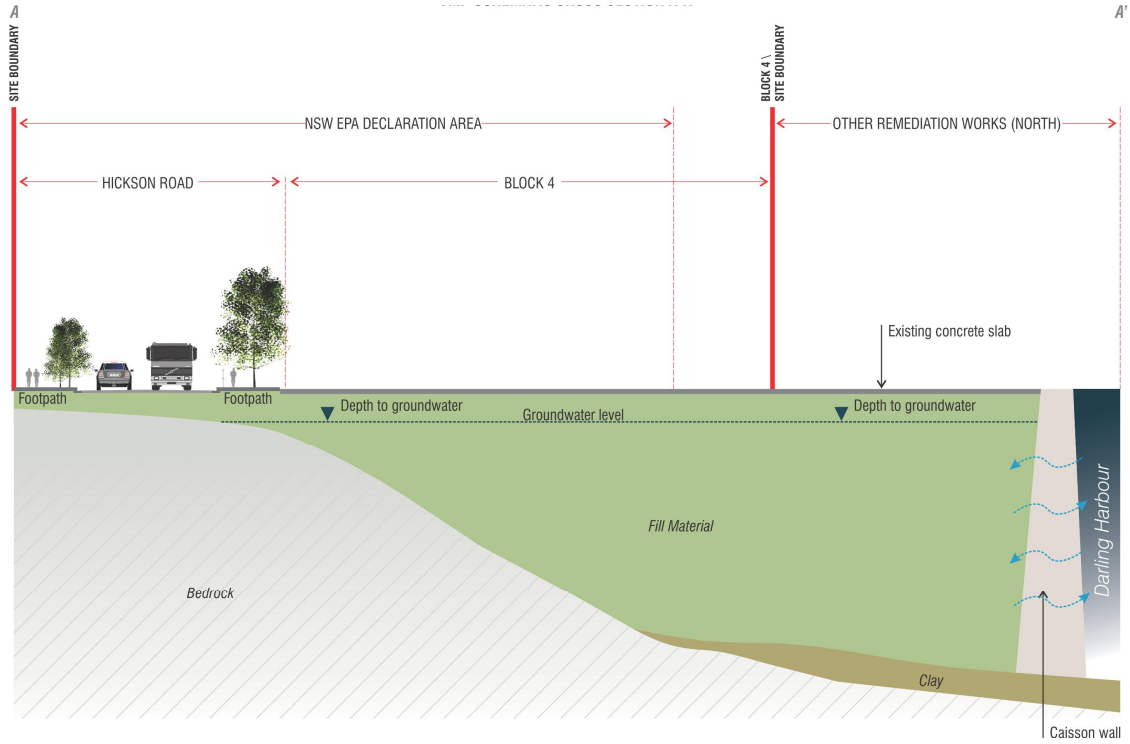
- Greater than 10% visible coal tar (where coal tar is a phase separated hydrocarbon by-product from coal gasification); and/or
- Contaminant concentrations exceeding the following limits:
    - Polycyclic Aromatic Hydrocarbons (PAHs): 2,000 mg/kg; or
    - Benzo(a)Pyrene (B(a)P): 150 mg/kg.

1.4 Current Land Use

As indicated above, one of the objectives of this RAP is remediation of the Declaration Area to a standard which enables the NSW EPA's declaration of the Site as a Remediation Site to be revoked. As above, removal of the NSW EPA Declaration requires demonstration that contamination at the Declaration Area is not *significant enough to warrant regulation* (as per the *CLM Act*, 1997) under the current land use scenario. The current Declaration Area land use comprises of limited use with the majority of the Area being vacant, paved open space area.

Figure 2 presents a schematic cross section of the Declaration Area as assessed in this RAP (the alignment of this cross-section is shown in **Figure F4** in **Appendix B**).

Figure 2 Schematic Cross Section A-A' - Current Land Use



1.5 Site Layout

For the purpose of this RAP, the Site comprises the following areas:

1) the Declaration Area which comprises:
   - a section of Hickson Road, the public roadway located directly to the east of Barangaroo;
   - part of Barangaroo Block 4 (within Barangaroo South); and
   - part of Barangaroo Block 5 (within Barangaroo Central).
2) the remainder of Barangaroo Block 4 outside of the Declaration Area (i.e. located immediately west and south of the Declaration Area boundary).

It is noted that the Site includes the narrow portion of Block 4 located directly adjacent to and south of the Declaration Area boundary (refer to **Figure F2**). Due to the small area (approximately 85 m^2) and its location relative to the Declaration Area, gasworks contamination in this area will be addressed by this RAP as part of the VMP Remediation Works.

Block 4 includes the eastern portion of the historic Southern Cove which was in filled in or around the 1980s. The historic Southern Cove caisson wall is detailed in **Figure F5**).

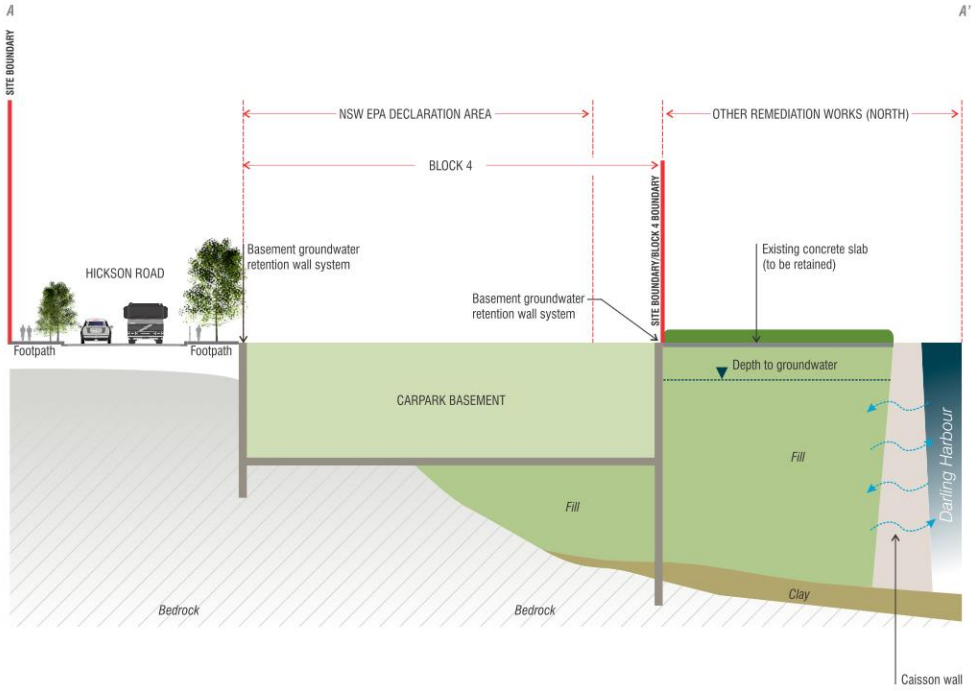
1.6 Proposed Block 4 Development and Land Use

The proposed development and land uses for Block 4 are summarised following. Further detail is provided in **Section 4.0**).

It is possible that the final details and configuration of land uses within Block 4 will be revised as part of the continued development design. However, the proposed land uses - that is a mixture of commercial, retail and high density residential and public open space (incorporating roads, community and related land uses) overlying the Block 4 basement - will remain generally consistent with that described within this RAP. If the final development design is changed in a way which affects the assumptions of the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) and this RAP, an Addendum will be prepared, as required, and submitted to the NSW EPA Accredited Site Auditor for approval.

The proposed land uses associated with Block 4 and assessed in this RAP are illustrated in **Figure 3** below (the approximate alignment of this cross-section is shown in **Figure F4** in **Appendix B**):

Figure 3 Schematic Cross Section A-A' (east-west through the Site) - Block 4 Development



As shown in **Figure 3** above, the western Site boundary and Block 4 western boundary coincide with the proposed extent of the Block 4 basement.

The Block 4 basement excavations will be supported by a basement groundwater retention wall system as shown in **Figure 3** above. In consideration of the thickness and design of the retention wall system, together with the additional drainage measures required for construction of the system, it is likely that only very small volumes of groundwater and vapour (if any) will penetrate through the wall. Further detail regarding the retention wall system is provided in **Section 4.3**).

1.7 Remediation Documentation

Supporting Management Plans and Work Procedures that will be prepared prior to commencement of the remediation works include:

- Occupational Health and Safety Plan (OH&S);
- Community Consultation Plan;
- Environmental Management Plan;
- Project Management Plan;

- Quality Management Plan;
- Asbestos Management Plan;
- Emergency Response and Contingency Plan;
- Excavation Plans to be prepared in support of the Block 4 Development Remediation Works (refer to **Section 9.3** and **14.3**);
- Surfactant Enhanced *In Situ* Chemical Oxidation (S-ISCO®) and Surfactant Enhanced Product Recovery (SEPR™) Pilot Trial Report (refer to **Section 16.2.3**);
- Reuse Materials Management Plan (to be prepared by the Barangaroo Delivery Authority [the Authority] as part of its overall management of the Barangaroo site);
- S-ISCO® and SEPR™ Detailed Work Plan, if adopted as the preferred remediation methodology (refer to **Section 16.3**);
- Validation SAQP (refer to **Section 19.2.3**);
- VMP Remediation Works Groundwater Monitoring Plan (GMP, refer to **Section 17.4.2**); and
- Block 4 Development Remediation Works GMP (if an alternate *in situ* remediation is adopted refer to **Section 17.4.3**).

Further detail regarding the above Project Documentation is provided in **Section 13.1.3**.

Notwithstanding the above plans, an appropriate level of information is detailed in this RAP regarding whether or not:

- the NSW EPA Declaration 21122 can be revoked; and
- if the Block 4 Development Works proceed, Block 4 can be made suitable for the proposed land uses (i.e. including commercial, retail, high density residential and public open space).

1.8 Staged Remediation

Implementation of required remediation works are proposed to be undertaken as part of the Barangaroo Development. As a consequence, they may be staged as the development works progress and undertaken in discrete stages. In particular, this may require remediation of key site areas (e.g. Block 4, Block 5 and Hickson Road) to be completed and validated separately, in sequence. Staged remediation may also be required within key site areas (for example within Block 4) to accommodate the required development and construction sequence and methodology. Further detail on validation requirements in terms of staging is provided in **Section 19.2.1**.

Site Audit Statements (SASs) prepared by a NSW EPA accredited auditor in accordance with the *CLM Act* (1997) will similarly be staged to progressively validate the Site.

1.9 Remediation of Adjacent Areas

Separate RAPs have been or are being prepared to describe the remediation required in relation to those areas of Barangaroo South that are adjacent to the Site. The RAPs focus on areas designated by Lend Lease and the Authority, as follows (refer to **Figure F2** in **Appendix B**):

- AECOM, 2011b. *Amended RAP Other Remediation Works (South) (ORWS) Area* (Finalised report) – relates to Blocks 1 to 3 within Barangaroo South (located south of the Site), and is designed to identify remediation required to facilitate the Stage 1a Development; and
- *RAP Other Remediation Works (North) (ORWN) Area* (to be prepared by AECOM) – relates to the ORWN site area within Barangaroo South (located west of Block 4). This area is outside the Declaration Area and is designed to identify remediation required to facilitate development works in this area.

A separate RAP (currently being prepared for the Authority by JBS Environmental) will also be prepared for Barangaroo Central (including the part of Block 5 that is outside the Declaration Area) to identify remediation works required to facilitate the Barangaroo Central development works.

2.0 Assessment and Approval Process

The planning regime to guide the future redevelopment of the overall Barangaroo site is established by the:

- Planning provisions of Schedule 3 Part 12 of the *State Environmental Planning Policy (Major Development)*, 2005; and
- *Barangaroo Concept Plan (Concept Plan 06_0162)* as approved on 9 February 2007 and modified on 25 September 2007, 16 February 2009 and 16 December 2010.

A "site-wide" *Overarching RAP* has been prepared by ERM (Final, June 2010) for the Authority, and provides an overarching conceptual remediation framework for the whole of Barangaroo. The *Overarching RAP* allows for the provision of separate, detailed RAPs for site portions, of which this RAP is one.

It is noted that there is no option for material excavated from the Declaration Area to be re-used in Headland Park based on the RAP prepared for Headland Park (JBS Environmental, 2011).

2.1 Project Applications

Remediation works as described by this RAP will be subject to assessment and determination by the Minister for Planning as State Significant Development under Part 4 of the *EP&A Act* [8]. As such, an application will be made to the NSW DoPI for remediation and land forming works within the Declaration Area. An Environmental Impact Statement (EIS) will be prepared to address these assessment requirements, in support of the application and to seek planning approval. AECOM has prepared this RAP for Lend Lease as part of the future EIS.

2.1.1 S-ISCO® and SEPR™ Pilot Trial Project Approval

The Surfactant Enhanced In situ Chemical Oxidation (S-ISCO®) and Surfactant Enhanced Product Recovery (SEPR™) Pilot Trial was assessed and subsequently approved as a Major Project by the Minister for Planning, pursuant to Part 3a of the *Environmental Planning and Assessment Act* (1979). The following summarises the successful planning process:

- July - November 2010 - Detailed Environmental Assessment prepared;
- November 2010 - Project Application and Environmental Assessment Report submitted to the Department of Planning (Major Project MP10_0087);
- November 2010 - January 2011 - Public exhibition and receipt of stakeholder submissions;
- January 2011- Submission of Preferred Project Report to the Department of Planning, in response to stakeholder submissions; and
- March 2011 - Minister approves S-ISCO®/SEPR™ Pilot Trial (MP10_0087).

The Pilot Trial (refer to **Section 16.2**) and precursor Proving Phase pilot trial (hereafter referred to as the 'Proving Phase', refer to **Section 16.1**) will inform the selection of the preferred remediation approach according to the process described by this RAP.

2.2 Legislation Relevant to Remediation Works

The NSW EPA administers a number of Acts and legislative instruments relevant to the remediation works. These include:

- *Contaminated Land Management (CLM) Act*, 2007;
- *CLM Amendment Act*, 2008;
- Department of Environment and Conservation (DEC), 2006a. *Guidelines for the NSW Site Auditor Scheme* (2nd edition);
- *The Protection of the Environment Operations (POEO) Act,* 1997, in particular, licensing obligations under that Act; and

[8] Lend Lease has made an application to the DoPI for the remediation works to be transitioned from Part 3A of the EP&A Act to State Significant Development which is subject to Part 4 of the EP&A Act.

- DUAP and NSW EPA (1998) *Managing Land Contamination: Planning Guidelines, State Environmental Planning Policy (SEPP) 55 - Remediation of Land*.

2.2.1 CLM Act (1997)

The *CLM Act* (1997) is the primary Act under which contaminated land is regulated by the NSW EPA. Relevant legislation relating to the *CLM Act* (1997) includes the *Contaminated Land Management Regulation* (2008), which commenced on 1 September 2008.

This section addresses the following aspects of the *Act*:

- Determination and suitability of a contaminated site for a proposed use including the generation of remediation criteria;
- Existing orders and regulatory instruments applicable to the Site; and
- Voluntary remediation proposals and agreements.

The *Guidelines for the NSW Site Auditor's Scheme (The Auditor Guidelines)* (DEC, 2006a) were prepared by the Department of Environment and Conservation (DEC, now known as the NSW EPA) under the *CLM Act* (1997). *The Auditor Guidelines* (DEC, 2006a) describe a decision process for assessing urban redevelopment sites that should be followed by contaminated land consultants. *The Auditor Guidelines* (DEC, 2006a) prescribe soil investigation levels (SILs), which are the concentrations of particular contaminants above which further investigation and evaluation (such as through completion of a quantitative risk assessment) are required.

The substances for which SILs have been prescribed do not include all of the Contaminants of Potential Concern (CoPC) identified at the Site. *The Auditor Guidelines* (DEC, 2006a) make the following provision for such circumstances:

"…where SILs are not available for particular contaminants, or assessment of contaminants against SILs at a particular site is inconclusive… The auditor must check whether the risk assessment is in accordance with the NEPM [National Environmental Protection (Assessment of Site Contamination) Measures] and any relevant guidelines made or approved by DEC. The auditor must also check that any human health risk assessment satisfies all the requirements in the checklist in Appendix VII. The auditor must check that all site-specific risk assessments are scientifically valid and that the site-specific criteria recommended by the consultant are appropriate to protect public health and the environment."

Adoption of the SILs is generally considered inappropriate for remediation works as this may result in unnecessary increased remediation effort and cost. As such, where site investigations indicate that the SILs are exceeded, it is considered appropriate to adopt a health-based and ecological risk assessment approach in determining suitable criteria for the identified CoPC.

In accordance with the *ERM RAP* (2008c), it was considered that a Tier 2 and Tier 3 Human Risk assessment and a qualitative ecological risk assessment was required to set Site-specific clean up criteria. The *VMP HHERA* (AECOM, 2012c) was prepared to derive site-specific clean up criteria for the Declaration Area based on its current land use. The risk assessment process, by which the site-specific criteria were derived for the VMP Remediation Works, is summarised in **Section 7.1**.

The *Declaration Site (Development Works) HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) were similarly prepared to derive site-specific clean up criteria for the proposed Block 4 Development Works, which will include a combination of residential, commercial and public open space uses. The risk assessment process, by which the site-specific criteria were derived for the Block 4 Development Remediation Works, is summarised in **Section 7.2**.

The *CLM Act* (1997) also sets out requirements for site audits. The *CLM Act* (1997) requires a site audit to be undertaken under certain circumstances, such as if the site is a Declared Remediation site, as is the case with the Declaration Area. In consideration of this requirement, it is understood that Site Audit Statements will be prepared by a NSW EPA Accredited Site Auditor for the Site (or parts thereof, as discussed in **Section 1.8**). The SASs will confirm whether:

- the Declaration Area (or parts thereof) has been remediated to a standard to enable the NSW EPA Declaration to be revoked (i.e. the VMP Remediation Works); and
- Block 4 has been remediated to a standard suitable for the proposed post development land uses (i.e. the Block 4 Development Remediation Works).

It is noted that the majority of the provisions in the *CLM Amendment Act* (2008) received assent on 10 December 2008. The purpose of the amendments was to allow contaminated sites to be cleaned up more efficiently while reinforcing the 'polluter pays' principle. The key amendments to the *CLM Act* (1997) included:

- introducing new powers to enable the NSW EPA (then a part of DECCW) to require certain persons to carry out a preliminary investigation of site contamination;
- amalgamation of the investigation and remediation stages into a single 'management' stage that can cover investigation, remediation or both;
- removing the concept of 'significant risk of harm';
- enabling the NSW EPA to declare land to be 'significantly contaminated land' if it has reason to believe that land is contaminated and the contamination is significant enough to warrant regulation;
- enabling management orders to be issued to any one or more persons who are responsible for the contamination of land;
- enabling the NSW EPA to issue a management order or to withdraw its approval of a voluntary management proposal that has not delivered a satisfactory outcome in managing contamination;
- provision of a more objective basis for the duty to notify the NSW EPA of contaminated land based on criteria to be listed in new guidelines; and
- requiring land owners and persons carrying out certain activities to notify the NSW EPA of contamination when it becomes aware of that contamination.

2.2.2 POEO Act (1997)

Section 48 of the *POEO Act* (1997) requires a person to obtain a licence from the NSW EPA before carrying out any of the premises-based activities described in Schedule 1 of that *Act*.

Schedule 1 includes the following activity:

"Contaminated soil treatment works for on-site or off-site treatment (including, in either case, incineration or storage of contaminated soil but excluding excavation for treatment at another site) that:

(1) handle more than 1,000 cubic metres per year of contaminated soil not originating from the site on which the works are located; or

(2) handle contaminated soil originating exclusively from the site on which the works are located; and

(a) incinerate more than 1,000 cubic metres per year of contaminated soil, or

(b) treat otherwise than by incineration and store more than 30,000 cubic metres of contaminated soil, or

(c) disturb more than an aggregate area of 3 hectares of contaminated soil."

The remediation works for the Site will involve remediation of contaminated soil originating from the Site only but will require the treatment of more than 30,000 m^3 of contaminated soil. Consequently, the related soil treatment works will require a Variation of the existing Environment Protection License (EPL, refer to **Appendix G**) for Barangaroo under the *POEO Act*.

2.2.3 State Environmental Planning Policy 55 (1998)

SEPP 55 – Remediation of Land (1998) specifies when remediation work will require Development Consent (i.e. Category 1 remediation work).

Clause 9 of SEPP 55 defines Category 1 remediation works as:

- Designated development; or
- Being carried out or to be carried out on land declared to be critical habitat; or
- Likely to have significant effect on a critical habitat or a threatened species, population or ecological community; or
- Development for which another State environmental policy or regional environmental plan requires development consent; or

- Carried out or to be carried out in an area or zone to which any classifications to the following effect apply under an environmental planning instrument.
    - coastal protection;
    - conservation or heritage conservation;
    - habitat area, habitat protection area, habitat or wildlife corridor;
    - environment protection;
    - escarpment, escarpment protection or escarpment preservation;
    - floodway;
    - littoral rainforest;
    - nature reserve;
    - scenic area or scenic protection; and
    - wetland.
- is "carried out or to be carried out on any land in a manner that does not comply with a policy made under the contaminated land planning guidelines by the council for any local government area in which the land is situated".

All other remediation work may be carried out without development consent and is known as Category 2 remediation work.

The remediation works will need to comply with the provisions of *SEPP 55* (1998) where appropriate. **Appendix D** of this RAP details which part of the document addresses the various requirements of *SEPP 55* (1998).

It is noted that the *Barangaroo Independent Remediation Review Panel Report* (8 December 2011) prepared by the Barangaroo Independent Remediation Review Panel concluded the approach to remediation for the project was being undertaken with *consideration of contamination and the objective of SEPP 55* (1998) *has been appropriately provided for in the determination of approvals*.

As required by the *Barangaroo Independent Remediation Review Panel Report* (2011), the City of Sydney Council will be notified of the proposed remediation works.

2.2.4 Amended NEPM (1999)

The *National Environment Protection (Assessment of Site Contamination) Measure* (*NEPM*, 1999) has previously been endorsed by the NSW EPA under Section 105 of the *CLM Act* (1997) as amended. The purpose of the NEPM is to '*establish a nationally-consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, contaminated land auditors, land owners, developers and industry*'.

The *NEPM* (1999) has recently been amended by the *National Environment (Assessment of Site Contamination) Amendment Measure* (*NEPAM*, 2013) which was made by the Council of Australian Governments Standing Council on Environment and Waste on 11 April 2013. The *NEPM* (1999) as amended by the *NEPAM* (2013) (here-in referred to as 'the *NEPM* [1999] as amended') has subsequently also been approved by the NSW EPA under Section 105 of the *CLM Act* (1997) as amended on 11 June 2013.

This RAP, together with the *Declaration Site HHERA* (AECOM, 2011a), the *VMP HHERA* (AECOM, 2102c), and the *Declaration Site HHERA Letter* (AECOM, 2012d) have been reviewed in consideration of the *NEPM* (1999) as amended. Based on the outcomes of this review it is considered that the *Declaration Site HHERA* (AECOM, 2011a), the *VMP HHERA* (AECOM, 2012c) and the *Declaration Site HHERA Letter* (AECOM, 2102d) together with this RAP are consistent with the requirements of the *NEPM* (1999) as amended.

3.0 Site Identification and History

3.1 Site Identification

The following table provides Site identification details.

Table 1 Site Identification Details

Item	Description
Site Owner	The Authority
Client	Lend Lease (Millers Point) Pty Ltd (LL)
Site Address	Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Legal Description (Lot and DP)	Part Lot 5 and Part Lot 3 in Deposited Plan 876514 Section of Hickson Road in State Plan 118 and 162 (refer to **Figure F2** in **Appendix B**)
County and Parish	County of Cumberland, Parish of Saint Phillip
Local Government Authority	City of Sydney
Current Zoning	Site within Hickson Road: Maritime and Transport Zone Site within Barangaroo: Part zone B4 Mixed Use[a] and Public Recreation RE1
Current Land Use	Barangaroo: Unused (note that some parts of the Site are temporarily being used as a staging area for construction works in the ORWS Area). Partial access for public recreation (walking and bike riding) (specifically the Harbour Walk). Hickson Road: Public Roadway used by vehicular traffic, pedestrians and bike riders. All areas of the Site may be accessed by intrusive maintenance workers.
Site Area*	Block 4 (within the Declaration Area): 10,685 m^2 Block 4 (outside the Declaration Area and part of the proposed Development Works): 3,527 m^2 Total Block 4 Area: 14,211 m^2 Block 5 Area: 4,823 m^2 Hickson Road Area: 5,724 m^2 Total Declaration Area: 21,232 m^2 Total Site Area: 24,758 m^2
Approximate Average Elevation	2 - 3 m Australian Height Datum (AHD)
Site Location	**Figure F1** (in **Appendix B**)
Site Layout	**Figure F2** (in **Appendix B**)

Notes: * Site Area is approximate and derived from Computer Aided Design (CAD) plans provided by LL.

AHD – Australian Height Datum

[a] NSW Department of Planning and Infrastructure, 2010. *State Environmental Planning Policy (Major Development) Amendment (Barangaroo) 2010*.

3.2 Site History

The history of the Millers Point area in which the Site is located, has been detailed in the publication *Land at Millers Pont Ownership and Usage* (Broomham, 2007). It is understood that the study was commissioned by the former Gasworks owners (Jemena). The historic layout of the gasworks infrastructure is detailed in **Figure F3** in **Appendix B**.

The following summarises historic information presented in Broomham (2007), ERM (2007, 2008a) and URS (2001). Those historic activities which relate directly to the Site and/or other parts of Barangaroo are specifically noted.

- **1788-1839**: During early colonial times the shoreline was extended and a wharf and a cottage were constructed near the southern boundary of the original subdivision.
- **1839:** A part of the Site was occupied by the Australian Gas Light Company (AGL)] in 1839. The gasworks were extended in 1869 to include a retort house and gasholder 100 feet (approximately 30 metres) in diameter. The gasworks were located at the eastern boundary of Barangaroo and extended across Hickson Road. The remainder of Barangaroo was used for shipping and manufacturing activities.
- **1882**: AGL acquired an additional land on the north side of the gasworks and constructed an additional retort house, demolished the first two gas holders and replaced them with a larger 152 feet (approximately 46 metres) diameter gas holder. A tramway system and hydraulic lift was also constructed to transport coke to a depot in Kent Street.
- **1897**: AGL purchased a small piece of land on the northern boundary of the former gasworks site to extend the site 40 feet to the north (Broomham, 2007).
- **1899**: A building that housed a carburetted water gas plant was constructed.
- **1908**: Wharf frontages to the north of the gasworks were dredged to make way for the rat-proof sea wall.
- **1912**: The Minister for Public Works of the State of NSW and Sydney Harbour Trust Commissioners (SHTC) owned part of the Site (part of Lot 3 in DP 876514) between 1912 and 1930. However, it is understood that AGL continued to occupy the gasworks site until 1921 (ERM, 2007 and URS (2001).
- **1918**: Production at the gasworks was terminated at the Site.
- **1921**: SHTC gained possession of the gasworks site.
- **Mid 1920s**: The following activities occurred at the Site, in the mid-1920s:
    - Portions of the gasworks (gasholder and purifier beds) were demolished between 1922 and 1925. The former gasholder tanks were backfilled (ERM, 2007 and URS (2001).
    - Hickson Road was constructed through the former gasworks site. At those locations where no rock foundation was identified, a 4-inch (approximately 10 cm) thick foundation of blue metal followed by an 8 inch (approximately 20 cm) thick foundation of concrete was present. A 6-inch (approximately 15 cm) thick foundation of concrete was placed in those locations where a rock foundation was identified;
    - New jetties and cross-wharf sections of new berths required the complete dismantling of the AGL wharf and excavation into a significant part of the former gasworks;
    - The former gasworks was covered with workshops, including blacksmiths, plumbers, carpenters and a motor garage at the northern end; and
    - There was a SHTC depot located on the western side of Hickson Road.
- **Late 1930s**: MSB painted creosote on the wharf piles (located across Barangaroo Stage 1) to protect them against insects. Part of the Site was transferred to MSB after the SHTC was dissolved in 1936;
- **1951**: Five finger wharfs with approximately a dozen east-west oriented narrow warehouse buildings were present on the western edge of Barangaroo Stage 1.
- **1960s**: The wharfs were reconstructed across the Site. This included the construction of parallel berths with large cargo-moving areas, demolition and removal of some old wharf structures and formation of new sea walls by sinking caissons filled with concrete.
- **1968**: By 1968 the area behind (east of) the sea wall was in-filled (with unclassified fill) and the area was now a continuous wharf. These works occurred across the western portion of Block 4 and 5.
- **1970s and 1980s**: The wharves across the Barangaroo Stage 1 site, including the Site, remained utilised for port activities. The 1972 aerial photograph indicated the finger wharfs had been filled in and the Site comprised a sealed area with two large warehouses, on the northern and western boundary. Southern Cove is still operative.
- **1988**: Southern Cove filled across the Site and in the area to the west.
- **1995**: The longshore wharves at the Barangaroo Stage 1 site were leased to Patrick Stevedores No 2 until 2006. The Sydney Ports Corporation (SPC) was also established in 1995.
- **1999:** The SHFA was formed under the Sydney Harbour Foreshore Authority Act 1998 to consolidate the work and functions of City West Development Corporation, Darling Harbour Authority and Sydney Cove

Authority. Lots 3 and 5 of DP 876514 were transferred to SHFA in 2007. Wharf 8 Overseas Passenger Terminal constructed within the Site.

- **2007**: The Site is declared an Investigation Area by the NSW EPA.
- **2008**: The wharf west of the Site vacated and warehouses demolished in preparation for development.
- **2009**: The Site is declared a Remediation Site by the NSW EPA.
- **2011**: The Site (excluding Hickson Road) is used as part of the construction site supporting the Barangaroo South Stage 1a basement construction (within the ORWS Area).

3.2.1 Filling History

Based on a review of historic aerial photographs and maps of Barangaroo, the history of filling may be summarised as follows:

- **1836 to 1888**: there appeared to be some limited filling around Millers Point towards Darling and Sydney Harbours;
- **1888 to 1897**: filling occurred into Darling Harbour in the vicinity of the Site and there were several finger wharves constructed at the southern end of Barangaroo (offsite to the south);
- **1897 to 1951**: further filling around Millers Point (to the west and north) and four finger wharfs were constructed in the central portion of Barangaroo (northwest of the Site);
- **1951 to 1968**: the southern-most portion of Barangaroo (the current Overseas Passenger Terminal Area) was filled in to the current eastern extent of the Darling Harbour shoreline (within the ORWS area);
- **1968 to 1986**: the area between the historic Southern Cove and Millers Point was filled in after the finger wharves were demolished;
- **1986 to 1988**: the historic Southern Cove was filled in; and
- **1988 to present**: no more significant filling occurred.

It should be noted that, notwithstanding the filling history that can be inferred from the above site history, it is difficult to identify, based on observations from the site investigations, distinct differences in fill type relative to the historical filling sequence at the Site. Further, it appears that the majority of Blocks 4 and Block 5, was filled between 1951 and 1968. A review of the 1983 and 2004 aerial photographs (ERM, 2007) indicates that the historic Southern Cove is the most recent part of the Barangaroo South Development Area to have been infilled.

3.2.2 Historic Gasworks Infrastructure

The former AGL (now Jemena) gasworks historically occupied most of Block 4 and 5 and extended to the area now occupied by Hickson Road (refer to **Figure F5** in **Appendix B**). It is understood that URS (2001) estimated that the footprint occupied by the former gasworks[9] was approximately 5,420 m^2. The following infrastructure is understood to have been present within this footprint:

- Retort House;
- Meter House;
- Tar tank;
- Engine House;
- Gasholders; and
- Purifier Beds.

Previous investigations and remediation works (undertaken at The Bond site on Hickson Road) have identified that existing gasworks infrastructure extend across Hickson Road, including part of the annulus of the former main gasholder, a smaller secondary gasholder and a tar tank (Coffey, 2008).

[9] AECOM did not have access to the URS (2001) report and is unable to confirm whether this area refers to the entire gasworks site or only the gasworks infrastructure.

For the purposes of this RAP, the remnant historic gas holder annuli and tar tank infrastructure located beneath the Site (which are understood to comprise of excavations cut into the underlying bedrock) will be referred to as described in **Table 2** below (refer also to **Figure F3** in **Appendix B**):

Table 2 Historic Gas Works Infrastructure Details

Historic gas works infrastructure	Site area	Relevant sampling location	Approximate depth of cut into bedrock (m bgl)
Main gas holder annulus (part of)	Hickson Road	BH5	10
1870 gas holder annulus	Block 4/Hickson Road	MW10 / MW15	9.4
Tar tank	Hickson Road	MW7 / BH7 and BH53 / MW53	5.5
Small gas holder	Hickson Road	No relevant sampling location. The small gas holder is located directly north of the southern tar tank and coinciding with the location of the main gasholder annulus.	Not known

3.2.3 WorkCover Dangerous Goods Records

ERM (2007) included a search of NSW WorkCover Dangerous Goods Records, which indicated two licences for the greater Barangaroo site (35/032114 and 35/022097) were held by Patrick Stevedores Operations Pty Ltd and Union Bulkships Pty Ltd for the storage of above ground storage of Liquified Petroleum Gas (LPG).

ERM (2007) stated that a WorkCover representative indicated that this may not adequately reflect historic and bulk storage of dangerous goods, as WorkCover was not the only relevant dangerous goods authority for the Site.

3.3 Declaration as Remediation Site

The Declaration Area (refer to **Figure F2** in **Appendix B**) has been declared a remediation site under the *Contaminated Land Management Act* 1997, as follows:

Declaration Number 21122; Area Number 3221

The Environmental Protection Authority (EPA) declares the following land to be an investigation area under the Contaminated Land Management Act 1997 ("1997"):

Land to which this declaration applies ("the site"):

- *Part Lot 5 and Part Lot 3 in Deposited Plan (DP) 876514, Hickson Road, Millers Point;*
- *The part of Hickson Road adjacent to:*
  - *30-34 Hickson Road being Lot 11 DP1065410*
  - *36 Hickson Road being Lot 5 DP873158 and Lot 12 DP1065410; and*
  - *38 Hickson Road being SP72797 Millers Point*

In the City of Sydney local government area, the site coincides with the known footprint of the former gasworks facilities. A map of the site is available for inspection at the offices of the Department of the Environment and Climate Change, Level 14, 59-61 Goulburn Street, Sydney, NSW.

Nature of contamination affecting the site:

The EPA believes that the site is contaminated with gasworks waste and particularly waste tar as a result of the previous use of the site as a gasworks plant. The chemical composition of gasworks waste includes the following substances ("the contaminants"): polycyclic aromatic hydrocarbons (PAHs); benzene, toluene, ethylene and xylene (BTEX); total petroleum hydrocarbon (TPHs); ammonia; phenol and cyanide.

Nature of harm that the contaminants may cause:

The EPA has considered the matters in S.9 of the Act and for the following reasons has determined that the site is contaminated in such a way as to present a significant risk of harm to human health and the environment:

- *Groundwater on the site has been found to be contaminated by TPHs, PAHs, BTEX, ammonia, phenol and cyanide at concentrations significantly exceeding the relevant trigger values for the protection of human health and aquatic ecosystems in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ, 2000).*
- *These groundwater contaminants include human carcinogens and substances toxic to aquatic ecosystems.*
- *The contaminated groundwater is likely to be migrating from the site to Darling Harbour and could ultimately affect aquatic ecosystems.*
- *Contaminated groundwater is impacting on the surrounding areas including the basement of a residential building adjacent to the site, potentially exposing humans in that building to vapours; however it is currently being effectively controlled.*
- *Contaminated groundwater is likely to be migrating from the site to Darling Harbour and could ultimately affect aquatic ecosystems.*

Further action under the Act:

The making of this declaration does not prevent the carrying out of a voluntary remediation of the site and any person may submit a voluntary remediation proposal for the site to the EPA. If the proposal satisfies the requirements of S.26 of the Act, the EPA may agree not to issue a remediation order to the person or persons bringing the proposal.

It is noted that the Site Audit Statements relating to 30-34, 36 and 38 Hickson Road (discussed above) are provided in Appendix E of the *VMP Remediation Extent* report (AECOM, 2013c).

4.0 Proposed Block 4 Development Works and Basement Area

This section describes the proposed future Block 4 Development Works. It is noted that these works are distinct from the VMP Remediation Works (which are required to enable the NSW EPA's declaration of the Declaration Area to be revoked). It is important to note in the event that the proposed Block 4 Development Works do not occur, the VMP Remediation Works will still be undertaken.

4.1 Proposed Land Uses – Block 4 Development Area

The proposed Block 4 development land uses incorporates a mixture of commercial, retail and high density residential and public open space (incorporating roads, community and related land uses) overlying the Block 4 basement (refer to **Section 4.2**).

As noted in **Section 1.6**, it is possible that the final details and configuration of land uses within Block 4 will be revised as part of the continued development design. However, the proposed land uses will remain generally consistent with that described within this RAP.

4.2 Block 4 Basement Area

The Block 4 basement excavations will be supported by a series of groundwater retention walls constructed around the perimeter of the Block 4 basement (refer to **Figure F4** in **Appendix B**). The groundwater retention walls will consist of diaphragm walls (or equivalent), extending to and keyed into bedrock with a reinforced concrete basement wall, constructed on the inside.

Where basement excavations extend into bedrock, exposed bedrock surfaces will be covered with shotcrete or concrete. It is anticipated that perimeter walls and shotcrete / concrete covered bedrock, together with other controls which are standard practice for basement construction, will effectively isolate the basement from surrounding ground conditions.

Based on the current Lend Lease basement designs (refer to **Figure F4** in **Appendix B**) it is understood that the car park basement in Block 4 will be excavated and constructed to a typical depth of approximately 8 m below ground level (bgl) (RL -5.6 m AHD). As indicated in **Figure F4** in **Appendix B**, a portion of the Block 4 basement will extend beyond the western boundary of the Declaration Area.

The basement footprint will likely extend into the underlying bedrock across the eastern portion of Block 4 where bedrock is generally present at depths ranging between 2 and 10 m below ground level (RL -0.5 m to -7.5 m AHD). Consequently, fill material will typically remain beneath the basements in the western portions of Block 4 (as presented in the Schematic Cross Section, **Figure 3**, refer to **Section 1.6**).

The proposed basement construction within Block 4 (as shown in **Figure 3** above) will result in existing site materials:

- Being removed as part of Block 4 basement excavations and subject to either:
    - Off-site disposal to an appropriately licensed landfill or other Site in accordance with an EPA approved Resource Recovery Exemption; and/or
    - Reuse (refer to **Section 7.3**); or
- Remaining *in situ* below the Block 4 basement area and within the retention wall system and without hydraulic connection with Darling Harbour.

Further details regarding the assumptions relating to the Block 4 Development Works and included in the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) are provided in **Section 7.2.3**.

As noted previously, it is possible that the final details and configuration of land uses within Block 4 will be revised as part of the continued development design. If the basement design is changed in a way that affects the assumptions detailed herein (refer to **Section 7.2.3**), contingency actions may be considered (refer to **Section 23.10**). If required, an Addendum to this RAP will be prepared and submitted to the NSW EPA Accredited Site Auditor for approval.

It is noted that a future road may be proposed on the Block 4 / Block 5 boundary alignment, with part of the road located on the northern strip of Block 4. The final layout of this road is subject to further design and development. This road may be constructed over the Block 4 basement, such that remediation of the area (if required) is

undertaken as part of Block 4 basement excavation and remediation as per this RAP. Alternatively, the road may be constructed at the current grade (i.e. with no underlying basement). If this occurs, remediation of the area will be undertaken in accordance with **Section 4.4** and **Section 23.12** of this RAP.

It is noted that in the unlikely event that the Block 4 Development Remediation Works are not undertaken, the proposed basement groundwater retention wall system will not be constructed (refer to **Section 4.3** below).

4.3 Basement Groundwater Retention Wall System

The Block 4 basement excavations will be supported by a series of groundwater retention walls constructed around the perimeter of the Block 4 basement (refer to **Figure F4** in **Appendix B**). The groundwater retention walls will consist of diaphragm walls (or equivalent), extending to and keyed into bedrock and will be a minimum thickness of 600 mm.

Where basement excavations extend into bedrock, exposed bedrock surfaces will be covered with shotcrete or concrete. It is anticipated that perimeter walls and shotcrete / concrete covered bedrock, together with other controls which are standard practice for basement construction, will effectively isolate the basement from surrounding ground conditions. Consequently, the development of ecological risk based criteria for Block 4 (i.e. within the retention wall system) was not considered to be required for ecological protection.

Further details regarding the assumptions included in the *Declaration Site HHERA* (AECOM, 2013c) and the *Declaration Site HHERA Letter* (AECOM, 2012d) are provided in **Section 7.2.3**.

4.4 Development Design Finalisation

It is possible that the final details and configuration of land use and basement design within Block 4 will be revised as part of the continued development design. However, the proposed land uses for Block 4 - that is a mixture of commercial, retail and high density residential (with minimal access to soil) with associated open space area (planter boxes, paved areas and parkland) - will remain generally consistent with that described within this RAP.

If the design is changed in a way that affects the Block 4 Development Remediation Works assumptions detailed herein (refer to **Section 7.2.3**), an Addendum to this RAP will be prepared and submitted to the NSW EPA Accredited Site Auditor for approval.

Contingency measures designed to address modification of the development design (for example, minor changes in the depth of the basement or alignment of the Block 4 retention wall system) are detailed in **Section 23.12**.

The future land use of Block 5 is subject to further design by the Authority. It is understood that the proposed land uses will likely remain generally consistent with those described for Block 4 – that is a mixture of commercial, retail and high density residential and public open space (incorporating roads, community and related land uses) overlying basements. However, given the preliminary status of the future Block 5 land use design, this RAP is focused on the VMP Remediation Works within Block 5 only.

Future development of Block 5 will require a separate RAP (or an Addendum to this RAP) to be prepared and submitted to the NSW EPA Accredited Site Auditor for approval. If the Block 5 development works relates to VMP Remediation Works, the document would also be submitted to the NSW EPA for approval.

5.0 Previous Investigations

A number of previous investigations have been undertaken at the Site. It is noted that these investigations also include investigations undertaken in areas of Barangaroo South that are not the subject of this RAP. The reports considered relevant to this RAP include the following.

- Noel Arnold & Associates 1996. *Initial Environmental Assessment*, Sydney Ports Corporation, Darling Harbour Berths 3-8 Hickson Road, Darling Harbour. June.
- Coffey 1998. *Environmental Soil Quality Assessment of Wharf 8, Darling Harbour*.
- URS 2001. *Contamination Review for Darling Harbour Berths 3-8*.
- Jeffery and Katauskas (J&K) 2006. *Geotechnical Report development of Wharves 3-8 at East Darling Harbour*. August.
- ERM 2007. *Environmental Site Assessment, East Darling Harbour, Sydney, NSW*, Final Report. 21 June.
- Coffey Environments 2008. *Preliminary Environmental Investigation, 30-38 Hickson Road, Millers Point, NSW 2000*. 12 May.
- ERM 2008a. *Additional Investigation Works at Barangaroo, Hickson Road, Millers Point, NSW*. July.
- ERM 2008b. *Preliminary Sediment Screening Works at East Darling Harbour, Adjacent to Barangaroo, NSW*, Draft, Rev 03. August.
- Coffey 2010. *Barangaroo Stage 1 Development Geotechnical Report*. 15 October.
- ERM 2010. *Overarching Remedial Action Plan for the Barangaroo Project Site, Sydney*. June.
- AECOM 2010a. *Data Gap Investigation, Other Remediation Works (South) Area, Hickson Road, Millers Point, NSW*. 27 May.
- AECOM 2010b. Data Gap Investigation, EPA Declaration Area (Parts of Barangaroo and Hickson Road) Millers Point NSW. 23 September 2010.
- AECOM 2010c. *Data Gap Investigation, Other Remediation Works (North) Area, Hickson Road, Millers Point, NSW*. 20 October 2010.
- AECOM 2010d. *Groundwater Discharge Study, Stage 1 Barangaroo Development*. 3 November 2010.
- AECOM 2011a. *Declaration Site (Development Works) HHERA, Hickson Road, Millers Point, NSW*. 9 June (final).
- AECOM 2011b. *Amended Remedial Action Plan, Barangaroo - ORWS Area*. 7 July (Final).
- AECOM 2012a. *Supplementary Data Gap Investigation, VMP Area, Hickson Road, Millers Point, NSW*. 9 March (Final).
- AECOM 2012b. *Contaminant Flux and Discharge estimations for natural residual soil and marine sediments, EPA Declaration Area 21122 and adjacent areas of Barangaroo South and Barangaroo Central*. 14 March. Refer to Appendix C of the *VMP Remediation Extent* report (AECOM 2013b).
- AECOM 2012c. *Human Health and Ecological Risk Assessment, VMP Remediation Works Area. (Addressing the NSW EPA Remediation Site Declaration 21122, Millers Point).* 25 October 2012.
- AECOM 2012d. *Declaration Site HHERA Letter* (Draft) - *Human Health and Ecological Risk Assessment - Declaration Site, Barangaroo. Assessment of the Implications of the Revised Basement Design*. 3 July.
- AECOM 2012e. *Tree Root Mass Investigation, Hickson Road, Millers Point, NSW*. 23 November (Final).
- AECOM 2013b. *Additional Groundwater Modelling to Supplement Contaminant Flux and Discharge Estimates for Natural Soils and Marine Sediments for EPA Declaration Area 21122*. 12 March 2013. Refer to Appendix D of the *VMP Remediation Extent* report (AECOM 2013b).
- AECOM 2013c. *VMP Remediation Extent, VMP Remediation Works Area, (Parts of Barangaroo and Hickson Road), Millers Point, NSW*. 13 March 2013.
- JBS Environmental Pty Limited (JBS) 2012. *Barangaroo Central DGI, Hickson Road, Sydney, NSW*. August (Revision C).

These reports are summarised in **Sections 5.1** to **5.19** below.

Sample locations from the previous investigations are presented in **Figure F3** in **Appendix B**.

In addition to the above investigations, additional documentation which has been reviewed and was considered during the preparation of the DGI reports includes the following:

- LL supplied CD, 2010. The Authority Supplied Historical Work As Executed Drawings for the Former Wharf Structures at Berths 3 to 8, Barangaroo. CD dated 21 January.
- LL supplied CD, 2010. Geotechnical Information - Barangaroo Area (including CBD Metro Geotechnical and Environmental Investigations, completed by Coffey). CD dated 21 January.
- LL Scheme CAD files provided to AECOM in December 2009.

5.1 NA&A (1996)

Noel Arnold and Associates (NA&A) were commissioned by the Sydney Ports Corporation to undertake an Initial Environmental Assessment at Berths 3-8 Hickson Road, Darling Harbour, NSW.

The report details results of an initial contamination assessment and provides options for remedial management of the area investigated. Known and potential contamination was not determined to be a risk to the ongoing use by the then occupant providing subsurface materials were not disturbed. Impact was identified in the area of the former AGL Gasworks located to the north of the Site.

5.2 Coffey (1998)

Coffey was engaged by Sydney Ports Corporation to undertake an Environmental Soil Quality Assessment of Wharf 8, Darling Harbour.

The investigation was a limited site assessment including soil sampling at Wharf 8 to identify contamination and provide options for disposal of excavated soil associated with proposed development. The ESA reported limited PAH contamination and identified material required for off-site disposal that would likely require industrial or hazardous waste classification.

5.3 URS (2001)

URS was commissioned by the Sydney Harbour Foreshore Authority (SHFA) to conduct a Contamination Review for Darling Harbour – Berths 3/8, which comprised a review of the contamination issues collated from 11 reports, produced between1993 to 2001. The review identified soil and groundwater contamination associated with the former gasworks, including off-site migration, and soil contamination associated with current vehicle maintenance operations.

5.4 Jeffery and Katauskas (2006)

Jeffery and Katauskas Pty Ltd (J&K) undertook a Geotechnical Investigation for the East Darling Harbour property (Barangaroo). The investigation was undertaken concurrently with the ERM (2007) Environmental Site Assessment (ESA) which is summarised in **Section 5.5** below.

Key geotechnical findings from the J&K investigation were:

- Fill was sandy and increased in clay content with depth and refusal occurred within fill at several locations across the Site;
- The fill contained large pieces of rubble and was poorly compacted;
- The alluvial sediments consisted predominantly of sandy clays which extended to sandstone bedrock; and
- Sandstone bedrock was generally shallower at the eastern portions of the Site and deepest over the western portion towards Darling Harbour.

5.5 ERM (2007)

Environmental Resources Management Australia (ERM) was commissioned by SHFA to undertake an Environmental Site Assessment (ESA) which consisted of a Stage 1 Preliminary Site Investigation (PSI) and

Stage 2 Detailed Site Investigation (DSI) for the East Darling Harbour property (Barangaroo, ERM, 2007). The investigation was undertaken concurrently with the J&K (2006) investigation (summarised in **Section 5.4** above).

The PSI component of the investigation reported that Barangaroo (including part of the Site) was historically used for port/wharf activities and workshops. The former AGL gasworks site was located within the Site boundary and reclamation activities had historically occurred at Barangaroo for the construction of the wharfs.

Based on the historical information ERM concurred with URS (2001) that the contaminants of potential concern (CoPC) for Barangaroo were TPH, BTEX, heavy metals, PAHs, polychlorinated biphenyls (PCBs), cyanide, sulfates, organochlorine pesticides (OCPs) and organophosphate pesticides (OPPs).

The ESA made the following conclusions:

- Impacts to soil and groundwater were identified predominantly within the area of the former gasworks infrastructure and the reclaimed area west of the Site, with the primary contaminants of concern confirmed as lead, TPH/BTEX and PAH;
- No non aqueous phase liquids (NAPLs) were observed during the investigation, however concentrations of organic contaminants such as TPH indicated that NAPL was likely present in the vicinity of the former gasworks area;
- The groundwater regime was likely to be strongly influenced by tidal fluctuation; and
- There appeared to be potential for both migration of contamination onto the Site from the east and migration of contamination from the site into adjacent properties and into Darling Harbour.

The ESA included the following key recommendations:

- The extent of the risks to human health and the environment should be assessed through further investigations and a quantitative risk assessment; and
- Additional delineation investigations and assessment of vapour flux from impacted areas and further assessment of hydrogeological conditions should be undertaken before developing a RAP.

A summary of soil and groundwater results from the ESA is included in **Section 5.8** along with the additional soil data from the 2008 ERM additional investigation (ERM, 2008a).

5.6 Coffey (2008)

Coffey was commissioned by the Council of the City of Sydney to undertake a Preliminary Environmental Investigation (PEI) at the segment of Hickson Road (between numbers 30 to 38), Millers Point, NSW, which is located in the eastern portion of the Site.

- Soil samples were analysed for Heavy Metals, TPH, BTEX, PAH, phenols, chlorinated hydrocarbons and asbestos. Groundwater samples were analysed for heavy metals, TPH, BTEX, PAH, phenols, chlorinated hydrocarbons and ammonia.
- The general ground conditions encountered during the intrusive investigation comprised asphalt overlaying concrete and fill ranging in depth between 3.1 and 9.4 m bgl. The fill generally consisted of gravelly sand and sandy gravels with minimal anthropogenic inclusions. The fill was generally underlain by sandstone, with the exception of residual clayey sand and sand soils at two locations (BH3 and BH2).
- Tar was encountered in boreholes BH7 (4.6-5.4 m bgl) and BH10 (8.5 and 9.4 m bgl, assumed to be within the 1870 gas holder annulus) which were located in the southern portion of the investigation area.
- Concentrations of heavy metals, phenols and chlorinated hydrocarbons were either less than the laboratory Limit of Reporting (LOR) or the adopted assessment criteria in all samples analysed. Asbestos fibres were not detected in any sample analysed.

The Coffey PEI made the following conclusions and recommendations:

- High concentrations of soil and groundwater contamination were present in the former gasworks infrastructure, with the nature of the contamination typical of gasworks operations;

Based on localised sources of contamination identified within the historic infilled infrastructure (i.e. the tar tank and the 1870 gas holder), the migration of less mobile contaminants may be reduced by the surrounding bedrock, but has the potential to migrate as separate phase hydrocarbon slowly along fractures and joints;

- The extent of deeper contamination associated with the former main gas holder annulus could not be delineated as part of the investigation;
- The current use of the land as a public road was considered to be a low risk to human health as there was no direct contact with contaminated soils; and
- Following additional investigations to reduce uncertainties and further delineate the impacted soils and groundwater, a Remedial Action Plan should be developed.

5.7 ERM (2008a)

ERM was commissioned by SHFA to undertake additional soil and groundwater investigation works at Barangaroo (ERM, 2008a). The objectives of the works were to fill in data gaps in soil and groundwater data to enable a RAP to be developed.

A summary of the results from within the Site are provided in **Table 3** below. The table also includes the relevant ERM (2007) ESA results. Note the soil results were assessed against NEPC, 1999. *Guideline on the Investigation Levels for Soil and Groundwater. Schedule B(1)*. National Environmental Protection Measure. National Environmental Protection Council.

Table 3 Summary of Soil and Groundwater Analytical Results from ERM and Coffey Investigations

Analyte	No. Soil Results	Soil Results (Coffey and ERM)	Groundwater Results (All monitoring rounds, Coffey and ERM)
Heavy Metals	142	Concentrations of metals in samples were all less than NEPM (1999) Health Investigation Level (HIL) D Criteria with the exception of lead in the following sample locations: BH201/10.3 (3190 mg/kg) BH132_1.5-1.95 (12100 mg/kg) BH074_1.5-1.95 (1930 mg/kg) BH067-1.5-1.95 (13600 mg/kg) BH062-1.5-1.95 (2870 mg/kg) Metal concentration ranges are listed below. Lead (<5 to 13 600 mg/kg) Arsenic (<5 to 33 mg/kg) Cadmium (<1 to 2) Chromium (III+VI) (<2 to 171 mg/kg) Copper (<5 to 171 mg/kg) Mercury (<0.1 to 5.2 mg/kg) Nickel (<2 to 107 mg/kg)Zinc (<5 to 4770 mg/kg)	Heavy metal concentration ranges and exceedances are listed below. Lead : <0.0002 to 0.037 mg/L (ANZECC [2000] 95% trigger value [ANZECC] exceedances in MW15 and MW6 and MW7) Arsenic: <0.0005 mg/L to 0.024 mg/L Cadmium: <0.0001 to 0.007 mg/L Chromium (III+VI): <0.0005 to 0.017 mg/L (ANZECC exceedances in MW10, MW15, MW198 and MW204D) Copper: <0.001 to 0.003 mg/L (ANZECC exceedances in MW7 and MW10) Mercury: <0.0001 to 0.0011 mg/L (ANZECC [99%] exceedances in MW15,MW198, MW204D, MW205 and MW7, MW15 and MW10) Nickel: 0.005 to 0.158 mg/L (ANZECC exceedances in MW205, MW198, MW15 and MW10) Zinc: 0.009 to 0.373 mg/L (ANZECC exceedances in MW10, MW6, MW15 and MW3 and in MW15, MW198, MW200 and MW205)
TPH C_6-C_9	137	TPH C_6-C_9 was detected in 35 samples and the concentration range was <2 to 7590 mg/kg. 19 samples exceeded the NSW EPA (1994) criteria of 65 mg/kg. The highest concentration was in sample MW10_8.6-8.7.	TPH C_6-C_9 concentrations ranged from <20 to 73600 µg/L The highest concentration was in MW205 and the lowest in MW6.

Analyte	No. Soil Results	Soil Results (Coffey and ERM)	Groundwater Results (All monitoring rounds, Coffey and ERM)
TPH C_{10}-C_{36}	143	TPH C_{10}-C_{36} was detected in 82 samples and the concentration range was <50 to 181 100 mg/kg. 19 samples exceeded the NSW EPA (1994) criteria of 1000 mg/kg. The highest concentration was in sample MW10_8.6-8.7.	TPH C_{10}-C_{36} concentrations ranged from <50 to 205 000 µg/L. The highest concentration was in MW15 and the lowest in MW6.
BTEX	137	Benzene, Toluene, Ethylbenzene and Total Xylene was detected in 27 to 31 samples and the concentration ranges and number of exceedances of the NSW EPA (1994) criteria were: Benzene (<0.2 to 1510 mg/kg), 24 exceedances Toluene (<0.2 to 2650 mg/kg), 4 exceedances Ethylbenzene (<0.2 to 261 mg/kg), 2 exceedances Total Xylene (<0.01 to 2576 mg/kg), 16 exceedances The highest concentration was in sample MW10_8.6-8.7.	The following BTEX concentration ranges have been reported: Benzene: <1 to 40200 µg/L (ANZECC exceedances in MW15,MW200, MW204D, MW205, MW209 and MW7, MW15 and MW10) Ethylbenzene: <2 to 3020 µg/ L (highest concentration in MW205) Toluene: <0.002 to 17.6 µg/L (highest concentration in MW15) Total Xylene: <4 to 6700 µg/L (highest concentration in MW15)
PAHs	143	PAH compounds were detected in 35 samples and the concentration range was <0.5 to 29652.8 mg/kg. 102 samples exceeded the NEPM (1999) HIL D Criteria for Total PAHs of 100 mg/kg. The highest concentration was in sample MW10_8.6-8.7. B(a)P was detected in 88 samples and the concentration range was <0.5 to 29652.8 mg/kg. 51 samples exceeded the NEPM (1999) HIL D Criteria for B(a)P of 652 mg/kg. The highest concentration was in sample BH204D/1.5.	PAH concentration ranges are listed below. Total PAHs: 2.2 to 384000 µg/L (highest concentration in MW15) Naphthalene: 0.6 to 192000 µg/L (ANZECC exceedances in MW15, MW7 and MW3 and MW210, MW209, MW206, MW205, MW204D, MW200 and MW15) B(a)P: <0.2 to 7750 µg/L (highest concentration in MW15)
Phenols	72	Concentrations of Phenol in all samples were all less than NEPM (1999) HIL D Criteria of 42 500 mg/kg. Phenol was detected in nine samples and the concentration range of was <0.5 to 1720 mg/kg.	The concentrations of Phenol ranged between <1 µg/L to 249 000 µg/L. There were ANZECC exceedances in MW15, MW7 and MW3 and MW15, MW200 and MW204D. The highest concentration was in MW204D and the lowest in MW3.
PCBs	73	PCBs were only detected in 2 samples with concentrations of 0.43 mg/kg (BH115 1.5_1.95) and 0.74 mg/kg (BH062-3.0-3.45). Concentrations of PCBs in all samples were all less than NEPM (1999) HIL D Criteria of 50 mg/kg.	Concentrations of PCBs were less than the laboratory LOR in all samples analysed.
OCPs/OPPs	2	OCPs and OPPs were not detected at concentrations greater than the LOR.	Not analysed.
Asbestos	12	Chrysotile and amosite asbestos fibres detected in BH203/1.5	Not applicable

The ERM Additional Investigation included the following recommendations:

- A quantitative human health and ecological risk assessment should be undertaken once further details of future redevelopment are known;
- Results of the investigation should be assessed with reference to previous investigations undertaken for Barangaroo;
- Routine groundwater monitoring should be considered to assess temporal variations in CoPC;
- Considering asbestos was identified in only one sample, it was unlikely that asbestos contamination was wide spread, however it was recommended that further work is required to determine the extent and nature of asbestos in fill; and
- A RAP should be developed.

5.8 ERM (2008b)

ERM was commissioned by SHFA to undertake Preliminary Sediment Screening Works at East Darling Harbour, adjacent to Barangaroo (ERM, 2008c). The preliminary sediment screening works were conducted in East Darling Harbour to identify potential offsite migration of contamination from the Site to sediments in Darling Harbour.

Sediment cores were collected from the Harbour adjacent to Barangaroo along 7 transects. Screening identified PAH, tributyl tin (TBT) and metals exceeding ANZECC/ARMCANZ (2000) interim sediment quality guidelines (low). Elevated concentrations of TPH C_{10}-C_{36} were also reported. The report concluded that remediation of sediments in Darling Harbour would not be required.

5.9 ERM (2010)

ERM was commissioned by SHFA to complete a conceptual *Overarching RAP* for the Barangaroo site. The conceptual RAP envisaged the following scope of works for the site remediation and management of various areas of the Barangaroo site:

- Completion of a Quantitative HERA to develop Risk Based Cleanup Levels (RBCLs) for each area of the Barangaroo site;
- Preparation of a Remedial Works Plan (RWP), Remediation EMP, OH&S Plan, Community Consultation Plan, a Long Term EMP;
- Planning and approvals;
- Site establishment for remediation; and
- Demolition of and appropriate disposal of remaining structures.

The Barangaroo site was divided into four areas (Area 1 to Area 4) for the purposes of the RAP. Of these Areas, Area 1 relates to Block 4 and 5 within the Declaration Area and Area 3 relates to the Hickson Road portion of the Site. The RAP provided a brief assessment of remediation options for Area 1 and 3 including the following:

- On-site treatment of soil and groundwater and reuse of materials on-site where possible;
- *In situ* treatment following bench scale testing and the Pilot Trial program;
- Excavation, off-site treatment and reinstatement onsite;
- Removal of contaminated material to an approved site or facility and replacement with validated clean fill; and
- On-site management via encapsulation with a physical barrier.

5.10 AECOM (2010b) Data Gap Investigation, EPA Declaration Area (Parts of Barangaroo and Hickson Road)

AECOM was engaged by Lend Lease to undertake a DGI (AECOM, 2010b) for the Declaration Area (including groundwater monitoring in down hydraulic gradient areas).

A summary of all analytical data available from all previous investigations, including this DGI, for the Declaration Area is provided in Section 4 of the *VMP Remediation Extent* report (AECOM, 2013c).

Fill Materials and Natural Soils

The results of the DGI (which included consideration of investigations conducted by others) are briefly summarised following:

- Observed fill materials generally comprised unconsolidated gravels, sand, bricks, sandstone, timber, slag and steel in a variable gravelly sand to clayey sand matrix. Fill materials were present above natural silty sands, gravelly sands, clays, weathered sandstone and sand with components of clay overlying sandstone bedrock. These results were generally similar to the previous investigations and confirm the presence highly variable fill material underlying the Declaration Area, thickening to the west towards Darling Harbour; and
- Field observations indicated that free tar was observed as a DNAPL in wells MW204D, MW205, MW206, MW53, MW15, BH7 and BH10 (MW10), as well as testpits TP05 and TP07. It was noted that groundwater samples were not collected from the wells, however NAPL samples were collected from monitoring wells MW205 and MW206. All wells with free tar were located within the location of the former gasworks. BH1 (located on Hickson Road to the north of the Declaration Area) was unable to be sampled as the well was dry. Down-gradient well MW212 was filled with sand and unable to be sampled.

Based on the reported results, the following conclusions were made regarding the lateral and vertical extent of contamination in fill and natural material:

- The maximum concentrations of CoPC were generally located in proximity to and down gradient from the former gasworks infrastructure in the Declaration Area. Free tar was identified in a number of additional locations in Hickson Road and Block 4 within and in the vicinity of the tar tank, purifying beds and 1870 gasholder, indicating these locations are source areas of contamination;
- Reported concentrations of TPH, BTEX and PAHs generally decreased with distance from the inferred source areas. The results indicate that lateral migration of contamination has and continues to occur; and
- Asbestos was identified in a single sample during a previous investigation. A second sample reported the presence of unidentified mineral fibres. The reported results and visual observations during sampling indicated that asbestos is not widespread within fill materials within the Declaration Area.

Hydrogeological Conditions

The results of the DGI indicated that groundwater beneath the Declaration Area is present as an unconfined, shallow aquifer within the fill materials and the underlying natural sediments. Groundwater is also likely to occur as a deeper bedrock aquifer within the underlying sandstone bedrock. Groundwater within the bedrock would occur as a fractured bedrock aquifer, potentially confined by an overlying clay unit in some areas of the Declaration Area.

Due to the proximity of the Declaration Area to Darling Harbour, the depth to groundwater is shallow and the overall direction of groundwater flow is expected to be towards Darling Harbour. Groundwater within the Declaration Area is tidally influenced, resulting in the fluctuation of groundwater levels within the fill materials and natural sediments. Groundwater chemistry within the Declaration Area is dominated by sodium and chloride ions, indicative of a saline environment. Variability in the groundwater chemistry and hardness was present in some areas of Declaration Area, which was attributed to the presence of the fill materials.

The hydraulic conductivities reported within the Declaration Area were variable due to the inconsistent nature and distribution of fill materials. This variability in conductivity results in inconsistent lag times for tidal influence across the Declaration Area and creates a tortuous flow path for groundwater and associated contamination.

Groundwater

Contaminants associated with the former gasworks operation were present in groundwater within and down-gradient of the Declaration Area. The distribution of groundwater contamination across the Declaration Area appears to be influenced by tidal fluctuations and the variable nature and distribution of fill materials used to backfill the Declaration Area.

Significant concentrations of TPH, BTEX, PAH were reported in groundwater across the former footprint of the gasworks infrastructure. Cyanide concentrations (free and weak acid dissociable) were reported in various wells in the Declaration Area but showed no correlation with naphthalene (considered a gasworks indicator CoPC) indicating that if the reported cyanide is related to the gasworks it does not appear to be as persistent as the organic contaminants.

Free phase tar was reported in several wells located within the footprint of the former gasworks site. Tar was observed within wells installed at varied depths throughout the profile, indicating dense non aqueous phase liquid (DNAPL) is present within the Declaration Area within fill materials, natural sediments and bedrock. Given the varied depth of DNAPL occurrence within the Declaration Area, it is likely that the associated dissolved phase contamination also exhibits significant spatial variability in terms of depth of occurrence and concentration.

Contaminant concentrations reported in down hydraulic gradient well AECOM MW60 (located down gradient of the Declaration Area in the ORWN Area), screened between 14 and 22 m bgl (-11.31 to 19.31 m AHD) across the base of the fill and natural sediments immediately overlying bedrock, was an order of magnitude higher than concentrations reported for more shallow down-gradient wells. This suggests the most significant dissolved phase concentrations are at depth down-gradient of the Declaration Area and based on the depths to the Harbour floor reported in ERM (2008b), which ranged between 10 m to 13.2 m below the water surface, are present at an elevation below the sea floor of Darling Harbour.

Heavy metals concentrations exceeding the guidelines were widespread across the Declaration Area. Compounds exceeding the criteria in numerous monitoring wells included cobalt, copper, lead, nickel and zinc. The slightly acidic nature of groundwater within the Declaration Area may also be contributing to the mobilisation of heavy metals from within the fill materials. Metals concentrations were generally consistent with previous investigations.

Recommendations

The DGI included the following recommendations:

- A Site-specific HHERA or HHERAs should be prepared providing remediation goals suitable for : (a) removal of the NSW EPA Declaration; and, (b) remediation of the Declaration Area for the proposed future land use; and
- A RAP or RAPs should be prepared detailing options for remediation and/or management that will:
    - Facilitate removal of the NSW EPA Declaration;
    - Render the Declaration Area suitable for its intended future land use; and
    - Detail validation requirements to be implemented to demonstrate successful completion of the remedial.

5.11 AECOM (2010c) Data Gap Investigation, Other Remediation Works (North) Area

AECOM was engaged by Lend Lease to undertake a DGI of the Barangaroo Other Works (North) Remediation Area (ORWN Area), that is immediately west of the Site (refer to **Figure F2** in **Appendix B**).

The results of the DGI (which included consideration of investigations conducted by others) are briefly summarised following:

- Encountered fill depths ranged from 10.0 to 23.5 m bgl. Fill materials were generally shallower in the east, closest to Hickson Road, and deeper in the west, closest to Darling Harbour. The thickness of fill material generally increased from east to west across the ORWN Area;
- Natural soils encountered across the ORWN Area comprised silty sands, gravelly sands, clays, weathered sandstone and sand with components of clay. Sandstone bedrock was encountered across the ORWN Area

with encountered depths ranging from 10.0 m bgl to 25.0 m bgl. Bedrock was generally shallower to the east, closest to Hickson Road, and deeper to the west, closest to Darling Harbour;

- The reported contaminants of potential concern (CoPC) were generally consistent with that identified during previous investigations and variably exceeded the adopted site investigation criteria across the ORWN Area;
- The maximum concentrations of CoPC were generally located in proximity to and down gradient from the former gasworks infrastructure in Blocks 4 and 5;
- A reported concentration of naphthalene above the soil vapour criteria was detected in the single soil vapour well located down-gradient of the former gasworks and in proximity to the Declaration Area indicating the potential presence of gasworks-derived impacts. Concentrations of toluene (below soil vapour guidelines) were also detected;
- Groundwater was encountered at depths ranging from 1.823 m bgl to 2.975 m bgl and is subject to tidal fluctuation; and
- The most significant groundwater contamination was reported for wells screened deeper within the aquifer, across the base of the fill and natural sediments immediately overlying bedrock. Monitoring wells screened entirely within the top 10 m of the aquifer generally reported TPH, PAH and BTEX concentrations less than the laboratory LOR.

The DGI included the following recommendations:

- A site-specific HHERA should be prepared providing remediation goals suitable for remediation of the ORWN Area for the proposed future land use;
- A RAP should be prepared detailing options for remediation and/or management that will:
    - Render the ORWN Area suitable for its intended land use; and
    - Detail validation requirements to be implemented to demonstrate successful completion of the remedial works.
- An Acid Sulfate Soil Management Plan may be required for the management of PASS during future excavation works.

5.12 AECOM (2010d) Groundwater Discharge Study, Barangaroo

In order to support the *VMP HHERA* (AECOM, 2012c), a key pathway and receptor that needed to be considered was the interaction of contaminated groundwater with Darling Harbour. A primary objective of the Groundwater Discharge Study was to inform the *VMP HHERA* (AECOM, 2012c) and *Declaration Site (Development Works) HHERA* (AECOM, 2011a) with respect to likely attenuation factors for contaminant mass flux due to mixing of seawater prior to discharge.

AECOM installed a transect of multilevel piezometers, comprising two arrays of three piezometers each, as well as a stilling well in Darling Harbour, immediately adjacent to the multilevel piezometer transect. Instantaneous hydraulic head measurements, groundwater and surface samples and hydraulic head time series data (hydrographs) were collected from these installations during the investigation.

Relative to that occurring from the fill sequence, groundwater discharge volumes and therefore contaminant mass flux from the marine sediments was considered to be negligible from a hydrogeological perspective. Groundwater discharge occurring via the basal Hawkesbury Sandstone was not considered significant in the context of contaminant flux due to very low values of permeability reported for this formation in the literature.

The tidal exchange prism is defined as the area immediately behind the caisson wall where full inundation of sea water occurs during the incoming and outgoing tide. The dimensions of the tidal exchange prism have been defined as being a rectangular volume extending 10 metres, on average, landward of the existing caisson wall. Where leachable source material is present within the tidal exchange prism, any resultant groundwater contamination is expected to discharge largely without further attenuation.

The Study indicated that of the total flux towards the Harbour in any given ebb tide, approximately 10% represents water from up gradient, which equates to a groundwater (including connate seawater) to seawater mixing ratio of approximately 1:10. However, given potential uncertainty regarding the original shoreline location and dates for the commencement of reclamation activities, attenuation factors for groundwater up gradient of the tidal exchange

prism were conservatively estimated as a factor of 5. It was concluded that contamination which has migrated into, or is otherwise present within the tidal exchange prism, was not expected to undergo further attenuation prior to discharging to the Harbour.

5.13 AECOM (2011a) Declaration Site HHERA

The *Declaration Site HHERA* (AECOM, 2011a) was prepared to develop SSTC (soil and groundwater concentrations) and SSESC (if applicable) that remediation would have to achieve to allow redevelopment for the land uses described in the proposed Declaration Area development plans. The SSTCs and SSESCs are concentrations that would not give rise to unacceptable risks to both human health and the environment under the specified land use and would be applicable to the Block 4 Development Remediation Works (refer **Section 4.0**).

5.13.1 Scope of Work

The *Declaration Site HHERA* (AECOM, 2011a) comprised the following key steps with respect to derivation of SSTCs:

- Identification of CoPC in environmental media, based on comparison to relevant human health based 'Tier 1' screening criteria;
- Qualitative and quantitative assessment of the toxicity of each CoPC;
- Development of Conceptual Site Models (CSMs) for land use scenarios relevant to the Block 4 Development Remediation Works;
- Quantitative Exposure Assessment for each land use scenario, in order to estimate the extent to which human receptors may be exposed to CoPC within the Block 4 Development Remediation Works area, including vapour and dust migration modelling where relevant;
- Adoption of acceptable risk levels to derive SSTC; and
- Derivation of media and chemical specific SSTC for each CoPC based on consideration of toxicity criteria, exposure parameters, contaminant transport modelling and acceptable risk levels.

The proposed design for the Block 4 Development Works includes construction of a basement groundwater retention wall system around the perimeter of Block 4 that will extend to and be keyed into bedrock. The development of SSESCs for the Block 4 area within the retention wall system is therefore not required for ecological protection.

Based on the Block 4 development plans, the broad land use scenarios for which SSTC have been derived are:

- **Scenario 1** - lower-most basement car park level below the water table;
- **Scenario 2** - upper-most basement car park level, partially above the water table;
- **Scenario 3** - unpaved public domain / open space;
- **Scenario 4** - paved public domain / open space;
- **Scenario 5** - typical commercial slab on ground construction ;
- **Scenario 6** - short term ground-intrusive maintenance; and
- **Scenario 7** - typical residential residence with basement construction.

5.13.2 Conclusions

Human Health Risks

a) Potentially unacceptable human health risks have been identified under a number of redevelopment scenarios and remediation is required to make the Site fit for the proposed land uses. The following specific issues were identified:

   1) **Scenario 1 (Lower Basement):** The highest reported groundwater concentrations of benzene, 2-methylnaphthalene, naphthalene and TPH C_{10}-C_{14} have the potential to result in unacceptable health risks from inhalation of vapours in the basement airspace.

2) **Scenario 2 (Upper Basement):** The highest reported concentrations of benzene, 1,2,4-trimethylbenzene, naphthalene and TPH C_{10}-C_{14} in soil and naphthalene and TPH C_{10}-C_{14} groundwater have the potential to result in unacceptable health risks from inhalation of vapours in indoor airspaces.

3) **Scenario 5 (Commercial Slab on Ground)**: The highest reported groundwater concentrations of naphthalene in soil and benzene, naphthalene and TPH C_{10}-C_{14} in groundwater at the Site, have the potential to result in unacceptable health risks due to vapour intrusion.

4) **Scenario 6 (Intrusive Maintenance)**: The highest reported groundwater concentrations of benzene, 2-methylnaphthalene, naphthalene, TPH C_{10}-C_{14}, TPH C_{15}-C_{28} and TPH C_{10}-C_{36} fractions and soil concentrations of carcinogenic polycyclic aromatic compounds (cPAHs) have the potential to result in adverse health risks to short-term intrusive maintenance workers, if workers come into direct contact with impacted soil or groundwater.

5) **Scenario 7 (High Density Residential)**: The highest reported soil concentrations of benzene, naphthalene and TPH C_{10}-C_{14} and groundwater concentrations of naphthalene and TPH C_{10}-C_{14} have the potential to result in unacceptable health risks due to vapour intrusion.

b) Unacceptable human health risks are not expected to be associated with Scenario 3 (Unpaved Recreation) and Scenario 4 (Paved Recreation) as SSTC for these scenario were not exceeded by reported Site concentrations, or the nature, extent and/or location of the exceedances were insignificant. The exposure duration for human health receptors for paved and unpaved areas of the Site are significantly less in duration than those considered in Scenario 2, 5 and 7.

c) The majority of soil/fill material from the Site is considered (based on human health considerations) to be suitable for reuse in the public domain (outside the Site) provided that the reused material meets human health based SSTC for public open space, commercial slab on ground or intrusive maintenance scenarios, as relevant to the specific location of reuse. Note that because the public domain areas will likely be in hydraulic connection with Darling Harbour, reused material should also meet ecological based SSESC derived by the applicable site-specific ecological risk assessment for the proposed reuse location.

d) The above conclusions are based on the exposure assumptions and vapour migration models described in this report. The exposure and modelling assumptions were selected to be conservative in order to account for potential uncertainties and provide a deliberate margin of safety. Recent building plans, supplied by Lend Lease, indicate that the current basement design is likely to provide significantly greater reduction in the potential for vapour intrusion than that modelled in the HHERA; thereby providing a further margin of safety.

Odour Risks

a) Minimal exceedances of theoretical (modelled) odour-based SSTC have been reported in soil and groundwater, however:

1) gasworks waste is inherently odorous material

2) it is possible that some odorous material could remain at the Site following remediation

3) the extent to which odorous vapours may enter basement structures is difficult to predict and/or model.

b) large scale source removal / remediation, as is proposed as part of the development, would be expected to significantly reduce the risk of future odours.

Visual Amenity Issues/Risks

Visual amenity issues are not considered likely to arise on the remainder of the Site, given the proposed future land uses and development plans.

5.13.3 Recommendations

Based on the above conclusions, and with consideration of the uncertainties and limitations of available data and information, the following recommendations are provided:

a) Basement design plans must include engineering controls to ensure that contaminated groundwater does not accumulate in compartments which are ventilated to basement airspaces since potentially adverse health risks and odours have been estimated to arise from low concentrations of volatile groundwater contaminants if water enters basements. The following is also recommended:

1) Basement levels should be maintained at a lower pressure than occupied areas above in accordance with AS 1668.2 (Standards Australia, 2002);

2) Sump rooms should be placed as far as possible from lift wells; and

3) Air exchange rates within the basement areas should be maintained at a minimum of the Australian Standard 4 per hour (note that the *Declaration Site HHERA Letter* [AECOM, 2012d] considered the implications of changing this assumption).

b) Tar should be removed from the immediate vicinity of outer basement walls to the extent practicable, and basement design and engineering controls should ensure that tar seepage into basements does not occur.

c) Soil and groundwater remaining within the Site should be remediated to meet relevant health/odour criteria (SSTC).The specific health/odour SSTC to be met in different Site locations will depend on the land use(s) relevant to the area. In the case where more than one Scenario is applicable to the area, the most conservative (i.e. the lowest value) of the applicable SSTCs will be adopted as the remediation goal.

d) Shallow groundwater within Hickson Road, if present at depths which may be directly contacted by intrusive workers, should meet SSTC for Scenario 6.

e) Unpaved open space (Scenario 3) areas will be covered in a minimum of 0.5 m of suitable fill. Suitable fill of greater than 0.5 m thickness is recommended in areas where deeper rooting trees will be planted. For the purposes of unpaved open space (Scenario 3), suitable fill is defined as either:

1) virgin excavated natural material (VENM); and

2) soil which contains contaminant concentrations below the terrestrial soil criteria (developed for the maintenance of plant health and human health.

f) It is recommended that paved open space (Scenario 4) areas will be covered in a minimum of 0.5 m of suitable fill (directly under the pavement). This is to account for the potential that paved areas may in the future be unpaved areas. Therefore for the purposes of definition, suitable fill will be defined as for unpaved open space areas (see above).

g) Validation of soil and groundwater following remediation should be undertaken using appropriate statistical methodologies to ensure that the arithmetic average concentration of contaminants are below relevant screening criteria, in accordance with NSW EPA (1995) guidance. The validation process should therefore include:

1) use of systematic sampling patterns;

2) collection of an appropriate number of samples for estimation of the arithmetic average concentration of contaminant(s) within relevant environmental media and land use areas (land use areas should be determined based on specific development plans with consideration to areas of soil and groundwater from which vapours may enter a given basement structure and/or from which CoPC may enter surface water bodies);

3) estimation of the 95% upper confidence limit (UCL) of the arithmetic average concentration within relevant environmental media and exposure areas;

h) The human health-based SSTC have accounted for potential exposures to mixtures of chemicals;

i) Soil sourced from the Site for proposed beneficial reuse in Public Domain areas of ORWN or ORWS should meet relevant health/odour criteria (SSTC) and SSESC developed in the HHERAs for those beneficial reuse locations. The risk based acceptance criteria for material that might be placed in the future Headland Park will be developed separately by others;

j) The RAP should include consideration of mitigation measures for the appropriate management of:

1) asbestos that may be potentially encountered during the remediation works; and

odours that may accumulate in the basements following construction (while this is considered very unlikely, it is recommended that it be considered as part of the contingency measures included within the RAP in recognition of the uncertainties inherent in assessment of odour).

5.14 AECOM (2012d) Declaration Site HHERA Letter

Subsequent to completion of the *Declaration Site HHERA* (AECOM, 2011a), the proposed design and use of the lower and upper basements was revised. Consequently, a *Declaration Site HHERA Letter* (AECOM, 2012d, refer to **Appendix C**) was prepared based on the following design modifications which changed the assumptions made by the *Declaration Site HHERA* (AECOM, 2011a):

- Amending the proposed ventilation rates within the lower and upper basements (in particular, reducing the daily average ventilation rates to less than 4 air exchanges per hour, to reflect the likely basement and the ventilation system design and operation). As a conservative approach, AECOM adopted the lowest calculated ventilation rates provided by Lend Lease for the basement designed for the Stage 1a basement. Reduced ventilation rates (likely required to optimise building energy use) influence the potential risks associated with vapour inhalation at the Site;
- Amending the actual shape and size of the basement car park areas (to which the public will have access) (in particular revising them from an indicative area of 25 m x 25 m x 3 m height to an area of 50 m x 50 m x 4.5 m height based on the proposed basement design); and
- Amending the use of the lower basement level to also include a loading dock utilised by full time workers in addition to a commercial/residential car park

The remodelling was undertaken to assess:

- the relevant soil and groundwater SSTCs (Scenario 1 and 2 which are representative of the proposed lower and upper basement) to reflect:
    - the revised layout for the lower and upper basement areas (both area and height); and
    - a reduction in the average air exchange rate associated with ventilation of the lower and upper basement areas.
- groundwater SSTCs (Scenario 1 which is representative of the lower basement levels) were undertaken to reflect use of the lower basement level as a loading dock with a full time worker.

The *Declaration Site HHERA Letter* (AECOM, 2012d) concluded that:

- The revised groundwater SSTCs for Scenario 1 and 2 are lower than those previously calculated. That is, the values originally presented within the *Declaration Site HHERA* (AECOM, 2011a) are less conservative; and based on the revised basement design and use, may not be protective of the Scenario 1 and 2 receptors. AECOM recommended that the revised groundwater SSTCs should be adopted in place of those in the *Declaration Site HHERA* (AECOM, 2011a) by the RAP (this report);
- The revised soil SSTCs for Scenario 2 are greater than the SSTCs originally presented in the *Declaration Site HHERA* (AECOM, 2011a). That is, the values originally presented within the *Declaration Site HHERA* (AECOM, 2011a) are more conservative and therefore are considered to be protective of the receptors modelled within exposure Scenario 2 based on the revised basement plans provided by Lend Lease; and
- The conclusions provided in *Declaration Site HHERA Letter* (AECOM, 2012d) are specific to the adopted assumptions, and should the proposed development deviate from these assumptions, the impact to derived SSTCs should be reviewed.

The key assumptions from both the *Declaration Site HHERA* (AECOM, 2011a) and the *Declaration Site HHERA Letter* (AECOM, 2012d) are detailed in **Section 7.2.3**.

5.15 AECOM (2012a) Supplementary Data Gap Investigation, VMP Area

AECOM was engaged by Lend Lease to undertake a *Supplementary DGI* (AECOM, 2012a) for the Site and adjacent areas.

The results of the *Supplementary DGI* (AECOM, 2012a) are summarised following:

- Tar impacted soil was identified at and below the fill and natural soil interface in boreholes BH400 to BH406, located within 30 m of the Declaration Area boundary;
- Concentrations of CoPC including lead, TPH, BTEX and PAHs exceeded the adopted site investigation criteria at all investigation locations (BH400 to BH413), with the exception of BH412;

- Observations of contamination and PID readings were consistent with analytical results;
- Asbestos fibre bundles were identified in fill materials at onsite location BH405 (Block 4) at a depth of 12-12.2 m bgl. Potential asbestos containing material (ACM) such as fibre cement fragments were not observed in any samples collected; and
- Concentrations of CoPC variably exceeded the adopted groundwater assessment criteria (ANZECC, 2000) in existing and newly installed monitoring wells, with the highest concentrations within the vicinity of the Declaration Area (i.e. within 30 m of the Declaration Area boundary) and adjacent to the Declaration Area boundary.

5.16 AECOM (2012c) VMP Human Health and Ecological Risk Assessment

The objectives of the *VMP HHERA* (AECOM, 2012c) were to:

- assess the risk to human health and the environment that the Declaration Area represents in its current form; and
- develop site-specific human health target criteria (SSTC) for soil and groundwater for use in defining the remediation end-point for the Declaration Area, where this end-point is defined as removal of the NSW EPA Declaration relating to the Declaration Area.

5.16.1 Scope of Work

The *VMP HHERA* (AECOM, 2012c) comprised the following key steps with respect to the derivation of SSTCs:

- **Historical Report Review and Data Evaluation**: Review and evaluation of data from the:
  - *Other Remediation Works (South) Area Data Gap Investigation* (DGI) (AECOM, 2010a);
  - *Data Gap Investigation EPA Declaration Area (Parts of Barangaroo Site and Hickson Road), Millers Point, NSW* (AECOM, 2010b);
  - *Other Remediation Works (North) Area DGI* (AECOM, 2010c); and
  - *Supplementary VMP Data Gap Investigation* (AECOM, 2012).
- **Human Health Risk Assessment:**
  - Refinement of the list of CoPC for human health (from that in the NSW EPA Declaration), based on comparison of Declaration Area data to relevant 'Tier 1' screening criteria;
  - Review of toxicological data for CoPC and identification of appropriate toxicity values to use in the HHERA;
  - Review of chemical and physical properties of each CoPC for risk assessment purposes;
  - Development of Conceptual Site Models (CSMs) for the current status of the Declaration Area, including:
    - summarising the sources, nature and extent of contamination at the Declaration Area;
    - description of the Declaration Area physical conditions (including geology and hydrogeology, existing physical structures) to be used in assessment of contaminant fate and transport modelling; and
    - identification of current human receptors and who may be exposed to Declaration Area contaminants and the pathways via which they may be exposed;
  - Quantitative exposure assessment:
    - establishment of relevant exposure parameters for identified receptors and exposure pathways; and
    - application of vapour and dust transport modelling to predict chemical concentrations in air which may result from identified soil and groundwater contamination.
  - Comparison of risk estimates with risk acceptance criteria recommended and/or adopted by state and federal regulatory agencies;

- Characterisation of the nature and potential incidence of adverse health effects to receptors based on comparison of estimated contaminant intake or exposures to relevant toxicity (dose-response) criteria;
- Where unacceptable risks were identified, chemicals were assessed in terms of their contribution to the total threshold and non-threshold risks reported. Where CoPC were defined to "significantly" contribute to reported risk totals, site specific target criteria (SSTC) were derived;
- SSTC for soil and groundwater were derived for those CoPC which were identified to "significantly" contribute to the total risk. Estimation of SSTC based on consideration of toxicity, exposure, contaminant migration modelling and acceptable risk levels;
- Comparison of SSTC for current scenarios to chemical concentrations reported within the Declaration Area; and
- Consideration of aesthetic risks or issues including odour.

- **Ecological Risk Assessment:**
  - Identification of appropriate ecological receptors, including both terrestrial and aquatic ecosystems (including groundwater dependant ecosystems);
  - Identification of relevant marine water quality criteria (MWQC) from a nationally adopted hierarchy of acceptable guidance documents plus consideration of additional international sources, based on the protection of the nearest surface water receptor, Darling Harbour;
  - Identification of potential risk associated with the CoPC based on the comparison of the concentration of CoPC (reported both within the Declaration Area and at the down hydraulic gradient boundary) with the adopted MWQC; and
  - Assessment of whether (or not) the concentrations of CoPC within the Declaration Area and at the down hydraulic gradient boundary represent a risk to groundwater dependant ecosystems.
- **Provision of recommendations for application of the SSTC.**

The scope of work also included a physical inspection of the Declaration Area by the risk assessors to gain an understanding of the local conditions and layout.

The focus of the *VMP HHERA* was on the chemicals specified within the NSW EPA Declaration, specifically:

- PAHs;
- BTEX;
- TPH;
- Ammonia;
- Phenol; and
- Cyanide.

Other contamination identified within the Declaration Area by previous investigations (for example heavy metals), which are not listed in the NSW EPA Declaration, are assessed as part of the *Declaration Site (Development Works) HHERA* (AECOM, 2011a, refer to **Section 5.13**).

5.16.2 Conclusions

Previous investigations have reported gasworks related contamination of soil and groundwater within the Declaration Area and beyond the boundary to the west and south.

Based on the human health risk assessment and ecological risk assessment and with consideration of the uncertainties and limitations of available data and information, the following conclusions are provided with respect to potential for human health, odour, aesthetic or ecological risks within the Declaration Area under the current land use scenario:

Human Health Risks

Unacceptable human health risks have been identified for the following scenario and remediation is required to make the Site fit for its current land use. The following specific issue was identified:

a) Scenario 2 (Intrusive Maintenance): The highest reported soil concentrations of total carcinogenic PAHs and maximum reported groundwater concentrations of benzene; naphthalene; fluoranthene; phenanthrene; pyrene; TPH C_{10}-C_{14}, TPH C_{15}-C_{28} and TPH C_{29}-$C_{36;}$ may result in adverse health risks to short-term intrusive maintenance workers who come into direct contact with soil and groundwater during trenching activities. Locations in Hickson Road where free tar has been reported are of particular significance, based on the potential for direct contact and indirect groundwater-derived vapour exposures.

Unacceptable human health risks are not expected to be associated with Scenario 1 (Paved Recreation) as SSTCs for this scenario were not exceeded by reported Site concentrations, it is also noted that the number of exposure routes for this scenario are significantly less than for the intrusive maintenance worker.

The development of human health SSTCs has considered the potential for mixtures of chemicals to be present at the Site.

AECOM understands that health risks to residents or other occupants of buildings adjacent the Site (e.g. on the east side of Hickson Road) associated with existing groundwater contamination have been assessed, that the assessment was endorsed by a NSW EPA accredited site auditor and that the risks are currently being effectively managed (as referenced by the NSW EPA Declaration 21122). Furthermore, it is expected that remediation of Hickson Road will further reduce the potential for risk to occupants of adjacent buildings. Potential health risks associated with existing soil and groundwater contamination identified west (in the ORWN Area) and south (in the ORWS Area) of the Site will be or have been addressed as part of the risk assessments relating to those specific areas.

Odour Risks

Odour-based SSTC for Scenarios 1 and 2 have been calculated and are observed to be lower than the SSTC derived to be protective of human health. However:

- gasworks waste is inherently odorous material; and
- it is possible that some odorous material could remain at the Site following remediation.

Visual Amenity Risks

Visual amenity issues are not considered significant on the Site under current land use scenarios.

Ecological Risks

Exceedances of the MWQC have been identified in groundwater within the Site and at the Site boundary, indicating the potential for an unacceptable risk to the environment. Remediation is required to minimise the risk of adverse impact to the environment. Further discussion regarding the identified risk to the environment from the Site in its current condition is presented in Section 8.1, 8.2, 8.4 and 8.6.3 of the *VMP HHERA* (AECOM, 2012c). The adoption of the MWQC to assess groundwater quality at the Site boundary is also discussed in **Section 7.1.3**.

It is noted that the analytical composition of chemicals of potential concern within the Site are: (a) consistent with those expected in association with historic gasworks; and, (b) similar in composition to those reported in areas down hydraulic gradient of the Site (ORWN), suggesting that impacted groundwater is migrating off Site.

5.16.3 Recommendations

Based on the above conclusions, and with consideration of the uncertainties and limitations of available data and information, the following recommendations were provided in relation to addressing the NSW EPA Declaration:

a) The results of the HHERA indicate that there are multiple lines of evidence that soil and groundwater concentrations within the Site and at the Site boundary represent an unacceptable risk to human health and ecological receptors and that remediation is required to address both human health and ecological protection with respect to the Remediation Site Declaration 21122.

b) Removal and/or remediation of separate phase gasworks waste and tar, to the extent practicable, should be undertaken as the primary remediation objective to minimise the risk to environment and human health.

c) Following remediation, groundwater should meet the Groundwater SSTC, and to the extent practicable, approach the MWQC, at the Site boundary.

d) With respect to the protection of the environment, the objective of meeting MWQC at the down hydraulic gradient Site boundary is for the ultimate protection of ecosystems within groundwater. This approach is

consistent with NSW EPA policy as discussed in Section 8.1, 8.4 and 8.2.3 of the *VMP HHERA* (AECOM, 2012c) and **Section 7.1.3** herein. As such, remediation of the soil within the unsaturated and saturated zones is required, to the extent practicable, as a secondary remediation objective to protect groundwater quality leaving the Site.

e) Soil within the unsaturated zone (<2.0 meters below ground surface [mbgs]) at the Site should be remediated, where practicable, to the Soil SSTC.

f) The RAP (this report) should include consideration of mitigation measures for the appropriate management of asbestos that may be potentially encountered during the remediation works.

g) Validation of groundwater will be undertaken by comparison of:

- individual groundwater monitoring results with the lowest of the derived SSTC; and
- groundwater monitoring results at the down-hydraulic gradient Site boundary with the MWQC, to the extent practicable.

h) Validation of soil following remediation should be undertaken in accordance with the following:

1) use of systematic sampling patterns;

2) collection of an appropriate number of samples for estimation of the arithmetic average concentration of contaminant(s) within relevant environmental media and exposure areas; and

3) estimation of the 95% upper confidence limit (UCL) of the arithmetic average concentration.

5.17 AECOM (2012e) Tree Root Mass Investigation, Hickson Road

AECOM was engaged by Lend Lease to undertake a *Tree Root Mass Investigation* (AECOM, 2012e) to assess potential contamination associated within selected tree roots located within the Hickson Road portion of the Site.

The purpose of the *Tree Root Mass Investigation* (AECOM, 2012e) was to evaluate: soil around the root mass zone from a contamination and phytotoxicity perspective and soil contamination conditions and potential for remediation requirements in the root mass zone.

Based on the results of the investigation, the following conclusions were made regarding the assessment of contamination within the tree root mass zones:

- TCM (as defined in **Section 6.6.1**) was not identified in any of the boreholes completed within the root mass zone of the investigated trees;
- Based on the shallow test pit excavations and boreholes completed, observed tree roots appear largely laterally confined to the footpath side of the kerb line (i.e. to the east of the kerb on the eastern side and to the west of the kerb on the western side of Hickson Road) and generally do not appear to extend further into Hickson Road;
- With regards to addressing the NSW EPA Declaration, the material assessed within the root mass zone of the trees investigated was considered suitable to remain *in situ* or for re-use within Hickson Road, based on the comparison of the 95% UCL concentrations to the soil SSESCs and SSTCs developed by the *VMP HHERA* (AECOM, 2012c); and
- Based on the reported results, remediation of the tree root mass zone is not required. Accordingly, potential future S-ISCO® injections in this area are not required.

5.18 VMP Remediation Extent (AECOM 2013b)

This *VMP Remediation Extent* report (AECOM, 2013c) was prepared to describe:

- The Remediation Goals, based on the assessment of risk in the *VMP HHERA* (AECOM, 2012c), that are applicable to remediation of the Declaration Area; and
- The extent of remediation required to achieve the Remediation Goals and thereby enable removal of the NSW EPA Declaration.

As such, the *VMP Remediation Extent* report represents a link between the *VMP HHERA* (AECOM, 2012c) and this *VMP/Block 4 RAP* and so the three reports should be read in conjunction.

5.18.1 Scope

The scope of work associated with the preparation of *VMP Remediation Extent* report (AECOM, 2013c) was:

- Review the Conceptual Site Model for the Declaration Area including consideration of available data from previous environmental investigations within the Declaration Area to assess the potential for contamination;
- Development of Remediation Goals for the protection of human health and the environment based on the recommendations of the *VMP HHERA* (AECOM, 2012c);
- Consideration of the extent to which the Remediation Goals can be practicably achieved based on:
    - Comparison of available site data for soil and groundwater to the Remediation Goals;
    - Identification of areas where contamination has been identified which requires remediation/management as part of the VMP, based on consideration of the Remediation Goals; and
    - Consideration of the standard and extent of remediation that can be practicably achieved by the remediation technologies that are most likely to be implemented at the Site and as required by:
        - The *Guidelines for the Assessment and Management of Groundwater Contamination* (NSW, DEC, 2007) which incorporate the principle of Clean-up to the extent practicable (CUTEP) (Section 4.3);
        - The principles of ESD as required by Section 9 of the *Contaminant Land Management (CLM) Act* (1997); and
        - The *Waste Avoidance and Resource Recovery Act* (2001).

5.18.2 Remediation Goals

The Remediation Goals developed by the *VMP Remediation Extent* report (AECOM, 2013c) for the protection of human health and the environment based on the recommendations of the *VMP HHERA* (AECOM, 2012c) were:

- As a primary goal, removal / remediation of Separate Phase Gasworks Waste and Tar (SPGWT) to the extent practicable as required by the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*; and
- As a secondary goal, removal/remediation of soil, to the extent practicable:
    - That is representative of CIM, which is defined as:
        - Unsaturated soil concentrations exceeding the soil SSTCs; and/or
        - Unsaturated or saturated soil concentrations that is considered to be the source of groundwater concentrations exceeding the groundwater SSTCs in fill material; and
    - Such that that groundwater quality within fill material leaving the Declaration Area (measured in fill material at the down hydraulic boundary) approaches the MWQC (as detailed in Section 3.4 of the *VMP Remediation Extent* report (AECOM, 2013c) and discussed further in **Section 7.1.3**).

5.18.3 Remediation Extent

The extent of remediation required in the unsaturated and saturated zones was presented on Figure F14 and Figure F15 of the *VMP Remediation Extent* report (AECOM, 2013c), respectively (and also provided as **Figure F10** and **Figure F11** in **Appendix B** of this RAP).

The lateral extent of remediation was determined based on consideration of:

- The presence of historic gasworks infrastructure and the distribution of SPGWT and CIM within the respective Site areas; and
- The extent of remediation that can be practicably accomplished for the protection of the environment based on:
    - The standard of remediation that can be practically achieved by the remediation technologies that are most likely to be implemented;
    - Regulatory policy requirements including:

- source removal, removal of NAPL to the extent practicable, and clean-up to the extent practicable as contemplated by the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*
- The principles of ESD as required by Section 9 of the *CLM Act* (1997); and
- The principles of the *Waste Avoidance and Resource Recovery Act* (2001).

The standard of remediation (as developed by the *VMP Remediation Extent* report [AECOM, 2013c]) to be achieved within the proposed Remediation Extent should equal the higher of:

- Removal of SPGWT to the extent practicable, for the protection of human health and the environment;
- Removal/remediation of soil and groundwater concentrations present within fill material exceeding the relevant $SSTC^{VMP}$, to the extent practicable; and
- Removal/remediation of contaminated fill materials such that the contaminant mass within the Remediation Extent fill material is reduced, on average, by 90%, to the extent practicable (calculated based on the estimated mass of naphthalene and TPH C_{10} - C_{14}).

The vertical extent of remediation was broadly defined as remediation to the depth of the underlying natural bedrock to a maximum depth of 10 m below ground level (bgl). The vertical extent of remediation is based on consideration of:

- locations where SPGWT has been reported;
- locations where exceedances of the groundwater SSTC and unsaturated soil SSTC have been reported;
- the footprint of historical gasworks structures and infrastructure; and
- the depth to bedrock (noting that the depth to bedrock steadily increases to the west beyond the 10 m bgl rock contour).

It was also noted that SPGWT and CIM have been reported in the natural marine sediments both within the Declaration Area and in some hydraulically down gradient areas to the west of the Declaration Area. However, the negligible contaminant flux from these natural materials is not considered to pose a significant risk to human health or the environment. As such, the proposed extent of remediation works excludes remediation of natural marine sediments which are present below a depth of 10 m bgl.

5.19 JBS Barangaroo Central DGI (JBS, 2012b)

JBS Environmental Pty Limited (JBS) was commissioned by the Authority to undertake the *Barangaroo Central DGI* (JBS, 2012b) within the Barangaroo Central site area (comprising parts of Lots 5 and 6 of Deposited Plan 876514). It is understood that the Barangaroo Central area is initially proposed to be developed as the Barangaroo Stage 1 Public Domain (comprising a range of open space land uses and car parking) and, in the future, will be developed for a mixture of high density residential and open space land uses.

The *Barangaroo Central DGI* (JBS, 2012b) involved drilling and soil sampling at 52 boreholes across the Barangaroo Central site. Of these boreholes, 24 were converted to either shallow or deep groundwater monitoring wells. None of the JBS groundwater monitoring wells installed down hydraulic gradient of the Site were screened within the natural marine sediments.

The following soil and groundwater sampling locations were located in proximity to the Site (i.e. within 30 metres of the western and northern Site boundaries, refer to **Figure F5** in **Appendix B**):

- Soil sampling locations:
  - BH539 to BH442 and BH549;
- Groundwater sampling locations
  - MW539 - screened between 3 and 6 m bgl. Natural clay was reported at 14 m bgl;
  - MW540 (shallow) - screened between 3 and 6 m bgl;
  - MW540 (deep) - screened between 10.7 and 13.7 m bgl. Natural clay was reported at 14 m bgl;
  - MW541 (shallow) - screened between 3 and 6 m bgl;

- MW541 (deep) - screened between 7.5 and 10.5 m bgl. Bedrock was reported to be present at 10.8 m bgl (natural clays were not encountered during the drilling works); and
- MW542 - screened between 2.5 and 5.5 m bgl. Natural clay was reported at 14.5 m bgl.

As detailed in Table 7.1.1 of the *Barangaroo Central DGI* report (JBS, 2012b), higher PAH concentrations and BTEX concentrations were reported to be present within the fill materials at depths greater than 6.9 m bgl at BH541 and BH542 (located 10m west of the Site boundary in Block 5). A '*slight hydrocarbon, hydrogen sulphide and methane odour*' was observed in the fill material at BH541 below a depth of 6.9 m bgl and a '*hydrogen sulphide odour*' was observed at a depth of 13 m bgl at BH542. No visual or olfactory evidence of tar was noted in the JBS borehole logs for the sampling locations listed above.

Total PAHs (2,798 mg/kg) were reported to exceed the Tar Containing Material (TCM) criteria (as described in **Section 6.6.1**) at a depth of 9.9-10.0 m bgl at BH541 (refer to **Figure F5** in **Appendix B**). Benzene and naphthalene groundwater concentrations in fill material also exceeded the Block 4 $SSTC^{VMP}$ (refer to **Section 7.1.4**) at this location (MW541D, refer to **Table T16**). This well is screened between 7.5 to 10.5 m bgl. The Conclusions section of the *Barangaroo Central DGI* report indicated that impacted material in the south-eastern corner of the Barangaroo Central site was '*considered to be acting as a source of groundwater contamination*'. Based on the finding of the *Barangaroo Central DGI* (JBS, 2012b), it was recommended that '*tar impacted materials as located at depth at the south-east of the site will require remediation/management based on identified impacts to groundwater in this area of the site*'.

No soil CoPC concentrations were reported at concentrations exceeding the Block 4 $SSTC^{VMP}$ (refer to **Section 7.1.4**) in the sampling locations detailed above (refer to **Figure F5** in **Appendix B**).

The JBS groundwater monitoring results reported adjacent to the Site boundary (i.e. monitoring wells MW539 to MW542) indicated that arsenic, PAHs and ammonia concentrations variably exceeded the MWQC (refer to **Section 7.1.3**). The results support the *VMP HHERA* (AECOM, 2012c) conclusion that groundwater quality at the Site boundary represents a potential for unacceptable risk to the environment (refer to **Section 5.16.2**).

6.0 Site Condition and Surrounding Environment

6.1 Current Land Use

The Site covers an irregular shaped area of approximately 2.5 ha (based on existing Lend Lease supplied site plans). The location and layout of the Site is presented in **Figure F2** and **Figure F3** in **Appendix B**.

The Site is currently vacant and variably paved with concrete and asphalt concrete. The Sydney Water Pumping Station (identified as SPS1129) located on the east side of Block 5 remains in operation and will be retained on Site in the future (refer to **Figure F10** in **Appendix B**).

Access to the Site (excluding Hickson Road) is limited by the presence of a cyclone wire fence on the eastern side. Entrance to the Site is controlled by the Lend Lease Stage 1a construction site entrance (Gate 1) located to the south of the Site. The Site (excluding Hickson Road) is currently used as a set down area for the construction materials for the ORWS basement works.

A section of Hickson Road forms the easternmost portion of the Site. The road is used as a vehicle thoroughfare, for vehicle parking, and by pedestrians using the footpaths on the eastern and western sides of the road.

AECOM notes that under the current land use scenario, or land use scenarios allowable at the Site without a development consent, public recreation land uses (specifically Hickson Road) are known to occur and intrusive maintenance work for road repair or site infrastructure development or maintenance may be expected to occur.

6.2 Surrounding Land Use

The Site is surrounded by the following land use:

- North: Barangaroo Central, including but not limited to the remainder of Block 5 (open space/concrete hardstand). A temporary cruise ship terminal is also located northwest of the Site.
- South: Barangaroo South Blocks 1 to 3 and the southern portion of Hickson Road followed by Sussex Street (public roads).
- East: Commercial and high density residential buildings with Jenkins Street beyond.
- West: the ORWN Area (to the west of Block 4) and the remainder of Block 5, followed by Darling Harbour.

The location and layout of the Site is presented on **Figure F2** and **Figure F3** in **Appendix B**.

6.3 Topography and Drainage

The topography of the Site is relatively flat having undergone significant historical land reclamation works (refer to the site survey plan, **Figure F13** in **Appendix B**). The entire Site is covered in hardstand (concrete and bitumen), with the exception of a number of trees on either side of Hickson Road.

As shown in **Figure F13** in **Appendix B**, the majority of stormwater runoff is captured by the various stormwater drains across the Site, which drain into Darling Harbour (although it is understood that some of the previous stormwater inlets within Barangaroo South have now been blocked off to prevent the egress of water from Barangaroo South to Darling Harbour). Topography and drainage regimes are further detailed in ERM (2008a).

6.4 Geology

6.4.1 Regional Geology

Reference to the *1:100, 000 Geological Survey of NSW (Sydney) Sheet 9130 (Ed 1) (*Herbert 1983*)* indicates that the stratigraphy of the Site comprises man-made fill material, marine clays and Hawkesbury Sandstone.

Information from previous investigations indicates that the former 1880s shoreline ran approximately along the western edge of Hickson Road (i.e. along the eastern edge of the proposed Stage 1b Development). The area to the west of Hickson Road is understood to have been progressively reclaimed. Aerial photographs from the 1950s indicate that the area between Hickson Road and the current shoreline was occupied by a number of finger wharves, extending from Hickson Road. It is understood that the space between the historical finger wharfs and seawalls were infilled in several stages between the 1960's and 1980's with various types of material. The former Southern Cove is understood to have been filled in 1988.

ERM (2007) identified and summarised the following subsurface conditions across the wider Barangaroo precinct:

- Hardstand (0 to 0.46 m bgl): consisting of concrete, asphalt and bitumen, generally in good condition with minimal staining;
- Road Base Fill (0 to 0.5 m bgl);
- Fill (0 to 18 m bgl): Fill materials consisting of sandstone, building rubble, bricks and concrete, silty gravelly sand. Black staining and odours (particularly around the former gasworks);
- Marine Clay/Sand (3.0 to 18.4 m bgl): Interbedded Clayey Sand and Sandy Clay, dark greyish brown, saturated, some shell fragments and organic matter, Sandy Clay (soft, high plasticity), Clayey Sand and Sand (lose to dense, low plasticity, fine to coarse sand, low to non-plasticity);
- Marine Clay/Sand (4.9 to 32.75 m bgl): Interbedded Clayey Sand, Sandy Clay and Sand, pale yellowish brown, white, reddish brown or dark greyish brown. Sandy Clay-stiff to hard, medium to high plasticity. Clayey Sand and Sand – loose to dense, fine to coarse sand, low or no plasticity; and
- Bedrock (1.3 to 32.75 m bgl): Weathered Sandstone, white, light yellowish, brown, olive brown and reddish brown, white, wet, fine to coarse grained, some fracturing noted.

The ORWS DGI (AECOM 2010a) summarised the subsurface conditions across the ORWS site (located south of the Site):

- Natural soils encountered across the ORWS site comprised silty sands, gravelly sands, clays, weathered sandstone and sand with components of clay. Gradual boundaries noted between the strength and extent of weathering reflected changes in the energy regime during deposition.
- Bedrock encountered across the Site was sandstone in every instance except for AECOM borehole BH13 where shale was encountered at 12.7 m bgl. The depth to bedrock encountered during the ORWS DGI was variable with sandstone depths ranging from 3.0 m bgl (BH11) to 19.2 m bgl (BH28). Bedrock was generally shallower in the eastern portion of the ORWS site closest to Hickson Road and deeper in the western portion. The thickness of fill material generally increased from east to west across the ORWS site.

6.4.2 Local Geology

AECOM (2010c) reported variable stratigraphic conditions across the Site; however, stratigraphy generally comprised fill material overlying natural weathered sandstone with clay components. Sandstone bedrock was generally present underlying natural weathered bedrock materials or in some instances directly underneath fill materials.

Fill material

The results of the Declaration Area DGI (AECOM, 2010c) (which included consideration of investigations conducted by others) are briefly summarised following:

- The depth of fill materials encountered during the Declaration Area DGI was reported to be variable, with fill depths ranging from 0.43 m bgl (BH67, Hickson Road) to 15.0 m bgl (BH36, Block 4). Fill materials were generally shallower in the eastern portion of the Site in the vicinity of Hickson Road, thickening toward the western portion of the Site;
- Observed fill materials generally comprised unconsolidated gravels, sand, bricks, sandstone, timber, slag and steel in a variable gravelly sand to clayey sand matrix. Fill materials were present above natural silty sands, gravelly sands, clays, weathered sandstone and sand with components of clay overlying sandstone bedrock. These results were generally similar to the previous investigations and confirm the presence highly variable fill material underlying the Site, thickening to the west towards Darling Harbour;
- The reported contamination was identified in fill and natural soils and at the bedrock interface. No rock coring was undertaken during the DGI but previous investigations (ERM 2007) have identified residual gasworks related material within bedrock underlying the Site;
- The presence of contamination was variably confirmed by the presence of odours, black staining, surface sheen on groundwater and the presence of tar; and
- Field observations indicated that free tar was observed as a DNAPL in wells MW204D, MW205, MW206, MW53, MW15, BH7 and BH10 (MW10), as well as testpits TP05 and TP07. It was noted that groundwater samples were not collected from the wells, however NAPL samples were collected from monitoring wells

MW205 and MW206. All wells with free tar were located within the location of the former gasworks. BH1 (located off Site to the north on Hickson Road) was unable to be sampled as the well was dry. Down-gradient well MW212 was filled with sand and unable to be sampled.

Natural material

- Natural soils underlying the Site comprised silty sands, gravelly sands, clays, weathered sandstone and sand with components of clay. Bedrock was noted to be present at a maximum depth of 14.45 m bgl at the Site (BH405, Block 4) during the Supplementary DGI (AECOM, 2012a).

6.5 Hydrogeology

The following groundwater conditions have been historically described at Barangaroo based on previous investigations (ERM 2007):

- Measured groundwater elevations in July 2006 during a high tide ranged between 0.083 m AHD (MW21) and 0.64 m AHD (MW10);
- Measured groundwater levels ranged between 2.094 m Below Top of Casing (BTOC) (MW09) and 2.545 m BTOC (MW20) in July 2006 during a high tide;
- The water table across the Site has been shown to be influenced by tidal fluctuations;
- Groundwater flow direction has been shown to generally flow to the west towards Darling Harbour; and
- Subsurface service trenches and low permeability fill material may present preferential pathways for transport of contaminants in groundwater.

It is noted that, in the opinion of AECOM, the current dataset and conceptual site model indicate that the shallow subsurface trenches are unlikely to act as preferential pathways for contaminant migration as the contamination is present at depths below the likely depth of the service trenches. This is based on the known shallow depth of bedrock beneath Hickson Road (i.e. shallower than 2 m bgl in some areas) and typical service construction works which generally install services above the depth of the groundwater table.

Results of the AECOM DGI (AECOM, 2010b) indicated groundwater was present beneath the Site within the fill and underlying natural materials. Groundwater was encountered at depths ranging from 1.38 to 2.92 m bgl and was subject to tidal fluctuation. Water level monitoring within selected wells over a three day period confirmed that groundwater underlying the area was tidally influenced as far east (inland) as Hickson Road, although the degree of fluctuation lessens toward the east.

The *Groundwater Discharge Study* (GDS, AECOM, 2010d) (refer to **Section 5.12**) indicated that due to tidal influences at the Site there is a discrepancy between the net migration rate and the linear groundwater flow velocity due to the alternation of the hydraulic gradient, which causes water and particles to oscillate rather than move constantly in a single direction (as assumed by the linear groundwater velocity equation). In this instance the oscillation and resultant net migration of contaminant particles can be visualised as a process whereby an individual particle migrates 10 steps eastward during the flood tide and 11 steps westward on the ebb tide (i.e. net migration and therefore net discharge occurs at a rate of one tenth of the estimated linear groundwater flow velocity).

Recharge to the Site is limited to exposed sandstone and soil areas to the immediate east of the Site at Observatory Hill. Since the Site is currently covered by hardstand areas, the majority of potential recharge flows off Site as stormwater outflow.

The hydrogeological conditions encountered during previous investigations within the Site are generally consistent with those encountered within the ORWS Area and across the broader Barangaroo precinct.

A search of the NSW Department of Natural Resources (DNR) groundwater bore data base by ERM (2007) reported 32 registered groundwater bores within a 4 km radius of Barangaroo. Groundwater bore information indicated that the bores were registered for either recreation, irrigation or monitoring purposes.

6.6 Site Contamination

6.6.1 Separate Phase Gasworks Waste and Tar (SPGWT)

For the purposes of this report, SPGWT refers to:

- Tar Containing Materials (TCM), as per the definition described below:
    - Greater than 10% visible coal tar (where coal tar is a phase separated hydrocarbon by-product from coal gasification); and/or
    - Contaminant concentrations exceeding the following limits:
        - Polycyclic Aromatic Hydrocarbons (PAHs) - 2,000 mg/kg; or
        - Benzo(a)Pyrene (B(a)P) - 150 mg/kg.
- Dense Non Aqueous Phase Liquids (DNAPLs).

The above TCM definition was originally proposed by AECOM and adopted by Lend Lease/the Authority to define TCM at the Site, particularly in the context of material that is unsuitable for beneficial reuse (in conjunction with the site-specific risk based criteria which were derived in the *VMP HHERA* [AECOM, 2012c]).

It is noted that the term SPGWT has not been used in the previous site investigation reports where such materials were variably referred to as tar, coal tar, etc.

Section 4.2.4 of the VMP HHERA (AECOM, 2012c) notes that the NSW DEC (2007) Guidelines for the Assessment and Management of Groundwater Contamination requires that:

- "Where light NAPLs (LNAPLs) or dense NAPLs (DNAPLs) are present in the subsurface they must be removed or treated as much as practicable".

Consequently, in accordance with NSW EPA policy and guidelines, and the remediation goals recommended by the VMP HHERA (AECOM, 2012c), all SPGWT identified on the Site and in adjacent off Site areas is required to be remediated to the extent practicable.

6.6.2 Soil

Soil analytical results for the Declaration Area are presented in **Table T3** to **T9**, **Appendix A** and soil results for Block 4 only presented in **Table T17**, **Appendix A**.

AECOM (2010b) reported odour, staining and sheen in soil samples as being common in fill materials across the eastern areas of the Site.

AECOM (2010b) reported that the maximum concentrations of CoPC were generally located in proximity to and down gradient of the former gasworks infrastructure in Block 4 and Hickson Road. CoPCs including: lead, TPH (C_6-C_9 and C_{10}-C_{36}), BTEX compounds, PAHs (including benzo(a)pyrene [B(a)P]) and sulphate variably exceeded the adopted Site investigation criteria. The reported results were generally consistent with the findings of previous investigations (i.e. ERM, 2007; ERM, 2008; Coffey, 2008) with respect to the identified CoPC, concentrations and/or impacts concentrated within the former gasworks area.

SPGWT was identified at eighteen locations at the Site (BH61, BH15, BH6, BH53, BH59, BH54,BH204s, BH41, BH55, BH019, BH204D, BH87, BH49, BH205, BH119, BH42, BH206, BH408) confirming the former gasworks as a source of contamination (refer to **Figure F6** in **Appendix B**).

Elevated concentrations of CoPC were also reported outside the Site, particularly to the west (AECOM, 2010c) and south (AECOM, 2010a). SPGWT was also been identified at seven locations to the west of the Site (BH60, BH70, BH74, BH400, BH402, BH403 and BH541) in areas down hydraulic gradient of the former gasworks area (refer to **Figure F6** in **Appendix B**).

Asbestos was identified at 2 sampling locations during previous site investigations at the Site. While widespread asbestos impacts in soil have not been identified in previous investigations at the Site, it is noted that asbestos fragments have been encountered during recent excavation of the adjacent ORWS site (located directly to the south). Accordingly, it is reasonable to anticipate that asbestos may be present within fill at the Site and could be encountered during excavations. The consideration of asbestos at the Site is discussed further in **Section 7.2.4.2**.

Section 10.2 of AECOM (2010b) presents a summary of minimum and maximum CoPC concentrations within the Declaration Area.

Soil Leachability

There has been a total of 45 Toxicity Characteristic Leaching Procedure (TCLP) analysis conducted on soil samples collected within the Site for the purpose of waste classification according to the NSW DECCW (2009) waste guidelines and a total of 11 samples have been analysed by Australian Standard Leaching Procedure (ASLP). Samples were selected based on field observations including odour, colour/staining and PID readings to select samples representative of chemical impact.

The initial 39 TCLP samples were collected during investigations conducted at the Site from 2008 until 2010 and are summarised within the Declaration Area DGI (AECOM, 2010b). Concentrations of metals including As, Ba, Cd, Cr, Co, Cu, Hg, Pb, Mn, Ni, Vn and Zn and PAHs including acenaphthene, acenaphthylene, anthracene, fluoranthene, fluorene, naphthalene, phenanthrene and pyrene were reported to be leaching at concentrations above the laboratory LOR.

The remaining ASLP analysis was conducted during the Supplementary DGI (AECOM, 2012a) and included six locations within the Site. The additional locations were analysed for ultra-trace (low level) PAH, phenols, BTEX, inorganics and metals. The additional analyses were undertaken on soil samples taken from locations selected to be representative of significant contamination identified from previous field observations (PID, visual and odour). The soil samples selected for the additional analyses were taken from locations where it was expected (based on field notes) that high leach results would correspond with high soil concentrations.

6.6.3 Soil Vapour

AECOM (2010b and 2010a) soil vapour analysis reported some gasworks-derived impacts which exceeded the adopted ambient air guidelines (adjusted using an attenuation factor of 0.01) for naphthalene (converted ATSDR MRL 2005) at two locations within the Site and one location in the ORWN Area and two locations within the ORWS Area.

6.6.4 Groundwater

Groundwater analytical results for the Declaration Area are presented in **Table T10** to **T13**, **Appendix A** and groundwater results for offsite areas are presented in **Table T16**, **Appendix A**. Block 4 groundwater results (only) are presented in **Table T18**, **Appendix A**.

Previous reports found that dissolved-phase concentrations of contaminants at the Site were variably above the Site investigation criteria e.g. lead, cadmium, chromium (III+VI), cobalt, copper, mercury, nickel, zinc, benzene, naphthalene and phenol (AECOM, 2010c; Coffey, 2008b).

The most significant groundwater contamination was identified in the immediate vicinity of the former gasworks infrastructure and contamination, including BTEX, naphthalene, PAHs, metals and ammonia, was present in both dissolved phase and SPGWT (Coffey, 2008b; ERM, 2008a; AECOM, 2010c). Concentrations of contaminants in excess of the assessment criteria were also identified in wells down-gradient of the gasworks footprint, indicating the westerly migration of contamination (AECOM, 2010b). The results of the AECOM (2010c) investigation indicated that the variable nature and distribution of fill materials at the Site caused localised variations in groundwater flow and associated contaminant migration, which is further complicated by tidal influences. The previous investigations indicate that there is contaminated groundwater migrating from the Site across the Site boundary.

AECOM (2010b) identified likely SPGWT at eight locations within Hickson Road and Block 4 in the vicinity of the tar tank, purifying beds and 1870 gasholder indicating these locations are the main source areas of contamination (specifically MW204D, MW205, MW206, MW53, MW15, BH7, BH10 and BH6). SPGWT was also identified within the Site at other locations, beyond the historic gasworks infrastructure. These findings were consistent with historical reports (specifically, Hickson Road samples reported in Coffey 2008, and MW204D in ERM 2008). SPGWT was observed within wells installed at varied depths throughout the profile, indicating dense non aqueous phase liquid (DNAPL) is present at the Site within the fill materials and natural sediments (AECOM, 2010b).

AECOM (2012a) identified SPGWT at and below the fill and natural soil interface in boreholes BH400, BH402 and BH403, located outside (within 30 m) the Declaration Area boundary (refer to **Figure F6** in **Appendix B**). Concentrations of CoPC variably exceeded the adopted groundwater assessment criteria in existing and newly installed monitoring wells, with the highest concentrations within the vicinity of the Declaration Area (i.e. within 30 m of the Declaration Area boundary) and adjacent to the Declaration Area boundary.

The groundwater summary tables presented in **Table T10** (Block 4 and Block 5 within the Declaration Area) and **Table T18** (Block 4 only), **Table T12** (the western Declaration Area boundary) and **Table T13** (Hickson Road) group the groundwater analysis results according to:

- Groundwater monitoring wells screened within the fill material only;
- Groundwater monitoring wells screened in the marine sediments/bedrock or across the fill material/marine sediment interface.

Review of the groundwater analysis data, with regard to the depth of the screened interval in the groundwater monitoring wells, indicate that:

- Block 4 and 5:
  - **Table T10** indicates that 5 of the 17 groundwater monitoring wells/sampling ports located in Block 4 and Block 5 within the Declaration Area reported concentrations that exceeded the groundwater $SSTC^{VMP}$. Of these 5 locations, 4 were screened within marine sediments or bedrock. One well (MW15/BH087) was screened within the fill in the northwest portion of the 1870 gasholder where SPGWT is considered likely to be present; and
  - **Table T18** indicates that 9 of the 18 groundwater monitoring wells/sampling ports located in Block 4 reported concentrations that exceeded the groundwater $SSTC^{DEV}$. Of these 9 locations, 8 were screened within marine sediments or bedrock. As above, one well (MW15/BH087) was screened within the fill in the northwest portion of the 1870 gasholder where SPGWT is considered likely to be present.
- Hickson Road – groundwater monitoring wells in Hickson Road were generally installed within fill material (i.e. no significant horizons of marine sediments were encountered). CoPC concentrations were reported to exceed the groundwater $SSTC^{VMP}$ within fill material within the former gasworks infrastructure where SPGWT has been identified (namely the tar tank and the eastern portion of the 1870 gasholder).
- The western Declaration Area boundary - gasworks related CoPC concentrations reported within the marine sediments were generally orders of magnitude higher than those reported in the fill material. Specifically, TPH, PAH and phenol compounds are generally reported at concentrations below the laboratory Limit of Reporting (LOR) within the fill material, but were reported above the LOR for wells screened within the marine sediments or bedrock (which is generally present at greater than 12 m bgl).

Based on the above information, CoPC concentrations in groundwater at the Site have been reported to be higher in:

- areas where SPGWT has been also identified to be present (refer to **Figure F6**);
- fill within the footprint of (or directly adjacent to) former gasworks infrastructure (as detailed in **Section 3.2.2**); and
- the marine sediments or bedrock that underlie at the Site.

In comparison, CoPC concentrations reported in groundwater in fill material outside the areas identified above generally do not exceed the groundwater $SSTC^{VMP}$ and $SSTC^{DEV}$.

These observations support the findings of the *Groundwater Discharge Study* (GDS) (AECOM, 2010d) and contaminant flux modelling undertaken by AECOM (refer to **Section 6.6.5**) which conclude that there is negligible contaminant flux from the natural marine sediments and bedrock at the Site.

6.6.5 Consideration of Contamination at Depth within Natural Marine Clays and Sediments

***Groundwater Discharge Study* (AECOM, 2010d)**

The *GDS* (AECOM 2010d) was prepared to inform the *VMP HHERA* (AECOM, 2012c) with respect to the interaction of groundwater from Barangaroo South (including the Site) with Darling Harbour and the potential for contaminant mass flux due to mixing of seawater prior to discharge.

Relative to that occurring from the fill sequence, groundwater discharge volumes and therefore contaminant mass flux from the marine sediments was considered to be negligible from a hydrogeological perspective. Groundwater discharge occurring via the basal Hawkesbury Sandstone was not considered significant in the context of contaminant flux due to very low values of permeability reported for this formation in the literature.

A complete summary of the *GDS* (AECOM, 2010d) is presented in **Section 5.12**.

***Contaminant Mass Flux Study* (AECOM, 2012b)**

AECOM undertook a *Contaminant Mass Flux Study* (AECOM, 2012b) to assess the significance of contaminant mass flux and discharge in the natural soil, marine sediments and groundwater underlying the Site.

The study is presented as part of the *VMP Remediation Extent Report* (AECOM, 2013c) and concluded that:

- Lithology and hydraulic conductivity data indicate that groundwater flow in the underlying natural soil and marine sediments is very low and in the order 0.4 metre per year, with contaminant velocities likely to be at least an order of magnitude lower due to attenuation (sorption, biological degradation, etc.);
- The effect of the twice daily tide provides changes in hydraulic head that further reduce the migration of groundwater and hence the contaminants;
- Mass discharge modelling indicates that both the mass and impact from the natural soil and marine sediments underlying the Site to the receiving water are insignificant and could not be measured due to the low expected concentrations; and
- The lines of evidence assessed indicate that there is not a significant flux and discharge of contamination from the natural soil and marine sediments underlying the Site into Darling Harbour.

Additional Groundwater Modelling study (AECOM, 2013b)

AECOM also undertook an *Additional Groundwater Modelling* study (AECOM, 2013b) which is similarly presented as part of the *VMP Remediation Extent Report* (AECOM, 2013c). The objective of the supplementary study was to assess: (a) the decrease in contaminant flux that could be expected to result from the proposed remediation extent; and (b) potential impacts to water quality in Darling Harbour from the contamination that will remain *in situ* in fill material and marine sediment as an outcome of the proposed remediation extent.

The study concluded:

- A significant (between 250% and 380%) improvement in contaminant mass flux would be expected to be realised by the proposed remediation;
- Less than 1% of the calculated contaminant mass flux to Darling Harbour from residual contamination remaining after the proposed remediation extent would be expected to be associated with contamination within the marine sediment; and
- Groundwater quality in fill discharging to Darling Harbour would be expected to improve over time. Contaminant mass flux from contamination that will remain *in situ* (both on Site and off Site) following the proposed remediation for the protection of human health:

6.7 Potentially Sensitive Receptors

6.7.1 Ecological

The nearest receptor for groundwater and surface water originating from the Site is considered to be ecosystems present within groundwater down hydraulic gradient of the Site and ultimately Darling Harbour, which forms part of the larger Sydney Harbour.

No other environmentally sensitive receptors have been identified.

6.7.2 Human Health

6.7.2.1 VMP Remediation Works

The Declaration Area is situated in a mixed commercial and residential area. The current Declaration Area use is considered to be vacant paved open space. The *VMP HHERA* (AECOM, 2012c) therefore focussed on potential human health exposure scenarios which are considered to be relevant under the current zoning of the Declaration Area and uses which are allowed without planning consent. As such, the broad land use scenarios for which SSTC were derived includes:

- paved recreation; and
- short term ground-intrusive maintenance.

Based on these scenarios, the *VMP HHERA* (2012b) considered that potential human exposure to contaminants of potential concern in impacted soil/fill materials and/or groundwater may occur via the following potential exposure pathways:

Scenario 1 (Paved Recreation):

- Inhalation of soil-derived vapours; and
- Inhalation of groundwater derived vapours.

Scenario 2 (Intrusive Maintenance):

- Inhalation of vapours derived from volatilisation from soil and vapour migration to within trenches/excavations;
- Dermal contact with groundwater that seeps into trenches or excavations;
- Inhalation of vapours derived from volatilisation from groundwater (within trench) to trench air; and
- Inhalation of vapours derived from volatilisation from subsurface groundwater and vapour migration to within trenches/excavations

The most highly exposed receptor for the intrusive maintenance scenario is a short term worker involved in maintenance/excavation activities. Consideration of this receptor in the *VMP HHERA* (AECOM, 2012c) is also considered to be protective of a casual observer, or banksman working above the trench.

Regular users of public open space within the Declaration Area (e.g. individuals crossing the Declaration Area to access the Harbour Walk or pedestrians using Hickson Road) have been considered in the *VMP HHERA* (AECOM, 2012c) as the most sensitive receptors for the Paved Recreation Scenario.

6.7.2.2 Block 4 Development Remediation Works

The *Declaration Site HHERA* (AECOM, 2011a) focussed on potential human health exposure scenarios which are considered to be relevant under the proposed future development of Block 4 (i.e. the Block 4 Development Works). It is noted that the *Declaration Site HHERA* (AECOM, 2011a) considered the entire Declaration Area. However, in consideration of the objectives of this RAP (refer to **Section 1.1**), the remediation criteria from the *Declaration Site HHERA* (AECOM, 2011a) are only applied to Block 4 (refer to **Section 7.2.1**).

The *Declaration Site HHERA* (AECOM, 2011a) considered that potential human exposure to CoPC in impacted soil/fill materials and/or groundwater may occur via the following potential exposure pathways:

- direct dermal contact with impacted materials;
- incidental ingestion of impacted materials;
- inhalation of volatile potential contaminants of concern; and
- inhalation of potential contaminants of concern sorbed to air-borne particulates.

The following potential human receptors were identified by the *Declaration Site HHERA* (AECOM, 2011a):

- workers on the Site exposed to subsurface materials during maintenance work;
- the general public accessing the Site;
- commercial tenants of buildings to be constructed at the Site; and
- future residents inhabiting the buildings to be constructed at the Site.

For further detail relating to the exposure pathways and potential human receptors for each of the considered land use scenarios refer to Section 5.3 of the *Declaration Site HHERA* (AECOM, 2011a).

7.0 Remediation Goals

7.1 VMP Remediation Works

The Remediation Goals for the VMP Remediation Works (in terms of the protection of human health and the environment) are detailed in Sections 3.3 and 3.4 of the *VMP Remediation Extent* report (AECOM, 2013c). A summary of these goals is provided in the following sections.

7.1.1 Chemicals of Potential Concern (CoPC)

The CoPC for the VMP Remediation Works are presented in **Table 4** below. The CoPC are based on those chemicals that the *VMP HHERA* (AECOM, 2012c) determined to be present within the Declaration Area at concentrations that represented a risk to human health and/or the environment. **Table 4** also identifies, based on the *VMP HHERA*, whether the CoPC represents a risk to human health, the environment, or both.

Table 4 CoPCs for VMP Remediation Works

CoPC	Risk to Human Health	Risk to the Environment
Benzene	✓	✓
Ethylbenzene	×	✓
Toluene	×	✓
Xylenes	×	✓
cPAH [1]	✓	×
Acenaphthene	×	✓
Acenaphthylene	×	✓
Anthracene	×	✓
Fluorene	×	✓
Fluoranthene	✓	×
Naphthalene	✓	✓
Phenanthrene	✓	✓
Pyrene	✓	×
Phenol	×	✓
TPH C_6 - C_9	×	✓
TPH C_{10} - C_{14}	✓	✓
TPH C_{15} – C_{28}	✓	✓
TPH C_{29} – C_{36}	✓	✓
Ammonia	✓	×

Notes: [1] cPAH - carcinogenic PAHs. Includes: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h) anthracene and indeno (1,2,3-c d)pyrene. The application of cPAH requires adjustment of the individual concentrations for each constituent listed in accordance with the Toxicity Equivalency Factors (TEFs) outlined in Table 2 of PAH toxicity profile, Appendix D in the *VMP HHERA* (AECOM, 2012c). The sum of the adjusted TEF concentrations is compared to the cPAH value presented above.

It should be noted that the CoPC considered by the *VMP HHERA* (AECOM, 2012c) were based on those defined within the NSW EPA Declaration. The complete list of chemicals which have been identified in soil and groundwater within the Declaration Area by previous investigations have been considered separately within the *Declaration Site HHERA* (AECOM, 2011a) as required for the proposed Block 4 Development Remediation Works (refer to **Section 4.0**).

7.1.2 Adopted Site Specific Target Criteria ($SSTC^{VMP}$)

The objective of the *VMP HHERA* (AECOM, 2012c) was to develop '$SSTC^{VMP}$' for soil and groundwater for use in defining the remediation end-point for the Declaration Area. The remediation end-point is defined as that required to render the Declaration Area suitable for continued use based on its current land use with no change to the site conditions. For the purposes of the *VMP HHERA* (AECOM, 2012c), a 'suitable for use' endpoint was considered to be that required to ensure that unacceptable risks to human health or the environment will not occur.

Tables T1 and **T2, Appendix A**, present the hybrid criteria that are applicable to the Declaration Area based on adoption of the lowest of the SSTC for the applicable two land use Scenarios as described by the *VMP HHERA* (AECOM, 2012c). That is, where more than one SSTC is applicable, the lowest SSTC has been adopted to derive the $SSTC^{VMP}$.

It is noted that soil $SSTC^{VMP}$ have been derived for the unsaturated soils only (assumed, based on the depth of groundwater reported across the Declaration Area, to be soils shallower than 2.0 m bgl). As described by the *VMP HHERA* (AECOM, 2012c), this approach is based on the potential exposure pathways identified for the Paved Recreation and Intrusive Maintenance Worker land use scenarios.

The *VMP HHERA* (AECOM, 2012c) did not derive a SSTC for ammonia concentrations in soil. Ammonia in soil was only analysed as part of the *VMP Supplementary Data Gap Investigation* (i.e. BH401 to BH413). Of the 20 samples collected and analysed from both fill material and natural marine sediments at the Site and in the ORWN Area, ammonia was only detected in one sample (8 mg/kg in the natural silty clay at BH411_19.0-19.1 [in the ORWN Area]) (refer to **Table T15**). TCM was not observed to be present in the discussed soil sample.

SSTCs were derived by the *VMP HHERA* (AECOM, 2012c) for ammonia concentrations in groundwater.

For the purpose of this document, Confirmed Impacted Material (CIM) is considered to be material that represents an unacceptable risk to human health and the environment and, as such, warrants remediation. The presence, or absence, of CIM and the resultant extent of remediation was be determined by comparison of soil and groundwater analytical results with the soil and groundwater $SSTC^{VMP}$.

7.1.3 Marine Water Quality Criteria

The selection of MWQC relevant to protection of aquatic ecological receptors is described by Section 8.4 of the *VMP HHERA* (AECOM, 2012c). The MWQC have been adopted at the Site boundary at the direction of the NSW EPA[10], as suitable screening criteria that are protective of the environment including: groundwater dependant ecosystems which may be present down hydraulic gradient of the Declaration Area boundary currently or in the future; and, Darling Harbour.

As required by the NSW EPA, the point of compliance for the purpose of assessing ecological risk is the down hydraulic gradient boundary of the Site boundary. As detailed in Section 8.1 of the *VMP HHERA* (AECOM, 2012c), this approach is consistent with the policies of the NSW EPA, in particular:

- The *CLM Act* (1997), section 9, which requires adoption of the precautionary principle where the lack of scientific certainty is not a reason for postponing measures. With respect to the Site, this relates to the protection of groundwater dependant ecosystems down hydraulic gradient of the Site and the requirement for remediation to the extent practicable (even in the absence of data demonstrating the presence, or otherwise, of such ecosystems now, or in the future);
- The NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*, which reemphasise the requirements of the *CLM Act* (1997) requiring protection of groundwater ecosystems according to the precautionary principle;
- The ANZECC (2000) *Water Quality Guidelines*, require that the protection of underground aquatic ecosystems and their novel fauna require the highest level of protection; and
- Schedule B(6) of the *NEPM* (1999) which states that determination of the point of use for groundwater is a jurisdictional matter and that the transfer of contaminated groundwater from a contaminated Site is not considered to be acceptable , even if the relevant guidelines are achieved at the point of use / discharge.

[10] The MWQC were adopted based on an e-mail from the NSW EPA Accredited Site Auditor dated 24 February 2011 (which was understood to be based on discussions between the Site Auditor and the NSW EPA). The MWQC were applied at the Declaration Area boundary based on directions from the NSW EPA received during the project meeting attended by the NSW EPA, the NSW EPA Accredited Site Auditor, the Authority and Lend Lease on 30 May 2012, which followed comments issued by the Site Auditor on 17 May 2012.

As detailed in Section 8.4 of the *VMP HHERA* (AECOM, 2012c) and as noted in the Schedule B(6) of the *NEPM* (1999), the relevant guideline for the protection of groundwater is based on protection of potential current and future groundwater dependant ecosystems which require the highest level of protection in accordance with the ANZECC (2000) *Water Quality Guidelines*. It is considered that this approach will also be protective of surface water quality at Darling Harbour.

The selected MWQC are summarised in **Table 5** below.

Table 5 Marine Water Quality Criteria

Analyte	Criteria (µg/L)	Source
Low MW PAHs		
Acenaphthene	5.8	CCME (1999) Freshwater Guideline
Acenaphthylene	5.8	Adopted criteria for Acenaphthene as surrogate
Anthracene	0.1 [a]	ANZECC (2000) 99% Marine Water Trigger Value (0.01 µg/L) identified to be lower than LOR.
Fluorene	3	CCME (1999) Freshwater Guideline
Naphthalene	70	ANZECC (2000) 95% Marine Water Trigger Value, moderate reliability
Phenanthrene	0.6 [a]	ANZECC (2000) 99% Marine Water Trigger Value
Other Organics		
Phenol	400	ANZECC (2000) 95% Marine Water Trigger Value
Petroleum Hydrocarbons		
Benzene	700	ANZECC (2000) 95% Marine Water Trigger Value, moderate reliability
Ethylbenzene	80	ANZECC (2000) 95% Fresh Water Trigger Value, low reliability
Toluene	180	ANZECC (2000) 95% Marine Water Trigger Value, low reliability
Xylene (m & p)	75	ANZECC (2000) 95% Marine Water Trigger Value, low reliability for *m*-xylene.
Xylene (o)	350	Adoption of the ANZECC (2000) 95% Marine Water Trigger Value, low reliability for xylene (o).
TPH C_6 - C_9	110	CCME (2008a Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil – Table B-9 values for TPH C_6 to C_8 and $C^{>}_8$ to C_{10}. Criteria calculated from a weighted average assuming a Coal Tar composition of 25% aliphatic and 75% aromatic components
TPH C_{10} - C_{14}	40	CCME (2008a) Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil – Table B-9 values for TPH $C_{>10}$ to C_{12} and $C_{>12}$ to C_{16}. Criteria calculated from a weighted average assuming a Coal Tar composition of 25% aliphatic and 75% aromatic components
TPH C_{15}-C_{28}	100	No guidelines values available, therefore the standard laboratory Limit of Reporting (LOR) has been adopted.
TPH C_{29}-C_{36}	50	No guidelines values available, therefore the standard LOR has been adopted.
Ammonia		
Ammonia as N	4,830	ANZECC (2000) 95% Marine Water Trigger Value, moderate reliability

Notes: (a) It is noted that these MWQC are less than the laboratory standard LOR. The laboratory standard LOR will be adopted in place of the MWQC where: (i) analysis of these chemicals is required; or, (ii) where the MWQC are considered in derivation of risk based criteria.

7.1.4 VMP Remediation Goals

The Remediation Goals developed by the *VMP Remediation Extent* report (AECOM, 2013c) for the protection of human health and the environment based on the recommendations of the *VMP HHERA* (AECOM, 2012c) are:

- As a primary goal, removal/remediation of SPGWT to the extent practicable as required by the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination* (refer to **Section 6.6.1** for the definition of SPGWT); and
- As a secondary goal, removal/remediation of soil, to the extent practicable:
    - That is representative of CIM, which is defined as:
        - Unsaturated soil concentrations exceeding the soil $SSTC^{VMP}$; and/or
        - Unsaturated or saturated soil concentrations that is considered to be the source of groundwater concentrations exceeding the groundwater $SSTC^{VMP}$ in fill material; and
    - Such that that groundwater quality within fill material leaving the Declaration Area (measured in fill at the down hydraulic Site boundary) approaches the MWQC (in accordance with NSW EPA policy, refer to **Section 7.1.3**).

The standard of remediation (as developed by the *VMP Remediation Extent* report [AECOM, 2013c]) to be achieved within the proposed Remediation Extent should equal the higher of:

- Removal of SPGWT to the extent practicable, for the protection of human health and the environment;
- Removal/remediation of soil and groundwater concentrations present within fill material exceeding the relevant $SSTC^{VMP}$, to the extent practicable; and
- Removal/remediation of contaminated fill materials such that the contaminant mass within the Remediation Extent fill material is reduced, on average, by 90%, to the extent practicable (calculated based on the estimated mass of naphthalene and TPH C_{10} - C_{14}).

As described in the *VMP Remediation Extent* report (AECOM, 2013c), the proposed VMP Remediation Extent has been developed in consideration of NSW EPA policy requirements and, in particular, the principles of:

- The NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination* which incorporate the principle of Clean-up to the extent practicable (CUTEP) (Section 4.3);
- The principles of ESD as required by Section 9 of the *CLM Act* (1997); and
- The *Waste Avoidance and Resource Recovery Act* (2001).

7.2 Block 4 Development Remediation Works

The following sections summarise development of the '$SSTC^{DEV}$' for soil and groundwater for the Block 4 Development Remediation Works as detailed in **Section 7.2.4**. The objective of the *Declaration Site HHERA* (AECOM, 2011a) was to develop $SSTC^{DEV}$ for soil and groundwater for use in defining the remediation end-point for the Block 4 Development Remediation Works. The remediation end-point is defined as that required to render Block 4 suitable for use following the proposed Block 4 Development Works. For the purposes of the *Declaration Site HHERA* (AECOM, 2011a), a 'suitable for use' endpoint was considered to be that required to ensure that unacceptable risks to human health or the environment will not occur.

Modifications to the proposed basement design resulted in changes to the assumptions included in the *Declaration Site HHERA* (AECOM, 2011a). In consideration of these changes, a *Declaration Site HHERA Letter* (AECOM, 2012d), refer to **Section 5.14** and **Appendix C**) was prepared to assess whether the revised basement design would require a change to the $SSTC^{DEV}$ presented within the *Declaration Site HHERA* (AECOM, 2011a). Consequently, the information and assumptions detailed in the following sections are based on both these documents.

It is noted that in the unlikely event that the Block 4 Development Remediation Works are not undertaken, the proposed basement groundwater retention wall system will not be constructed.

7.2.1 Applicability of Declaration Area SSTC^{DEV} to Block 4 outside the Declaration Area

As illustrated in **Figure F2** in **Appendix B**, Block 4 includes the western portion of Block 4 that is outside the Declaration Area. This area was not specifically considered by the *Declaration Site HHERA* (AECOM, 2011a). Notwithstanding, the SSTC derived by the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) are considered applicable, with respect to the protection of human health, to both: (a) the Declaration Area; and, (b) those parts of Block 4 that are outside the Declaration Area boundary. Application of the derived SSTC^{DEV} for soil and groundwater to Block 4 outside the Declaration Area boundary is considered appropriate based on the following considerations:

- The sources of contamination within Block 4 outside the Declaration Area boundary (i.e. waste associated with the former gasworks within the Declaration Area and importation of fill material for reclamation activities) are the same as those identified within the Declaration Area;
- The CoPC for which SSTC were derived in the *Declaration Site HHERA* (AECOM, 2011a) were selected based on the available environmental analytical data for the entire Barangaroo Development, i.e. based on soil and groundwater analytical data for Blocks 1 to 5 and Hickson Road (within the Declaration Area);
- The geological and hydrogeological conditions reported across Barangaroo South (including the ORWN and Declaration Area) are similar (although it is noted that conditions are highly variable through the precinct due to the history of reclamation and presence of underlying caisson and finger wharf structures); and
- The Lend Lease development plans and associated land use scenarios for which SSTC were derived in the *Declaration Site HHERA* (AECOM, 2011a) are the same as those for Block 4 outside the Declaration Area.

7.2.2 Block 4 SSTC^{DEV} Exposure Scenarios

Based on the information describing the proposed development provided by Lend Lease and associated assumptions (refer to **Section 1.6** and **7.2.3**), the *Declaration Site HHERA* (AECOM, 2011a) and the *Declaration Site HHERA Letter* (AECOM, 2012d, refer to **Section 5.14**) considered land use scenarios for which applicable SSTC^{DEV} for the Block 4 Development Remediation Works were derived. In consideration of risk to human health, the following scenarios were considered:

- **Scenario 1:** Lower-most basement car park level (below water table) with some groundwater seepage through the basement walls and floor;
- **Scenario 2:** Upper-most basement car park level (above water table) with no groundwater seepage through the basement walls and floor (surfaces are dry in top 2 m);
- **Scenario 3:** Unpaved Recreation, Public Domain (North) with no concrete/hardstand paving;
- **Scenario 4:** Paved Recreation, Public Domain (North) with concrete/hardstand paving;
- **Scenario 5:** Typical commercial slab on ground construction;
- **Scenario 6:** Short term ground-intrusive maintenance; and
- **Scenario 7:** High density residential (above a car park basement).

Table 6 below summarises the land use scenarios and assumptions as discussed in the *Declaration Site HHERA* (AECOM, 2011a) and as amended in the *Declaration Site HHERA Letter* (AECOM, 2012d).

Table 6 Summary of Land Use Scenarios Considered in the *Declaration Site HHERA*

Scenario Number	Name and Description	Most Sensitive Human Receptor	General Assumptions
1	Lower Basement Lower-most basement car park level (below water table), with groundwater seepage through walls and floor (i.e. limited groundwater seepage may be present at inner surface of outer wall and on floor surface).	Adult Worker Exposed up to 8 hr/day, 240 days/year, for 30 years.	Conservative scenario to assess risk if water seeps all the way through walls and floor of lower most basement level. Small layer of groundwater is assumed to be permanently present on some sections of the two walls and floor (within plenum (walls) up to a total of 2,250 m^2 across two walls and floor, equivalent to 50% of the surface area) surface area and to act as continuous vapour source. This is considered to be a conservative assumption. Advective flow of vapours is assumed to be negligible (airflow through saturated zone cannot occur due to zero air filled porosity).
2	Upper Basement Upper-most basement car park level, partially above water table. May be used for loading/unloading, or have full time car park attendant present.	Adult Worker Exposed up to 8 hr/day, 240 days/year, for 30 years.	Upper 2 m of walls may have soil directly adjacent to walls as a source of vapour. Lower 1 metre of 2 of the 4 walls may have water seepage through the wall. It has been conservatively assumed that 125m^2 of the two walls will be covered in water seepage (50% of the total wall area). Advective vapour flow considered possible through unsaturated soils (upper 2 m).
3	Unpaved Recreation Public domain area with no concrete/hardstand paving, but 50 cm of clean fill at surface.	Assumed to be exposed 2 hrs/day, 365 days/year, for 70 years.	Open Space with no Concrete Surface Covering. Assumed that areas are landscaped with at least 50 cm of clean fill overlying contaminated soil. Assume that there is significant oxygen movement through the top 2 m of soil based on the oxygen measurements collected during soil gas sampling conducted at the Declaration Area. Groundwater (GW) depth assumed to be 2 m bgl.
4	Paved Recreation Public Domain area with concrete/hardstand paving. Contaminated soil may be present directly underlying concrete surface cover.		Open Space with Concrete surface covering. Assume that there is significant oxygen movement through the top 2m of the soil based on the oxygen measurements collected during soil gas sampling at the Declaration Area. Concrete assumed to be minimum 15 cm thick and to have crack fraction of 0.001 (to account for higher cracking possible in surface covering)
5	Commercial Slab on Ground Typical commercial slab on ground scenario for public domain area where basement car park is not present.	Adult worker. Exposed up to 8 hr/day, 240 days/year, for 30 years. Scenario also protective of child who may visit premises on a less frequent basis.	Assumes typical slab on grade commercial premises at ground level. With a maximum of 2 storeys. To account for potential coffee shop, convenience store, restaurant, etc., that could be constructed within the Public Domain.

Scenario Number	Name and Description	Most Sensitive Human Receptor	General Assumptions
6	Intrusive Maintenance Short term intrusive maintenance scenario, e.g. for maintenance of utility services.	Adult worker 8 hrs/day, 15 days/year for 1 year. Water contact may occur due to shallow water – no more than 1 hour per day. Vapour may be derived from pooled GW or from exposed soils in trench.	Post development, short term maintenance work may be required. Assumed not to exceed 3 working weeks per year by same worker.
7	High Density Residential	Adult or child resident. Assumed to be exposed 24 hrs/day, 350 days/year, for 70 years.	Assuming that the AS 1668.2 car park ventilation rates will be met (approximately 4 exchanges per hour). Assumes that vapours which enter the upper level basement are uniformly mixed and 1/10 of the concentration migrates to the overlying residential property on the ground floor. Within the basement, the upper 2 m of walls may have soil directly adjacent to walls as a source of vapour. Lower 1 metre of 2 of the 4 walls may have water seepage through the wall. It has been conservatively assumed that 25m^2 of the two walls will be covered in water seepage (50% of the total wall area). This scenario would be protective of residential receptors in higher than ground floor premises, where vapour concentrations would be expected to be further diluted than if only mixed within one overlying residential level.

7.2.3 Derivation of SSTC^{DEV} and Key Assumptions

The SSTC^{DEV} for soil and groundwater derived in the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) were developed to provide human health risk-based concentrations that can be used as remediation criteria applicable:

- to areas of Block 4 based on the proposed land uses: if all CoPCs in samples are below the applicable SSTC^{DEV}, then further assessment of the health risks would not be warranted; and/or
- for the reuse of excavated material (either treated or untreated) within the Barangaroo Stage 1b Development: if all CoPC in samples are below the SSTC^{DEV}, then further assessment of the health risks would not be warranted.

Further details on how the SSTC^{DEV} have been derived are provided in the *Declaration Site HHERA* (AECOM, 2011a) and the *Declaration Site HHERA Letter* (AECOM, 2012d).

Key assumptions from the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) upon which the SSTC^{DEV} derivation was based are summarised below:

Soil:

- The derivation of SSTC^{DEV} has been based on plans and design assumptions provided by Lend Lease;
- The development of SSTC^{DEV} has assumed that tar will be removed from the immediate vicinity of outer basement walls to the extent practicable, and basement design and engineering controls should ensure that tar seepage into basements does not occur;

- There are significant biodegradation processes occurring within sub-surface soils based on measured oxygen concentrations beneath the sub-surface. To account for these biodegradation processes, a 10 fold factor (Davis 2009) has been adopted for site specific target criteria for soil for the paved and unpaved areas of the Site, where biodegradation processes are considered to be significant;
- The current theoretical estimation of soil concentrations within indoor and outdoor air is based on partitioning modelling which has been demonstrated to overestimate concentrations between 10-1,000 fold. To account for this conservatism, an adjustment factor of 10 has been applied. In all scenarios a soil partitioning factor of 10 has been applied to BTEX, TPH (fractions C_6-C_9 and C_{10}-C_{14} to account for the overconservative nature of vapour modelling associated with these chemicals (CCME, 2008b. CRC 2010);
- Risks associated with mixtures of chemicals have been modelled by applying proportional risks, referred to as the Hazard Index (HI). HI were applied as follows: BTEX (HI 0.25 each), PAH (HI 0.2), TPH (HI 0.25 total for aliphatic and aromatic per fraction), all other chemicals HI = 1;
- Chemicals are assumed to be volatile if Henry's Law constant is greater than 1 x 10^{-5} atm-m^3/mole (USEPA, 2004);
- The air exchange rate within the basement car park has been assumed to be 3.17 per hour. The adopted air exchange rate is based on modelling calculations prepared by Lend Lease for the ORWS basement design and is considered to be representative of the ventilation rates that will be accomplished in the basements to be constructed at the Site. It is understood that the ORWS basement ventilation system has been designed in accordance with AS 1668.2 and incorporates requirements for future building energy efficiency ratings; and
- In the unpaved recreation scenarios (Scenario 3 and Scenario 4) it has been assumes that the upper 0.5 m of soil is composed of “suitable fill” (defined as either VENM or soil which meets the Terrestrial Soil Criteria).

Groundwater:

- The derivation of $SSTC^{DEV}$ has been based on plans and design assumptions provided by Lend Lease;
- The development of $SSTC^{DEV}$ has assumed that tar will be removed from the immediate vicinity of outer basement walls to the extent practicable, and basement design and engineering controls should ensure that tar seepage into basements does not occur;
- There are significant biodegradation processes occurring within sub-surface soils based on measured oxygen concentrations beneath the sub-surface. To account for these biodegradation processes, a 10 fold factor (Davis, 2009) has been adopted for site specific target criteria for soil for the paved and unpaved areas of the Site, where biodegradation processes are considered to be significant;
- Risks associated with mixtures of chemicals have been modelled by applying proportional risks as follows: BTEX (HI 0.25 each), PAH (HI 0.2), TPH (HI 0.25 total for aliphatic and aromatic per fraction), all other chemicals HI = 1;
- The lower and upper basements have been modelled using a water seepage model adopted from Water 9 (USEPA, 1994);
- In the lower and upper basements a windspeed of 0.03 m/sec within the basements (scenario 1,2 and 7) has been modelled;
- Chemicals are assumed to be volatile if Henry's Law constant is greater than 1 x 10-5 atm-m3/mole (USEPA, 2004);
- The air exchange rate within the basement car park has been assumed to be 3.17 per hour. The adopted air exchange rate is based on modelling calculations prepared by Lend Lease for the ORWS basement design and is considered to be representative of the ventilation rates that will be accomplished in the basements to be constructed at the Site. It is understood that the ORWS basement ventilation system has been designed in accordance with AS 1668.2 and incorporates requirements for future building energy efficiency ratings;
- In basement scenarios (1, 2 and 7) it has been assumed that no more than two walls will be in contact with contaminated soil / groundwater (with Scenario 1 also considering exposures to the floor). Based on building plans provided by Lend Lease, it has been assumed that basement areas will be compartmentalised with each compartment adjacent to basement areas leaving a maximum of 2 exposed walls;

- The basement groundwater retention wall system will comprise a diaphragm wall (or equivalent), extending to and keyed into bedrock, with a reinforced concrete basement wall, constructed on the inside. The wall will be a minimum thickness of 600 mm;
- Any exposed sandstone will have a secondary concrete reinforced wall constructed as part of the basement (i.e. there will be no exposed sandstone);
- A plenum will be constructed which separates the retention wall system from the publically accessible general basement area. Any potential seepage water from perimeter walls will be collected into dish drains and a central sump for disposal as required. The plenum will also minimise the risk of vapour and groundwater penetrating the retention wall system and entering the basement car park; and
- The typical occupiable space within the basement carpark (i.e. upper and lower basements) will be 4.5 m in height and an area of 50 m x 50 m. No more than two walls of the space will be exposed to soil or groundwater.

The above *Declaration Site HHERA* (AECOM, 2011a) assumptions have been reviewed by the NSW EPA and NSW EPA Site Auditor and have subsequently been endorsed. On 11 July 2011, the NSW EPA (then the NSW OEH) issued a letter endorsing the *Declaration Site HHERA* (AECOM, 2011a) as part of the Project Approval No MP10 (Bulk Excavation and Basement Car Park).

In addition to the above assumptions, is has been assumed that soil $SSTC^{DEV}$ for the Block 4 basement area are not applicable (i.e. below the proposed basement and within the basement groundwater retention wall system, **Section 4.34.3**) as the basements will extend below the groundwater table and so potential risk to human health has been assessed with the derivation of groundwater $SSTC^{DEV}$.

It is possible that the final details and configuration of the basement groundwater retention wall system will be revised by Lend Lease as part of the continued development design. However, the basic function of the retention wall system will remain consistent with the above assumptions. If the final development design is changed which affects the assumptions of the *Declaration Site HHERA* (AECOM, 2011a), the *Declaration Site HHERA Letter* (AECOM, 2012d) and this RAP, contingency measures will be considered (as detailed in **Section 23.12**). If required, an Addendum will be prepared and submitted to the NSW EPA Accredited Site Auditor for approval/agreement. If the Addendum relates to VMP Remediation Works, the document would also be submitted to the NSW EPA for approval.

7.2.4 Block 4 Development Remediation Criteria

7.2.4.1 Derivation of Remediation Criteria

The $SSTC^{DEV}$ that are applicable to Block 4 are presented in **Table 7** below. The $SSTC^{DEV}$ have been selected in terms of areas, which share common proposed land uses (as illustrated in the **Figure 3** schematic in **Section 1.6** and **Figure F3** in **Appendix B**):

- **Block 4** - materials to remain *in situ* below the basement car park and within the retention wall system which will effectively remove hydraulic connection with Darling Harbour (note that as described by **Section 4.3**) the proposed basement carparks will extend to a depth below the groundwater table).

For land use scenarios where more than one $SSTC^{DEV}$ is applicable, the lowest (i.e. most conservative) $SSTC^{DEV}$ has been adopted to appropriately assess soil and groundwater quality in the Site areas (refer to **Table 7** below).

The risk based criteria applied to Block 4 (as illustrated in the **Figure 3** schematic, **Section 1.6**) are described in **Table 7** below and are detailed in **Table T1** and **T2**.

Table 7 Land Use and Applicable Risk Based Criteria

Area	Proposed Land Use	Applicable Risk Based Criteria
Block 4 – material remaining below basements	High density residential, retail and commercial multi storey towers, together with associated open space areas (including roads, landscaping, planter boxes and paved areas)	Soil $SSTC^{DEV}$: Not applicable (as basements will extend below the groundwater table)
		Groundwater $SSTC^{DEV}$: Scenario 1 – Lower Basement Scenario 2 - Upper Basement Scenario 7 – High Density Residential

7.2.4.2 Asbestos in Soil

***VMP HHERA* (AECOM, 2012c)**

The *VMP HHERA* (AECOM, 2012c) did not consider that asbestos was a CoPC because it had been agreed with the NSW EPA that the CoPC assessed by *VMP HHERA* (AECOM, 2012c) would be limited to those defined within the NSW EPA Declaration. The complete list of CoPC which have been identified in soil and groundwater at the Site by previous investigations were considered separately within the *Declaration Site HHERA* (AECOM, 2011a).

Notwithstanding, it was recommended by Section 10.2 of the *VMP HHERA* (AECOM, 2012c), that the risk of asbestos would be most appropriately managed by including appropriate mitigation measures for the management of asbestos as part of the RAP.

***Declaration Site HHERA* (AECOM, 2011a)**

The *Declaration Site HHERA* (AECOM, 2011a) did not consider that asbestos was a CoPC for which specific risk based criteria were required to be calculated. Rather, the *Declaration Site HHERA* (AECOM, 2011a) recommended that the risk of inhalation of asbestos fibres was most appropriately managed through implementation of appropriate management tools in this RAP.

The following discussion summarises the basis of this position. At the time when the *Declaration Site HHERA* (AECOM, 2011a) was initially prepared:

- ERM (2008a) previously analysed a total of 39 samples (12 samples from the Site) and detected chrysotile and amosite asbestos in a single location (BH203_1.5). It is noted that the laboratory did not report if the detected asbestos was in a bonded matrix or free fibres;
- A total of five samples (collected from locations where buried fill and rubble were identified) were analysed for asbestos during the *Declaration Area DGI* (AECOM, 2010b). No asbestos was detected in the samples analysed. A single result (AECOM BH48_11.5-11.7) reported the presence of unidentified mineral fibres. The corresponding bore log for this sample noted the presence of plastic, minor silt, crushed brick and road base gravels. No visual evidence of bonded fibre cement or possible asbestos fibres was observed by AECOM during the DGI investigation;
- Based on the results of the previous investigations within the Declaration Area, asbestos containing materials (ACMs) were not considered to be widespread within fill materials within the Declaration Area and therefore asbestos was not considered to be a contaminant of potential concern that required development of a risk based criteria in the *Declaration Site HHERA* (AECOM, 2011a); and
- It was recommended, as described by Section 5.1 and Section 10.2 of the *Declaration Site HHERA* (AECOM, 2011a), that the risk of asbestos would be most appropriately managed by including appropriate field screening and management tools for the management of asbestos (should it be encountered during remediation) as part of the RAP to be prepared for the Declaration Area.

Subsequent to preparation of the *Declaration Site HHERA* (AECOM, 2011a), additional analysis of asbestos has been undertaken as part of:

- The *Supplementary DGI* (AECOM, 2012a). Eleven soil samples were analysed for the presence of asbestos. Asbestos fibre bundles were identified in fill materials at location BH405 (the western portion of Block 4) at a depth of 12-12.2 m bgl. Potential ACM such as fibre cement fragments were not observed in any samples collected during this investigation;
- Geotechnical and archaeological investigations. Asbestos was detected in nine fill samples and in one fibre cement fragment collected from 7 (out of a total of 15) separate test pit locations analysed as part of geotechnical works conducted in Blocks 1 to 3. A total of 24 of the geotechnical bulk samples were subsequently analysed for ACM and asbestos fibres in accordance with the *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (Western Australian [WA] Department of Health, 2009) which have been incorporated into the NEPM (1999) as amended (refer to **Section 2.2.4**). ACM and asbestos fibres were not detected in any of the 24 samples (500 g) analysed by the laboratory following 7 mm sieving. Therefore, all samples analysed were less than the adopted criteria of 0.001% w/w asbestos for friable asbestos (FA) and asbestos fines (AF). However, the w/w % of bonded ACM in 7mm sieve screening samples exceeded the adopted assessment criteria of 0.05% in one sample (TP11_3.0-4.2 - 0.062%);

- Waste characterisation activities (February 2012 - July 2012) undertaken in relation to construction of the Stage 1a Development basement groundwater retention wall system and building foundations; and
- Excavation spoil characterisation activities (July 2012 – the date of this RAP) undertaken in relation to the bulk excavation of the Stage 1a basement (Blocks 1 to 3).

It is noted that the Stage 1a basement encompasses Blocks 1 to 3 and is located south of the Site. While these most recent sample results do not relate specifically to the Site, they are considered generally representative of fill materials within the Site.

Based on information provided by Lend Lease regarding sample analysis and monitoring during the waste characterisation and excavation spoil activities associated with the Stage 1a basement construction, it is understood that:

- ACM fragments have been encountered during the works;
- Airborne asbestos fibres have not been encountered in air quality monitoring undertaken as part of the works; and
- Asbestos identified during the bulk excavation works has been removed in accordance with an Asbestos Management Plan.

Approach to the Management of Asbestos

The results from analysis undertaken and observations made subsequent to the *Declaration Site HHERA* (AECOM, 2011a) suggest that it is probable that asbestos will be present within fill at the Site. The approach advocated by the *Declaration Site HHERA* (AECOM, 2011a) is considered appropriate for management of risks associated with asbestos that may be present at the Site because:

- the principle risk associated with asbestos that may be present at the Site is the inhalation of asbestos fibres during remediation and construction works. This risk is most appropriately managed through implementation of appropriate management tools in this RAP; and
- asbestos that may remain at the Site beneath a basement following completion of development works (as could be the case in the context of the Block 4 Development Remediation Works) will not represent an unacceptable risk to human health or the environment.

Consequently, the risk of asbestos will be managed appropriately during the remediation works via the preparation and implementation of an Asbestos Management Plan (refer to **Section 1.7**, **13.1.3** and **14.8**).

The Asbestos Management Plan and any associated ACM removal works will include consideration of construction worker protection and the following independent report commissioned and endorsed by the NSW EPA:

- Associate Professor Tim Driscoll, Sydney School of Public Health, Sydney Medical School, University of Sydney (March 2013). *The Use of Asbestos-Contaminated Soils on Barangaroo, Report to the Environment Protection Authority.*

7.2.4.3 Summary of Remediation Criteria

The soil and groundwater $SSTC^{DEV}$ derived from the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) are detailed in **Table T1** and **T2**, **Appendix A**. As required by the *Declaration Site HHERA* (AECOM, 2011a) and the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*, remediation in Block 4 also requires that SPGWT be removed to the extent practicable.

The Block 4 unsaturated and saturated soil analytical data is presented in **Table T17**.

As discussed in **Section 7.2.3**, soil $SSTC^{DEV}$ are not applicable to Block 4 because all soil from the unsaturated zone will be removed as part of the proposed basement excavations and soil $SSTC^{DEV}$ are not applicable to the saturated zone (refer to **Section 7.2.3**).

The Block 4 groundwater analytical data is compared to the applicable groundwater $SSTC^{DEV}$ in **Table T18**.

7.2.5 Implementation of the Remediation Criteria

$SSTC^{DEV}$ have been derived by the *Declaration Site HHERA* (AECOM, 2011a) and the *Declaration Site HHERA Letter* (AECOM, 2012d) based on the proposed development and land use scenarios. These criteria define:

- Unsaturated soil concentrations that represent an unacceptable risk to human health if the material is left *in situ* beneath Block 5 and Hickson Road; and
- Groundwater concentrations that represent an unacceptable risk to human health if present beneath the Block 4 basement.

7.2.5.1 Separate Phase Gasworks Waste and Tar (SPGWT)

Section 4.2.4 of the *Declaration Site HHERA* (AECOM, 2011a) notes that the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination* requires that "*Where light NAPLs (LNAPLs) or dense NAPLs (DNAPLs) are present in the subsurface they must be removed or treated as much as practicable*". Consequently, in accordance with NSW EPA policy and guidelines, NAPL (also referred to as SPGWT) identified in Block 4 is required to be remediated to the extent practicable.

7.2.5.2 Groundwater $SSTC^{DEV}$ Implementation

Groundwater quality at selected monitoring wells in Block 4 have been assessed against the groundwater $SSTC^{DEV}$ for the purposes of assessing the presence of CIM as discussed in **Section 8.4**.

7.3 Reuse of Excavated Material

There may be opportunity to reuse some of the excavated material removed as part of the remediation works (e.g. overburden or rock removed to facilitate deep excavation).

Only material that is free of SPGWT will be considered for reuse.

Opportunities for reuse, and the corresponding acceptance criteria, are summarised following:

- As backfill of excavations created as part of the remediation works within the Site that are not required for future basements as part of the development (subject to contaminant concentrations being less than the relevant Remediation Goals as described by **Section 7.1**);
- As fill in other parts of the Barangaroo South Development subject to compliance with the SSTCs developed in relation to those areas. Reuse criteria for the ORWS Public Domain are described in the *Amended ORWS RAP* (AECOM, June 2011). Reuse criteria for the ORWN Area will be described in the *ORWN RAP* (to be prepared by AECOM); and
- In other parts of the Barangaroo Development - specifically the Stage 2 Public Domain in Barangaroo Central. Reuse criteria for Barangaroo Central Public Domain are described in the separate HHERA prepared for the Authority (JBS, May 2012 [Draft]).

It is understood that the Authority has determined that no material from the Declaration Area will be accepted for reuse within Headland Park (*Headland Park RAP* [Rev 3], JBS, 2011). Therefore the option for reuse of material from the Declaration Area within Headland Park has not been considered.

The movement of materials from the Site for reuse within Barangaroo Central will be managed in accordance with the *Reuse Materials Management Plan* (refer to **Section 13.1.3**) to be prepared for the Authority (as recommended by the *Barangaroo Independent Remediation Review Panel Report* [Barangaroo Independent Remediation Review Panel, 2011]).

8.0 Remediation Extent – VMP Remediation Works

The *VMP Remediation Extent* report (AECOM, 2013c, refer to **Section 5.18**) was prepared to describe:

- The Remediation Goals, based on the assessment of risk in the *VMP HHERA* (AECOM, 2012c), that are applicable to remediation of the Declaration Area to achieve the nominated remediation objectives (refer to **Section 1.1**); and
- The extent of remediation required to render the Declaration Area protective of human health and the environment in its current condition.

The extent of remediation developed by the *VMP Remediation Extent* report (AECOM, 2013c) is summarised in the following sections.

8.1 Decision Process

The lateral extent of remediation required for protection of human health and the environment recommended by the *VMP Remediation Extent* report (AECOM, 2013c) was determined based on consideration of:

- The presence of historic gasworks infrastructure and the distribution of SPGWT and CIM within the respective Site areas; and
- The extent of remediation that can be practicably accomplished for the protection of the environment based on:
    - The standard of remediation that can be practically achieved by the remediation technologies that are most likely to be implemented;
    - Regulatory policy requirements including:
        - source removal, removal of NAPL to the extent practicable, and clean-up to the extent practicable as contemplated by the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*
        - The principles of ESD as required by Section 9 of the *CLM Act* (1997); and
        - The principles of the *Waste Avoidance and Resource Recovery Act* (2001).

8.2 Remediation Standard

The standard of remediation (as developed by the *VMP Remediation Extent* report [AECOM, 2013c]) to be achieved within the proposed Remediation Extent should equal the higher of:

- Removal of SPGWT to the extent practicable, for the protection of human health and the environment;
- Removal/remediation of soil and groundwater concentrations present within fill material exceeding the relevant $SSTC^{VMP}$, to the extent practicable; and
- Removal/remediation of contaminated fill materials such that the contaminant mass within the Remediation Extent fill material is reduced, on average, by 90%, to the extent practicable (calculated based on the estimated mass of naphthalene and TPH C_{10} - C_{14}).

8.3 Identification of SPGWT

The *VMP Remediation Extent* report (AECOM, 2013c) identified the presence of SPGWT (as defined in **Section 6.6.1**) based on consideration of both field observations and soil analysis results from previous investigations within the Declaration Area. SPGWT was generally identified (refer to **Figure F6** in **Appendix B**):

- in association with former gasworks infrastructure;
- down hydraulic gradient of former gasworks infrastructure; and
- in selected relatively isolated hotspots, likely associated with historical filling practices.

A detailed description of the identification of SPGWT is provided in the following sections of the *VMP Remediation Extent report* (AECOM, 2013c):

- Section 4.1.1 – with respect to Block 4 and Block 5;
- Section 4.2.1 – with respect to Hickson Road;
- Section 4.3.1 – with respect to off-site areas west of the Declaration Area; and
- Section 4.4.1 – with respect to off-site areas east of the Declaration Area.

8.4 Identification of CIM

The soil and groundwater analytical data for the Declaration Area and offsite areas is compared to the relevant $SSTC^{VMP}$ for the purpose of identifying CIM and SPGWT in the following tables presented in **Appendix A**:

- Declaration Area soil analytical results:
  - **Table T3**: Site wide Soil Analytical Results - Unsaturated
  - **Table T4**: Site wide Soil Analytical Results – Saturated
- Block 4 and Block 5 soil analytical results:
  - **Table T5**: Block 4 and 5 Soil Analytical Results - Unsaturated
  - **Table T6**: Block 4 and 5 Soil Analytical Results - Saturated
  - **Table T7**: Block 4 and 5 Asbestos Analytical Results
- Hickson Road soil analytical results:
  - **Table T8**: Hickson Road Soil Analytical Results - Unsaturated
  - **Table T9**: Hickson Road Soil Analytical Results – Saturated
- Block 4 and Block 5 groundwater analytical results:
  - **Table T10**: Block 4 and 5 Groundwater Analytical Results (2010-11)
  - **Table T11**: Block 4 and 5 Historic Groundwater Analytical Results
  - **Table T12**: Declaration Area Boundary Groundwater Analytical Results
- Hickson Road groundwater analytical results:
  - **Table T13**: Hickson Road Groundwater Analytical Results (2008-10)
- Off Site (Block 5 and ORWN) soil and groundwater analytical results:
  - **Table T14**: Off Site - Soil Analytical Results – Unsaturated
  - **Table T15**: Off Site - Soil Analytical Results – Saturated
  - **Table T16**: Off Site - Groundwater Analytical Results (west of Block 5 & ORWN)

Soil and groundwater analytical data beyond the Declaration Area boundary has also been assessed. This assessment has been included because the NSW EPA Accredited Site Auditor is required by NSW DEC (2006) to include in his/her site audit an assessment offsite impacts and the risk of cross contamination of onsite areas from offsite areas.

CoPC exceedances of the unsaturated soil and groundwater $SSTC^{VMP}$ are presented in **Figure F7** and **Figure F8** in **Appendix B** respectively. A detailed description of the identification of CIM is provided in the following sections of the *VMP Remediation Extent report* (AECOM, 2013c):

- Section 4.1.4 – with respect to Block 4 and Block 5; and
- Section 4.2.4 – with respect to Hickson Road.

8.5 Remediation Extent

The lateral extent of remediation required in the unsaturated and saturated zones for the protection of human health and the environment as recommended by the *VMP Remediation Extent* report (AECOM, 2013c) is presented on **Figure F10** and **Figure F11** in **Appendix B**, respectively.

The vertical extent of remediation has been broadly defined as remediation to the depth of the underlying natural bedrock to a maximum depth of 10 m below ground level (bgl). The vertical extent of remediation is based on consideration of:

- locations where SPGWT has been reported;
- locations where exceedances of the groundwater SSTC and unsaturated soil SSTC have been reported;
- the footprint of historical gasworks structures and infrastructure; and
- the depth to bedrock (noting that the depth to bedrock steadily increases to the west beyond the 10 m bgl rock contour).

While SPGWT and CIM have been reported in the natural marine sediments both within the Declaration Area and in some hydraulically down gradient areas to the west of the Declaration Area, the negligible contaminant flux from these natural materials is not considered to pose a significant risk to human health or the environment (refer to **Section 6.6.5**).

The recommended extent of remediation required for the protection of human health and the environment is also summarised for the respective parts of the Declaration Area in the following sections.

If SPGWT is encountered within fill material at the base of the Remediation Area during ex situ remediation works, the vertical extent of remediation will be increased, to the extent practicable, or to the depth of marine sediment or bedrock (which ever requires the smallest increase in the depth of remediation). Refer to **Section 19.5.1**.

For clarity, the Block 4 VMP Remediation Works relate to works required to facilitate removal of the NSW EPA Declaration. As such, the Block 4 VMP Remediation Works are focused on works required in relation to that part of Block 4 that is within the Declaration Area. With the exception of contamination that would otherwise require remediation to facilitate removal of the NSW EPA Declaration, the Block 4 VMP Remediation Works do not include that part of Block 4 which is outside the Declaration Area. In contrast, the Block 4 Development Remediation Works relate to works required to make the entire Block 4 footprint (i.e. within the proposed basement boundary) suitable for the proposed future use.

8.5.1 Block 4

- Unsaturated zone (i.e. between 0 and 2 m bgl):
  - All Block 4 areas where SPGWT has been identified (refer to Table 5 of the *VMP Remediation Extent* report and **Figure F10** in **Appendix B**).
- Saturated zone (i.e. greater than 2 m bgl):
  - All Block 4 areas where SPGWT has been identified (refer to Table 5 of the *VMP Remediation Extent* report and **Figure F11** in **Appendix B**);
  - The western portion of the 1870 gasholder annulus (Block 4);
  - The eastern portion of Block 4 (i.e. east of the 10 m bgl bedrock contour);
  - The south east portion of Block 4 in the vicinity of BH42/BH408; and
  - The western portion of Block 4 in the vicinity of BH49 and BH119.

8.5.2 Block 5

- Unsaturated zone (i.e. between 0 and 2 m bgl):
  - The Block 5 area where CIM has been identified (refer to **Figure F10** in **Appendix B**).
- Saturated zone (i.e. greater than 2 m bgl):
  - The Block 5 area where SPGWT has been identified (sampling location TP02, refer to Table 5 of the *VMP Remediation Extent* report and **Figure F11** in **Appendix B**); and

- The eastern portion of Block 5 (i.e. east of the 10 m bgl bedrock contour).

It is noted that the Sydney Water pumping station (SPS1129) will be retained within the Declaration Area in the future (refer to **Figure F10** in **Appendix B**). Sydney Water drawings for the pumping station confirm that the pumping station is founded within bedrock (ref. Sydney Water work as executed drawing No. SP1129/3A, dated 10 June 2004). The Sydney Water drawings show that bedrock in this area is present at approximately -4.3 m AHD and the base of the pump station was cut into bedrock to approximately -8.5 m AHD. Consequently, remediation beneath the structure is unlikely to be required. There is a possibility that some residual impacted soil adjacent to this structure may not be accessible for remediation (i.e. due to access constraints around the perimeter of the structure and related infrastructure [i.e. underground pipework, etc]). However, it is unlikely that remediation of these residual impacts will be required to facilitate removal of the NSW EPA Declaration in accordance with the Remediation Goals (refer to **Section 7.1.4**). Remediation works to be undertaken adjacent to the pumping station will need to consider appropriate protection measures for the structure.

8.5.3 Hickson Road

- Areas where SPGWT has been identified (refer to **Figure F6** and **Figure F11** in **Appendix B**):
  - The BH7/MW7 and BH53 area – the southern tar tank (refer to **Figure F5** in **Appendix B**);
  - The BH10/MW10 area - eastern portion of the 1870 gas holder;
  - The western portion of the main gas holder annulus;
  - The northern tar tank; and
  - The BH6, BH15 and BH61 area - located west and down hydraulic gradient of the main gas holder annulus and northern/southern tar tanks.

8.5.4 Offsite areas - west of the Declaration Area

- BH70 at a depth of approximately 2 to 3 m depth in fill material (based on the potential presence of SPGWT, refer to **Figure F6** in **Appendix B**); and
- BH541 (located west of the Block 5 portion of the Site) at a depth of approximately 9.9-10 m bgl in fill material (potential SPGWT).

For clarity, any remediation of SPGWT and/or CIM arising from gasworks contamination migrating from the Declaration Area is considered VMP Remediation Works because it is required to remove the NSW EPA Declaration.

SPGWT and CIM have been reported in the natural marine sediments in some hydraulically down gradient areas to the west of the Site (outside the recommended extent of VMP Remediation Works). As discussed in **Section 6.6.5** (and in Section 2.5 of the *VMP Remediation Extent* report [AECOM, 2013c]), it is considered that the negligible contaminant flux from these natural materials will not pose a significant risk to human health or the environment. As such, the proposed extent of VMP Remediation Works that is considered practicable excludes remediation of natural marine sediments which are present below a depth of 10 m bgl.

8.5.5 Offsite areas - east of the Declaration Area

As discussed in Section 5.4.1 of the *VMP Remediation Extent* report (AECOM, 2013c), SPGWT is potentially present in the area directly east of the Declaration Area (i.e. in the south east portion of the main gasholder annulus and the eastern edge of the tar tank). While remediation of these offsite areas was not recommended in the *VMP Remediation Extent* report, it was recommended that consideration should be given to management measures (likely engineering controls) to mitigate the risk of the remediated Declaration Area being re contaminated from potential offsite sources.

This may involve construction of a localised cut-off wall on the eastern Declaration Area boundary in the areas adjacent to the eastern portions of the main gasholder annulus and tar tank (if required). If a cut-off wall is to be installed, the NSW EPA Accredited Site Auditor will be consulted on the design.

9.0 Remediation Extent - Block 4 Development Remediation Works

9.1 Confirmed Impacted Material Assessment

The results of previous intrusive investigation programs within the Site and immediate surrounds are reported and summarised in **Section 5.0**. For the purposes of the assessment of CIM, all soil results from Block 4 (i.e. including both the Declaration Area and non-Declaration Area, refer to **Figure F4** in **Appendix B**) and located within the footprint of the proposed retention wall system are compared to the relevant $SSTC^{DEV}$ and presented in the following summary tables (refer to **Appendix A**):

- **Table T17**: Block 4 Soil Analytical Results - Unsaturated and Saturated; and
- **Table T18**: Block 4 Groundwater Analytical Results (2010-11).

The borehole and groundwater monitoring well locations are presented on **Figure F5** in **Appendix B**. Contaminant concentrations which exceed the relevant groundwater $SSTC^{DEV}$ are presented in **Figure F9** in **Appendix B**.

As soil $SSTC^{DEV}$ are not applicable for Block 4, the assessment of whether CIM is present in this area (i.e. within the footprint of the retention wall system) presented in the following sections is focused on the identification of SPGWT and groundwater CoPC concentrations which exceed the $SSTC^{DEV}$.

9.1.1 Separate Phase Gasworks Waste and Tar

As detailed in **Section 8.3** , based on consideration of both field observations and soil analytical results, SPGWT (as defined in **Section 6.6.1**) has primarily been identified in the following areas (refer to **Figure F6** in **Appendix B**):

- across most of the eastern portion of Block 4 - in association with former gasworks infrastructure;
- across part of the western portion of Block 4 - down gradient from the former gasworks infrastructure; and
- in relatively isolated locations - either associated with the migration of SPGWT from former gasworks infrastructure (i.e. in the southern portion of Block 4 area in the BH42/BH408 area) or from historical filling practices (i.e. BH49 and BH119).

Table 8 SPGWT Identified in Block 4

Site Area	Approximate SPGWT Depth Range (m bgl)	TCM identified in fill or natural material?
Eastern Block 4		
BH49	8.2 - 12.7 (depth of bedrock) [2]	Fill and natural sandy clay
BH52	4.2 - 4.4 (bedrock present at 5.2) [1]	Fill
BH54	1.0 - 1.8 (bedrock present at 3.0) [1]	Fill
BH55	1.0 - 2.9 (depth of bedrock) [3]	Fill
BH59	3.4 - 4.4 (depth of bedrock) [3]	Fill
BH087	1.5 -7.5 (depth of bedrock?) [3]	Fill
BH019	2.5 - 3.6 (depth of bedrock) [3]	Fill
BH141	3.0 – 4.1 (depth of bedrock) [3]	Fill
BH204S	1.0 (bedrock present at 1.3) [1]	Fill
BH204D	1.5 - 5.0 (natural clayey sand present at 4.1) [3]	Fill and natural sandy clay
BH205/MW205	DNAPL observed in groundwater (bedrock present at 11.0) [2]	Natural clayey sand
BH206/MW206	DNAPL observed in groundwater (bedrock present at 8.0) [2]	Bedrock
TP05	3.1 - 4.0 (bedrock present at 4.0) [2]	Fill

Site Area	Approximate SPGWT Depth Range (m bgl)	TCM identified in fill or natural material?
TP06	2.9 - 3.1 (bedrock present at 3.1) [2]	Fill
TP07	2.0 – 4.3 (depth of bedrock now known) [2]	Fill
Southern Block 4		
BH42	3.2 - 3.5 (depth of bedrock) [3]	Fill
BH408	8.0 - 9.4 (depth of bedrock) [2]	Natural silty sandy clay
Western Block 4		
BH48	14.5 m bgl on bedrock [2]	Upper surface of the natural bedrock (no marine sediment present)
BH119	7.5 - 10 (depth of bedrock not known) [3]	Fill
BH404	15.0 - 16.0 m bgl in 'silty clay' (bedrock at 16.0 m bgl) [2]	Natural silty clay
BH405	14 - 14.45 (within natural silty sandy clay, bedrock at 14.45 m bgl) [1]	Natural silty sandy clay
BH406	14.30 - 14.50 m bgl – tar band in fill material and tar noted from 15.0 - 16.8 m bgl in silty clay and silty sand (bedrock at 16.8 m bgl) [3]	Fill and natural clays

NOTES: The distribution of SPGWT described above is based on a review of the analytical results and field observations as denoted below:
[1] based on laboratory analytical data
[2] based on field observations (i.e. greater than 10% tar noted to be present in observed fill/soil)
[3] based on laboratory analytical data and field observations

It is noted that, based on observations from previous investigations, it is likely that SPGWT is present in other areas where former gasworks infrastructure that was not intersected by the previous investigations is present.

With the exception of some isolated areas of SPGWT, possibly related to historical filling practices, the distribution of SPGWT appears to be principally related to:

- Proximity to former gasworks related infrastructure (specifically the main gas holder annulus, the tar tank and the 1870 gas holder);
- Location relative to former gasworks related infrastructure (i.e. SPGWT is generally present down gradient of the former gasworks related infrastructure); and
- The reduced permeability of the underlying marine sediments and the sandstone bedrock profile which generally dips to the west (i.e. SPGWT is generally contained within the marine sediments but has generally not penetrated the underlying bedrock).

Consequently, the distribution of SPGWT is typically shallower in the eastern portion of Block 4 (generally 1.0 to 4.0 m bgl) and deeper in the western portion (approximately 7.5 to 15.0 m bgl) where it has been reported within the underlying marine sediments.

As discussed in **Section 6.6.1**, DNAPL is included within the definition of SPGWT. DNAPL has been identified at the following Block 4 borehole locations (refer to **Figure F6**):

- BH87/MW15;
- BH204D/MW204D;
- BH205/MW205; and
- BH206/MW206.

9.1.2 Non-Separate Phase Gasworks Waste and Tar

9.1.2.1 Unsaturated Soils

The Block 4 unsaturated soil results are presented in **Table T17**, **Appendix A**.

As discussed in **Section 7.2.3**, soil $SSTC^{DEV}$ have not been applied to the Block 4 unsaturated soils as all soil from the unsaturated zone will be removed as part of the proposed basement excavations.

9.1.2.2 Saturated Soils

The Block 4 saturated soil results are presented in **Table T17**, **Appendix A**.

As discussed in **Section 7.2.3**, soil $SSTC^{DEV}$ are not applicable to the Block 4 saturated soils as groundwater is considered to be the only potential exposure pathway with respect to human health. The risk of human health exposure via groundwater has been assessed through the derivation of groundwater $SSTC^{DEV}$. Consequently, the assessment of whether CIM is present in the Block 4 saturated zone is based on assessment of groundwater as detailed in **Section 9.1.3** below.

9.1.3 Groundwater Analytical Results

Groundwater analytical results for the monitoring wells located across Block 4 are presented in **Table T18** (taken from the 2010 or 2011 sampling events). A summary of the analytical data which reported CoPC concentrations above the relevant groundwater $SSTC^{DEV}$ is presented in **Table 9** below.

All other analytes reported concentrations below the groundwater $SSTC^{DEV}$.

Table 9 Block 4 Area Groundwater Results Summary

CoPC	EQL (µg/L)	SSTC^{DEV} (µg/L)	Number		Statistics (Concentrations µg/L)					Exceedences
			Results	Detects	Min.	Max.	Avg.	Med.	SD	
2-methylnaphthalene	0.1	4500	12	8	<2	105,000	9,204	122.5	30,189	MW205
Fluorene	0.1	13000	19	10	<1	21,100	1,192	11	4,827	MW205
Phenanthrene	0.1	5800	19	11	<1	74,100	4,076	14	16,969	MW205
Naphthalene	0.1	240	20	14	<1	283,000	17,114	460	62,705	IT3D, MW200, MW204S, MW205, MW206, MW54, MW40, MW15, MW209
TPH C_{10} - C_{14}	50	1800	19	12	<50	1,730,000	107,927	2,230	393,800	IT3D, MW200, MW204S, MW205, MW206, MW54, MW15, MW209
Benzene	1	7700	19	12	<1	17,900	2,899	56	5,897	MW15, MW200

9.1.4 Acid Sulfate Soils

One sample was analysed for Suspension Peroxide Oxidation Combined Acidity & Sulfur (SPOCAS) by AECOM to evaluate the potential for potential acid sulphate soils (PASS) or actual acid sulfate soils (AASS) to be present. The reported results indicate that AASS was not present in the sample analysed, however there is a low risk of PASS to be present.

Based on Table 4.4 of the Acid Sulfate Soils Management Advisory Committee (ASSMAC) *Acid Sulfate Soils Assessment Guidelines* (1998), the reported sulfur trail (% sulfur oxidisable) and Acid trail (mol H+/tonne) exceeds the Action criteria (0.03% and 18 mol H+/tonne respectively) if more than 1,000 tonnes of soils are to be disturbed triggering the need for an Acid Sulfate Soils management plan. These results and the corresponding indicative lime treatment dosage are presented in **Table 10**.

Table 10 Sample Sulfur Trail, Acid Trail and Lime Calculation (Block 4)

Sample ID	Area	Material Type	Depth interval (m)	Sulfur Trail %S oxidisable (S_{POS})	Acid Trail Titratable Peroxide Acidity (m H^+/t)	Lime calculation Kg $CaCO_3/m^3$
AECOM BH49	Block 4	Sandy Gravelly Clay FILL (stiff)	6.2-6.4	1.21	<2	<1

9.1.5 Identification of CIM

Overall assessment of groundwater results indicates that the following CoPC were reported at concentrations above the relevant $SSTC^{DEV}$ in Block 4:

- PAHs (2-methylnaphthalene, fluorene, phenanthrene and naphthalene);
- TPH C_{10}-$C_{14;}$
- Benzene.

9.1.5.1 PAHs

Overall assessment of groundwater results indicates the following:

- 2-methylnaphthalene, fluorene and phenanthrene were reported at concentrations greater than the relevant $SSTC^{DEV}$ in 1 out of 11 monitoring wells (MW205 in the central portion of Block 4); and
- Naphthalene was reported at concentrations greater than the relevant $SSTC^{DEV}$ in 9 out of 11 monitoring wells across Block 4.

The exceedances of 2-methylnaphthalene, fluorene, phenanthrene and naphthalene in groundwater generally correlated with observations of SPGWT in fill or natural sediment.

Based on the discussed PAH groundwater concentrations reported in Block 4, some 2-methylnaphthalene, fluorene, phenanthrene and naphthalene are considered representative of CIM and, as such, are discussed further in **Section 9.2.2**.

9.1.5.2 TPH and Benzene

Overall assessment of groundwater results indicates the following:

- Concentrations of TPH C_{10} - C_{14} were reported at concentrations greater than the $SSTC^{DEV}$ in 8 out of 11 monitoring wells in Block 4; and
- Concentrations of benzene were reported at concentrations greater than the groundwater $SSTC^{DEV}$ in 2 out of 11 monitoring wells in Block 4.

The exceedances of benzene and TPH C_{10} - C_{14} in groundwater generally correlated with observations of SPGWT in fill or natural sediment.

Based on the discussed TPH C_{10}-C_{14} and benzene groundwater concentrations reported in Block 4, some TPH C_{10}-C_{14} and benzene concentrations are considered representative of CIM and, as such, are discussed further in **Section 9.2.2**.

9.2 Remediation Extent

The preferred remediation option is to remediate soil contamination which has been demonstrated to represent a source of: (a) risk to human health; and/or (b) groundwater contamination that is a risk to human health. This approach is supported by the findings of the *Declaration Area DGI* (AECOM, 2010b) and *Supplementary DGI* (AECOM, 2012a), and the recommendations of the *ERM RAP* (ERM, 2010). This Section describes the extent of remediation works required in accordance with this approach. The remediation strategy(ies) to be adopted are described by **Section 10.0** and **11.0**.

The extent of soil remediation required to accomplish the goal of source removal within Block 4 will be predominantly defined by:

- The identification of SPGWT - as determined by the *Declaration Site HHERA* (AECOM, 2011a), SPGWT should be removed to the extent practicable as required by Section 4.3 of the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*;
- The distribution of CIM determined as an outcome of an assessment of groundwater concentrations against the $SSTC^{DEV}$ (where applicable, refer to **Section 7.2.4**);
- Consideration of other lines of evidence including:
    - contaminant flux, which has been demonstrated to vary between different lithologies at the Site;
    - the reduction in contaminant mass resulting from remediation of SPGWT and other areas of significant contamination; and
    - if the practical constraints of remediating identified CIM are considered to outweigh the actual benefits in terms of reduced risk to the environment and / or human health, the principles of CUTEP and ESD.

The outcomes of this assessment for Block 4 are detailed in **Section 9.2.2**.

9.2.1 Assumptions

The following provides a summary of the key assumptions made in assessing the extent of remediation required as part of the Block 4 Development Remediation Works:

- That the remediation works required to facilitate removal of the NSW EPA Declaration will be undertaken in conjunction with remediation requirements detailed herein (i.e. as required to prepare Block 4 for the proposed development works);
- The assumptions detailed in the *Declaration Site HHERA* (AECOM 2011a) and the *Declaration Site HHERA Letter* on which the $SSTC^{DEV}$ adopted to identify CIM are based (refer to **Section 7.2.3**);
- Visual and olfactory observations of soil quality can be used as a guide for the qualitative characterisation of soil contamination. This approach is consistent with AECOM experience during remediation of other former gasworks sites;
- Basement excavations in Block 4 will require excavation of fill and natural soils/bedrock as described by **Section 4.2**. The final basement design and related basement bulk excavation works will be subject to finalisation and potential development. If the design is changed and affects the assumptions in the *Declaration Site HHERA* (AECOM 2011a) and this RAP, an Addendum will be prepared, as required, and submitted to the NSW EPA Accredited Site Auditor for approval;
- The basement groundwater retention wall system will be keyed into the underlying bedrock around the entire perimeter of the proposed Block 4 basement area (as detailed in **Section 4.3**) and will connect directly to the ORWS retention wall system. Consequently, it is expected that this system will effectively isolate both the Block 4 basement car park and any material remaining in situ under it from the surrounding ground conditions and Darling Harbour;
- As an option, material that is surplus to the development requirements within Block 4, including material generated by the remedial works which is determined to be suitable, may be reused (refer to **Section 7.3**); and
- Dewatering and treatment of groundwater, where required, will be undertaken as part of the bulk excavation works for the development basements. Appropriate management of surface water generated as part of the earthworks program and soil remediation works will also be required (refer to **Section 17.0**).

9.2.2 Extent of Remediation

Based on the analytical data and findings presented in **Section 9.1**, CIM has been identified in Block 4 based on the presence of SPGWT and concentrations of groundwater which exceed the groundwater $SSTC^{DEV}$ for:

- PAHs (2-methylnaphthalene, fluorene, phenanthrene and naphthalene);
- TPH C_{10}-C_{14}; and
- Benzene.

9.2.2.1 Separate Phase Gasworks Waste and Tar

As discussed in **Section 9.1.1**, SPGWT has been identified in areas of Block 4 which will require remediation as required by the *Declaration Site HHERA* (AECOM, 2011a).

9.2.2.2 Contaminant Distribution in Groundwater

As shown in **Figure F9** in **Appendix B** groundwater contaminant concentrations exceeding the PAH (2-methylnaphthalene, fluorene, phenanthrene and naphthalene), TPH (TPH C_{10}-C_{14}) and benzene $SSTC^{DEV}$ in Block 4 are generally limited to areas where SPGWT has been identified to be present (i.e. the northeast part of Block 4).

The only exception to this is MW40, in which PAH and Benzene concentrations were reported at concentrations exceeding the $SSTC^{DEV}$.

9.2.2.3 Proposed Remediation Extent

Based on the distribution of SPGWT and CIM, the lateral extent of remediation works in Block 4 that will be undertaken will include the following site areas, which generally correspond with the location of historic gasworks structures. The lateral extent of remediation required as part of the Block 4 Development Remediation Works is presented **Figure F12** in **Appendix B** and as follows:

- All eastern Block 4 areas where SPGWT has been identified (refer to **Section 9.1.1**). SPGWT was generally reported at depths shallower than 8 m bgl;
- The southern portion of Block 4 where SPGWT has been identified (refer to **Section 9.1.1**). SPGWT was generally reported at depths shallower that 8 m bgl, with the exception of BH408 where SPGWT was reported to a depth of approximately 9.4 m bgl (the depth of bedrock);
- The portion of the 1870 gasholder annulus located in Block 4 and which is thought to extend to a depth of 9.4 m bgl. Based on observations from previous investigations, it is inferred that the annulus will comprise 'a trench' which has been cut into the underlying bedrock. However, this has not been demonstrated and remains unclear; and
- Isolated hotspots within the western portion of Block 4 where SPGWT has been identified in fill (refer to **Section 9.1.1**). SPGWT was reported in the vicinity of BH49 and BH119 in fill ranging between approximately 8.2 and 12.7 m bgl and 7.5 and 10 m bgl respectively (refer to **Table 8**).

It is noted that the majority of the SPGWT and CIM identified above would be excavated during the excavation works for the Block 4 basement which are anticipated to extend to a depth of approximately 8 m bgl (as detailed in **Section 4.2**). As such, it is proposed that the vertical extent of the Block 4 Development Remediation Works will generally be limited to the depth of the basement excavation (i.e. 8 m bgl).

The vertical extent of remediation at locations where SPGWT and CIM have been reported at depths greater than the depth of the basement excavation (which is currently proposed to be 8 m bgl) (specifically BH49 and BH119), or where SPGWT is observed in the base of the completed basement excavation, will be increased in the vicinity of the impact as described by **Section 19.5.3**.

Six groundwater monitoring wells are located within Block 4, but outside the Block 4 Development Works remediation extent (refer to **Figure F12** in **Appendix B**). CoPC concentrations in groundwater exceeding the groundwater $SSTC^{DEV}$ were reported in two (BH405 / IT03 and MW40). Remediation of these areas is not considered to be warranted for the following reasons.

- BH405 / IT03 - Groundwater CoPC concentrations exceeding the $SSTC^{DEV}$ were reported in the deep IT03 sample port (BH405/IT3D). However, CoPC concentrations in the shallow and middle depth sampling ports (IT03S and IT03M) were generally less that the laboratory LOR and significantly less than the relevant

groundwater SSTCs (refer to **Table T10**). The IT03S and IT03M sampling ports were installed at different depths in the fill material (2.5 and 8 m bgl) and would be representative of groundwater quality likely to be in contact with the base of the proposed Block 4 basement (i.e. 8 m bgl). Consequently, no remediation of the BH405/IT03 area is considered to be warranted;

- BH40 / MW40 - Groundwater CoPC concentrations exceeding the $SSTC^{DEV}$ were reported in MW40. This well is screened within the marine sediments (below a depth of 14.3 m bgl) where there is negligible contaminant flux to the fill materials. Therefore, groundwater represented by this result is unlikely to be in contact with the base of the proposed Block 4 basement (i.e. 8 m bgl). Consequently, remediation is not considered to be warranted.

Of the four remaining groundwater monitoring wells located within Block 4 but outside the proposed Block 4 Development Works remediation extent and which therefore could be representative of groundwater quality that will be in contact with the proposed Block 4 basement:

- three (MW45, MW58 and MW62) are screened within fill material at depths where the groundwater is likely to come into contact with the Block 4 basement (i.e. either the basement walls or base). CoPC concentrations in these three wells were generally less than the laboratory LOR and significantly less than the relevant groundwater SSTCs (refer to **Table T18**). This data confirms the conceptual site model that exceedances of the groundwater $SSTC^{DEV}$ are largely limited to areas where SPGWT has been identified. Based on the groundwater analytical data and absence of SPGWT reported at these locations, remediation of the fill material in these areas is not considered to be warranted; and

- one (MW210) is screened within the natural bedrock (below a depth of 14.8 m bgl) where there is negligible contaminant flux to the fill materials. Therefore, groundwater represented by this result is unlikely to be in contact with the base of the proposed Block 4 basement (i.e. 8 m bgl). Consequently, remediation of the bedrock at depth in this area is not considered to be warranted.

SPGWT was reported at four locations (BH48, BH404, BH405 / IT03 and BH406) within Block 4, but outside the Block 4 Development Works remediation extent (refer to **Figure F12** in **Appendix B**). Remediation of these areas is not considered to be warranted for the following reasons.

- BH48, BH404 and BH405/IT03 – SPGWT was reported within the marine sediment (which has been demonstrated to have negligible contaminant flux to the overlying fill material) and at depths significantly below the proposed depth of the basement. Therefore, it is unlikely to represent a risk to occupants of the basement; and

- BH406 – SPGWT was reported within fill material (a silty clay) but at a depth of 14.3 m bgl, which is significantly below the depth of the proposed basement and therefore unlikely to represent a risk to occupants of the basement.

As described by **Section 4.2**, the final depth of the basement is subject to confirmation. **Section 23.12** describes contingency measures that will be implemented in the event that the depth of the basement is changed as part of the design finalisation.

9.2.2.4 Management of Materials Outside the Remediation Extent

As above, the extent of excavation required for construction of the proposed basement within Block 4 is likely to be greater than the Block 4 Development Works remediation extent. It should be noted that fill materials to be excavated as part of the basement construction that are outside the remediation extent may still contain elevated concentrations of CoPCs and may also require management to mitigate risks to site workers, the community and the environment.

Previous investigations have reported Block 4 fill materials outside the extent of remediation (but within the material to be removed as part of the bulk excavation works) to be moderately odorous. Consequently, these materials will require management in accordance with the environmental control measures detailed in **Section 15.0** and **Section 20.3**.

Field observations of odour at the 33 borehole locations within Block 4 but outside the proposed Block 4 Development Works remediation extent are summarised in **Table 11** and presented in **Figure F12** in **Appendix B**. It should be noted that these field observations relate to material likely to be excavated as part of the Block 4 basement excavation works (i.e. excavation to 8 m bgl) only. Odorous material has been reported within Block 4 but outside the Block 4 Development Works remediation extent at depths below the proposed depth of the basement. However, these materials are unlikely to be disturbed as part of the basement excavation.

Table 11 Field observations for material to be excavated outside the Block 4 Development Remediation Extent

Field Observations	Borehole location	Depth of impact (m bgl)
Moderate tar odour	BH58	4.2 9.4
Hydrocarbon odour and sheen	BH404	7.0-8.0
Moderate hydrocarbon odour	BH068	3.0
Hydrocarbon odour and black staining	BH207	7.5-8.5

NOTE: The proposed vertical extent of remediation will be limited to 8 m bgl unless CIM or SPGWT is identified in the base of the excavation. Refer to **Section 9.2.2.3**.

9.3 Preliminary Waste Classification

Excavated material may require off-site disposal to a NSW EPA licensed landfill facility. Based on the metals, TPH, PAH and BTEX soil analytical results reported within Block 4, it is likely that materials to be excavated as part of the basement excavation works (that will include materials requiring remediation in accordance with **Section 9.2.2**) will be classified per the NSW DECCW (2009) *Waste Classification Guidelines* as a combination of:

- General Solid Waste;
- Restricted Solid Waste; and/or
- Hazardous Waste.

Material classified as Hazardous Waste will require treatment/stabilisation under an Immobilisation Approval to facilitate offsite disposal to a NSW EPA licensed landfill facility. Materials classified as Restricted Solid Waste may also be treated in accordance with an Immobilisation Approval to facilitate disposal to landfill under a lesser waste classification.

Refer to **Section 14.7.10** for further details on the required waste classification of materials. The relevant waste classifications will be detailed in Excavation Plans to be prepared in support of the Block 4 Development Remediation Works.

10.0 Remediation Technology Assessment

A wide range of technology options were considered for remediation of the Site in accordance with the nominated remediation objectives and goals. This section describes the Remedial Technology Assessment process which was applied by AECOM and Lend Lease towards selection of the preferred remediation alternative(s). In undertaking this evaluation, AECOM and Lend Lease were cognisant of the fact that the most cost-effective and sustainable remediation approach may be a combination of one or more individual remedial technologies.

As described by **Sections 7.1** and **7.2** the Remediation Goals and remediation extent are focussed on removal, to the extent practicable, and management of materials which represent a source of groundwater contamination (SPGWT or CIM) or which represent risk to human health or the environment. Therefore, the remedial technology assessment was focussed primarily on soil remediation technologies.

The remedial technology assessment process involved the following phases:

- **Identification of Remedial Technology Options** – a review of the primary information sources to identify potential treatment technologies for the Site;
- **Screening of Remedial Technology Options** –an initial comparison of all identified technologies to assess their suitability for implementation at the Site; and
- **Assessment of Remedial Technology Options** – a more detailed review of the highest rating technologies from the screening stage, against the key remediation objectives.

The remedial technology assessment has also:

- Been undertaken independently of the extent of remediation described by **Section 8.0** and **Section 9.0**. In particular, consideration has been given to the identification and assessment of remediation technology options that are applicable to the remediation of both fill materials and natural marine sediments. This is important in the context of the VMP Remediation, because the extent of remediation described by the *VMP Remediation Extent Report* (AECOM, 2013c) (as reiterated in **Section 8.5**) is based, in part, on the technical capability of the potential technologies that may be adopted by the remediation works.
- Drawn on previous direct experience that Lend Lease and members of the AECOM project team has had at 30-34 Hickson Road and other similar remediation projects; and
- Been undertaken with consideration of NSW EPA remediation hierarchy as described by DEC (2006a) which requires that soil remediation and management be implemented in the following preferred order:
    - on-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
    - off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site;
    - removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill; and
    - consolidation and isolation of the soil on-site by containment within a properly designed barrier.

10.1 Identification of Remedial Technology Options

A review of primary information sources identified more than twenty remedial technology options that were potentially applicable to the remediation of the identified contaminated soils at the Site. The remediation technology options identified are presented in **Table T19** (**Appendix A**) and summarised following.

10.1.1 *In situ* remedial technologies

- Stabilisation or Solidification;
- S-ISCO®;
- Thermal Conductive Heating;
- Monitored Natural Attenuation;
- Soil Vapour Extraction;

- Enhanced Bioremediation;
- Containment;
- Phytoremediation;
- Electrical Resistive Heating;
- Vitrification;
- Steam Stripping;
- Surfactant and/or co-solvent injection; and
- Permeable reactive barrier.

10.1.2 Ex situ remedial technologies

- Stabilisation or Solidification;
- S-ESCO™;
- Thermal Desorption;
- Co-burning;
- Asphalt batching;
- Bioremediation (biopiles, bioreactor, landfarming);
- Chemical oxidation;
- Soil Washing;
- Supercritical Water Oxidation; and
- Electrokinetics.

10.2 Screening of Remediation Technology Options

Based on AECOM's current understanding of the soil and groundwater contamination at the Site, the identified remedial technologies were screened in consideration of the key parameters identified in **Section 10.2.1**. A weighting factor, as summarised below, was assigned to each of the key parameters following a review process with AECOM and Lend Lease. A score ranging from 1 (low) to 5 (high) was then assigned to each of the key parameters for each of the identified remedial technologies (note that in the case of the financial category, a higher ranking relates to a lower cost alternative). The total score for each remedial technology was then calculated by summing the product of the weighting factor and score for each key parameter (refer to **Table T19** in **Appendix A**).

10.2.1 Key Parameters for Selection of Remediation Technology Options

- Sustainability (25%) of the individual Remediation Technology Option – including consideration of:
  - the life cycle of contaminated materials with the goal of reducing waste and reusing/recycling materials where possible; and
  - the principles of ESD as required by Section 9 of the *CLM Act* (1997).
- Technical constraints (30%) – including:
  - Applicability of the technology to the identified contamination (specifically type, location, quantity and concentration). As above, and notwithstanding the extent of remediation, contamination present in both fill materials and marine sediments were considered for the purpose of this assessment;
  - Ability of the technology to achieve the required soil and groundwater SSTCs; and
  - Acceptance of technology by local and international remediation practitioners and regulators (including anticipated regulatory acceptance).

- Financial (15%) – relative cost of implementing the technology at the Site including capital costs associated with equipment purchase and commissioning and continuing costs associated with operation, maintenance and water treatment/disposal;
- Logistical (10%) – additional factors that may limit the ability to implement the technology within the particular constraints of the Site, the associated development, and the surrounding land uses;
- Timing (10%) – timeframe required to complete feasibility assessments, pilot trial and design of remediation system, and duration required until achievement of the Remediation Goals; and
- Community (10%) - including likelihood of community acceptance of proposed strategy, community impact during the remedial works (i.e. including potential disruption to traffic and additional traffic movements leaving the Site), and continuing impact from legacies remaining upon conclusion of the remediation.

The sustainability component of the screening assessment of the individual Remediation Technology Option included consideration of the following:

- Resource Use (6%) – specifically energy and water (per the ESD principles required by Section 9 of the *CLM Act* [1997]);
- Waste Generation (6%) – production of by-products requiring further treatment or management for appropriate disposal (per the requirements of the *Waste Avoidance and Resource Recovery Act* [2001]);
- Material Reusability (6%) – potential for reuse or recycling (per the requirements of the *Waste Avoidance and Resource Recovery Act* [2001]);
- Carbon dioxide (CO2) Generation (6%) – resulting from emissions during the remedial works (per the ESD principles required by Section 9 of the *CLM Act* [1997]); and
- Ongoing Management and Risk (5%) – continuing short term and long term maintenance and monitoring obligations and the risk of additional remedial works being required into the future.

10.2.2 Screening Outcomes

The results of the screening assessment are presented in the **Table T19** in **Appendix A**.

As an outcome of the screening assessment, many of the remedial technologies were discounted from further detailed consideration. Technologies were typically eliminated from further consideration on the basis that they:

- Are not suitable for the identified contaminants of concern;
- Are impractical in the context of addressing the identified contamination; or
- Have a very high cost in comparison with other technologies.

Those technologies which were considered to be potentially suitable based on the screening assessment were evaluated in more detail against each of the remediation objectives. Based on the initial screening process, seven remediation technologies were selected for further detailed consideration as follows.

- Ex situ Remediation Technologies:
  - **Excavation and Ex Situ Thermal Desorption (on site):** Desorption and/or destruction of organic contaminants in excavated soil by heating, usually by a direct heating thermal unit;
  - **Excavation and ex Situ Thermal Desorption (off site):** Desorption and/or destruction of organic contaminants in excavated soil by heating, usually by direct heating thermal unit. Requires transport of materials to an off-site thermal desorption facility;
  - **Excavation and ex situ stabilisation (on site):** Encapsulation of contaminant by ex situ blending with chemical binders to immobilise contaminants of concern. Stabilised material could be disposed off site or re used on site; and
  - **Excavation and S-ESCO™:** Ex situ treatment of excavated soils using strong oxidants, such as hydrogen peroxide, permanganate or persulphate, to degrade a wide range of organic contaminants.
- In situ Remediation Technologies:
  - **S-ISCO®:** Injection of strong oxidants, such as hydrogen peroxide, permanganate or persulphate in the presence of a surfactant, into the subsurface to degrade a wide range of organic contaminants;

- ***In Situ* Stabilisation or Solidification:** Encapsulation of contaminant by *in situ* blending with chemical binders to immobilise contaminants of concern. This could be achieved by large drilling of large diameter borehole and mixing of fly ash, lime, cement with the contaminated soil; and
- **Physical Containment:** Containment or capping of contaminated soil to prevent or significantly reduce contaminant migration and to prevent human and environmental exposure.

10.3 Assessment of Remedial Technology Options

The seven remedial technologies selected based on the screening assessment were each subjected to a more detailed assessment against the key remediation objectives for the Site, namely:

- Ability to reduce the significant risk of harm identified by the NSW EPA declaration; and
- Ability to facilitate the proposed future land use.

10.3.1 Excavation and Ex Situ Thermal Desorption (on site)

This process heats excavated waste materials to high temperatures that will volatilise water and organic contaminants. Thermal desorption employs mechanical tumbling and heating to drive the organics from the soil into the gas phase. Temperatures and residence times are designed to volatilise selected contaminants, but not oxidize them. Waste gases are further oxidised in a secondary combustor and other wastes are treated or sent to a licensed facility for destruction.

Factors that may limit the applicability and effectiveness of a thermal desorption system include:

- particle size requirements for handling (such as the presence of oversize and debris as would be expected to be present in fill material);
- presence of fine grained clay and silty soils (such as marine sediments);
- high organic content;
- high metals content;
- high moisture content (such as in soils removed from below the groundwater table);
- presence of tarry soils/sediments (with a high calorific value); and
- presence of abrasive material.

Significant materials handling including separation, dewatering, and drying would be required prior to thermal desorption of contaminated material. A pilot or demonstration project would likely be required to demonstrate the efficacy of the approach. Residual waste streams would also require further treatment which would increase treatment costs. Finally, it is considered highly unlikely that an on-site thermal desorption facility located on-site and adjacent to the Sydney CBD would receive regulatory or community endorsement. Thermal desorption is highly energy intensive and, depending on the treatment methods adopted to manage waste by products, will result in significant CO_2 emissions.

10.3.2 Excavation and Ex Situ Thermal Desorption (offsite)

Section 10.3.1 provides a description of the thermal desorption process which is applicable to thermal desorption implemented both on site and off site.

The key difference between on site and off site thermal desorption is the likelihood of regulatory and community endorsement. It is considered more likely that regulatory approval of a thermal desorption facility would be received if established off-site. However, additional logistical limitations associated with the transport of large quantities of contaminated soil either through CBD streets or via Sydney Harbour would likely significantly inhibit the validity of this alternative.

10.3.3 Excavation and Ex situ Stabilisation or Solidification

Ex situ Solidification or Stabilisation (similar to *in situ* Solidification or Stabilisation as described by **Section 10.3.6)** reduces the mobility of contaminants through both physical and chemical means. Stabilisation or Solidification does not destroy the contaminants but alters the conditions of the material such that risks are significantly reduced. The main changes are reduced permeability of the treated mass and decreased mobility of the contaminants. The geotechnical properties are also improved.

Chemical additives (i.e. Portland Cement, lime, organic polymers, silicates, flyash, slag, kiln dust) are added to the contaminated matrix to limit the waste's solubility and mobility, and lower its toxicity. This technology can be applied ex situ, by excavating and mixing the materials with the solidifying/stabilising agent and then placing the solidified material in an appropriate location. Soil is excavated, screened to remove materials too large to be effectively treated and its moisture content amended to suit treatment. The chemical additives are blended into the soil typically using a pugmill.

Stabilisation or Solidification can treat a broad range of contaminants including petroleum hydrocarbons, PAHs and metals. *In situ* and ex situ Stabilisation or Solidification processes have been used extensively in North America and Australia to address high levels of contaminants at former manufactured gas plants. Of specific relevance is the previous remediation of the adjacent Bond development in Hickson Road by Lend Lease in 2002, which successfully utilised ex situ stabilisation / solidification to treat gas works waste, including tar, from the same gas works as is present within the Site. For the Bond remediation, approximately 13,000 tonnes of contaminated material were excavated and treated, including 1,000 tonnes removed from the 9m deep gasholder annulus trench.

Limitations associated with *in situ* soil stabilisation associated with the depth of contamination, the presence of fine grained materials (for example marine sediments) and the presence of subsurface obstructions are less evident in ex situ stabilisation due to the fact the contamination is physically removed from the ground and can be subject to pre-treatment (screening to remove oversize and moisture conditioning) prior to treatment usually using a pugmill (with the option of multiple passes should initial mixing be inadequate).

Bench scale trials, and pilot scale demonstration trials would be required as a precursor to design and finalisation of formulations for ex situ solidification and stabilisation. Further, if disposal of the treated material to landfill is required, an Immobilisation Approval from the NSW EPA would also be required. It is noted that the NSW EPA has a general Immobilisation Approval for tar contamination associated with former gas works which is based on stabilisation using cement. However, this general approval is limited to tar impacted materials with contaminant concentrations which fall within pre-defined thresholds which may be exceeded by the tar impacted material expected to be encountered at the Site.

Depending on the quality of the treated material, capping and containment of the stabilised or solidified material can be undertaken to facilitate future land use.

Future monitoring may be required should the stabilised or solidified material be placed on-site (for SPGWT-free material only), to assess ongoing groundwater conditions.

A summary of the *Ex situ Stabilisation Trials – DECC Declaration Area, Barangaroo* undertaken by EnviroPacific Services (EPS) is provided in **Section 10.5**.

10.3.4 Excavation and S-ESCO™

Section 10.3.5 provides a description of the chemical oxidation process which is applicable to both *in situ* and ex situ chemical oxidation remediation technologies. In summary, chemical oxidation converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert.

S-ESCO™ can be used to address specific challenges associated with tar impacted material. However, the ex situ nature of the technology and the ability to physically amend the material prior to treatment reduces the reliance on surfactant enhancement. Soil is excavated, screened to remove materials too large to be effectively treated and its moisture content amended to suit treatment. Chemical dosing of the soil (chemicals including the surfactant, oxidant and catalyst) is accomplished in parallel with physical mixing using specially designed injection equipment. The rate of chemical dosing can be adjusted to accommodate variations in the feed material quality and contaminant concentration. The combination of chemical dosing and physical mixing provides a greater degree of confidence in comparison to *in situ* approaches. Treatment of the contamination (i.e. conversion of hazardous contaminants to non-hazardous compounds) takes place within a week of chemical dosing and mixing. The treated material is generally non-odorous and has the same geotechnical properties as the un-treated material (with the exception of having a higher moisture content).

Ex situ remediation approaches, including chemical oxidation, are consistent with the proposed future development regime for part of the Site which requires excavation of Block 4 for construction of a basement (partially founded in bedrock).

10.3.5 ISCO

Given the ongoing roadway land use of Hickson Road and extensive network of underground services in this area, *in situ* remediation approaches, including ISCO, are particularly applicable to this area.

Chemical oxidation converts hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. The oxidizing agents most commonly used are ozone, hydrogen peroxide/Fenton's Reagent (including modified Fenton's Reagent), permanganates, hypochlorites, chlorine, sodium persulphate, and chlorine dioxide. Chemical oxidation has been used on a number of sites to address PAHs, TPHs, BTEX and SPGWT (or similar) associated with former manufactured gas works plants.

The oxidation process is non-selective and the oxidant is consumed by other organics and inorganics in soil and not necessarily the target contaminant. Excess chemical is therefore required to overcome the inherent soil demand. The success of chemical oxidation is dependent on the permeability of the soil matrix, the ability of the oxidant to be delivered to the identified contamination, the organic content of the soil, and the solubility of the contaminants.

The *ERM RAP* (ERM, 2008c) discounted the use of ISCO based on the risk that it might negatively impact on water and sediment quality in the Harbour. The by-products of the chemical reactions produced by ISCO are oxygen, sulphate, CO_2 and hydrogen, all of which are constituents of sea water. Further, AECOM's review of this technology indicates ISCO actually stimulates microbiological activity, therefore promoting the continuing attenuation of contamination (as opposed to sterilising ground conditions and destroying microbiological activity). A potential risk is the establishment of preferential pathways which might result in direct discharge of oxidants to surface water. However, this risk is controlled by having a good understanding of ground conditions and careful design of the injection system (possibly including the use of extraction wells to control oxidant movement).

The presence of separate phase product (tar) is sometimes considered to be a factor which limits the applicability of chemical oxidation. The key challenges with the remediation of tar using ISCO are:

- Oxidant demand/dose requirements – the majority of the tar mass at the former gas works site is non-target hydrocarbons as opposed to specific chemicals of concern which otherwise drive the remediation. As a result, in the case of highly saturated tar (such as might have accumulated in the base of a former tar tank), a relatively large oxidant does is required making ISCO less cost effective than it might otherwise be for lower saturation NAPL;
- Delivery and heterogeneity – in the case of highly saturated tar, the relative permeability of the tar will be lower than the surrounding strata making it difficult to ensure delivery of the oxidant to the tar; and
- An additional risk, sometimes attributed to the remediation of tar using ISCO is the precipitation of metals, such as iron, as a result of the oxidation process and encrusting on the outside of the tar. This is not considered to be a significant issue; rather the key challenge is the relative permeability of the tar to the surrounding strata.

10.3.6 *In Situ* Stabilisation or Solidification

Solidification or Stabilisation reduces the mobility of contaminants through both physical and chemical means. Contaminants are physically or chemically bound to the medium to produce a non-leachable material. The process physically binds or encloses contaminants within a stabilised matrix. With *in situ* stabilisation or solidification, the soils are mixed in-place and treated.

Stabilisation or solidification does not destroy the contaminants but alters the conditions of the material such that risks are significantly reduced. The main soil changes are reduced permeability of the treated mass and decreased mobility of the contaminants. The soil geotechnical properties are also improved.

Chemical additives (i.e., Portland cement, lime, organic polymers, silicates, flyash, slag, kiln dust) are added to the contaminated matrix to limit the waste's solubility and mobility, and lower its toxicity. The chemical additives and water are blended into the soil. Varying the amount of reagent relative to the moisture content in the material requiring treatment produces a range of product consistency, from a loose soil to a monolith.

Stabilisation or Solidification can treat a broad range of contaminants including petroleum hydrocarbons, PAHs and metals. *In situ* and ex situ Stabilisation or Solidification processes have been used extensively in North America and Australia to address high levels of contaminants at former manufactured gas plants.

In situ soil stabilisation is typically accomplished through repeated mixing the additives (in either solid or slurry form) and soil using large diameter (1.8m) rotary augers. The performance of *in situ* solidification or stabilisation is highly dependent on the ability to effectively mix the soil and additives; which is in turn a function of:

- the depth of contamination (depth is typically limited to 12 m bgl due to limitations on the depth to which the large diameter augers can be used);
- the type of lithology (*in situ* stabilisation is generally not suited to clay, including marine sediments);
- the presence of significant subsurface obstructions (for example below ground utilities or substantial debris associated with historical filling activities); and
- the presence of groundwater (groundwater at the Site is present at approximately 2 m bgl).

Bench scale trials, and pilot trial demonstration projects would be required as a precursor to design and finalisation of formulations for *in situ* and/or ex situ solidification and stabilisation. Subject to the considerations described above, *in situ* stabilisation or solidification can also be implemented in a relatively short time-frame. Depending on the quality of the treated material, capping and containment of the stabilised or solidified material may be required to facilitate future land use. Some dewatering of the treatment area may be required.

Long-term monitoring is still required because the contaminated material is not removed or destroyed.

10.3.7 Physical Containment

Physical containment involves the construction and placement of barriers that sever the pathway between the contaminant source and the receptor. Containment barriers may be placed around its perimeter, as a cover, or in all of these areas, as dictated by site-specific conditions. Containment barriers can be constructed of clean materials, impermeable clay layers, and/or geomembranes.

Subsurface barriers, such as sheetpiles and bentonite clay walls, can also be used to contain groundwater, NAPLs and vapours. Monitoring systems are required to detect contaminant leaching and to ensure the continued integrity of the barrier systems.

Although physical containment does not remove or destroy the contamination, containment technologies can effectively manage exposure risks, can be implemented in a timely manner, and are generally economical. Physical containment technologies have been selected for use at other former manufactured gas works sites within Australia and around the world.

Physical Containment would contain, but not destroy, the identified contamination. Notwithstanding, it is considered unlikely that physical containment alone would be considered acceptable by regulators nor would containment satisfactorily address the NSW EPA Declaration of investigation/remediation area.

10.3.8 Surfactant Enhanced In situ Chemical Oxidation (S-ISCO®)

Each of the challenges identified above with respect to ISCO can likely be addressed through the use of S-ISCO® as discussed below and in **Section 10.4**. S-ISCO® is an innovative technology which has successfully been implemented at former gas works sites. The process works by dissolving the tar material using a surfactant and then oxidising the resulting tar and surfactant mixture. The key design considerations are: which surfactants and oxidants work best in combination; whether they should be injected simultaneously or in sequence; and, what conditions, such as might be provided by the addition of a catalyst, will enhance the reaction (for example persulphate oxidises more strongly at 40 deg C than it does at 25 deg C). Increasing the heat of reaction also assists in mobilising the tar.

These design considerations have been or will be the subject of bench scale trials, and pilot scale demonstration trials undertaken as a precursor to design and finalisation of an S-ISCO® remediation approach.

A summary of the S-ISCO® laboratory treatability trial conducted by VeruTEK® is provided in **Section 10.4**. The samples assessed by the treatability trial were obtained from test pits excavated in Block 4 and Block 5 and, based on comparison of the reported contaminant concentrations in the samples with previous site investigation results, were considered to be representative of contaminant masses likely to be encountered during remediation. The trial indicated that S-ISCO® was very effective at reducing the contaminant mass in the samples with destruction efficiencies typically ranging from 80% to greater than 99%. Given that the laboratory trials were only run for 14 days, while actual implementation would be expected to last from 1 to 2 months, it was anticipated that the reported destruction efficiencies could be improved at full scale implementation.

A Pilot Trial is proposed for the purpose of demonstrating the efficacy of S-ISCO® as a remediation approach in Block 5 and Hickson Road. Summaries of the proposed Proving Phase and subsequent Pilot Trial are presented in **Section 16.1 and 16.2**, respectively.

Although the S-ISCO® method is more difficult to apply in the unsaturated zone due to difficulties in controlling the even distribution of the oxidizing chemicals, the method has been applied successfully by implementation of adjusted chemical oxidants to provide greater retention of the S-ISCO® chemicals within the unsaturated zone.

Examples of other sites at which S-ISCO® has been successfully implemented are included in Appendix J of the WPTMP (VeruTEK, 2011).

Section 23.13 presents a summary of specific risks potentially associated with the implementation of S-SICO at the Site. Mitigation measures that will be implemented to minimise adverse impacts and contingency measures that will be enacted in the unlikely event that impacts are observed are also summarised. Specific risks considered include:

- Impact on Darling Harbour by S-ISCO® chemistry;
- Impact on groundwater and Darling Harbour by the mobilisation of metals;
- Impact to subsurface infrastructure (specifically underground services);
- Impacts to buildings (specifically basements);
- Impact to human health (including maintenance workers and occupants of adjacent buildings) from soil vapours; and
- Impact due to daylighting of S-ISCO® chemistry.

A more detailed assessment of potential risks and a description of specific mitigation measures, including action levels for implementation of the mitigation measures based on observations from the proposed monitoring program, will be set out in the S-ISCO® and SEPR™ Detailed Work Plan prepared for the remediation works (refer to **Section 13.1.3**). It is expected that these mitigation measures will be similar to those described in the WPTMP (VeruTEK, 2011) in relation to the proposed Pilot Trial. Specific controls that would be implemented during S-ISCO® and SEPR™ remediation works to monitor the progress of the remediation and manage the above referenced risks include those summarised following.

- Soil Vapour Extraction (SVE) – a SVE system would operate continuously during S-ISCO® and SEPR™ injections and extractions to minimise the risk of soil vapour generated by the S-ISCO® reactions from reaching the ground surfaces or nearby basements (refer to **Section 16.3.5**).
- Process Monitoring – will be undertaken through remediation to track operational parameters, control the injections and optimise performance (refer to **Section 16.3.6.1**).
- Performance Monitoring – will include continuous and period monitoring of specific groundwater parameters that will provide information as to where the injected chemicals are travelling and the nature of their reactions. Performance monitoring will also be used to optimise performance (refer to **Section 16.3.6.2**).
- Groundwater Monitoring – groundwater samples will be collected periodically during the remediation process and analysed for PAHs, TPH and metals to confirm that the treatment is proceeding as expected and that neither CoPCs nor metals are being mobilised by the treatment process (refer to **Section 16.3.6.3**). The groundwater monitoring program will include monitoring of total residual chlorine before during and after the Pilot Trial to address specific concerns raised by the community in response to the Pilot Trial Project Application process.
- Soil Vapour Monitoring – will be undertaken to monitoring the presence and safety of soil vapours potentially generated by the oxidation reactions. Soil vapour monitoring will be undertaken in proximity to all identified sensitive receptors (including near basements and underground service access points or infrastructure) and will effectively validate the success (or otherwise) of the SVE system at mitigating exposure to soil vapours.

10.3.9 Conclusion of Remedial Technology Option Assessment

Of the seven remedial technologies selected based on the screening assessment, two were considered to be preferred based on outcome of the more detailed assessment against the following key remediation objectives:

- Ability to reduce the significant risk of harm identified by the NSW EPA declaration; and

- Ability to facilitate the proposed future land use.

The two preferred remediation technologies were:

1) S-ISCO® (refer to **Section 10.3.5**); and

2) Excavation and ex situ stabilisation (on-site) (refer to **Section 10.3.3**).

Some of the reasons for why other remediation technologies were not preferred included:

- Being inconsistent with the remediation hierarchy required by the NSW EPA (DEC 2006a) (for example on-site treatment of soil contamination such that it is destroyed or the associated hazard is reduced to an acceptable level is preferred over off-site treatment or on-site management without treatment);
- High energy usage and/or waste generation which is inconsistent with the principles of ESD (as required by Section 9 of the *CLM Act* (1997); and
- Being inconsistent with the requirement to not have a long term environmental management plan (which is consistent with the remediation hierarchy promulgated by the DEC 2006a). This approach is consistent with the provisions of:
    - The *NEPM* (1999). In particular, the management of contamination through implementation of a Long Term Environmental Management Plan is:
        - the least preferred approach specified by the hierarchy of clean-up and management protocols; and
        - should only be implemented in cases where on-site or off-site treatment of contamination is not considered practicable; and/or there is no readily available or economically feasible approach for remediation; and
    - The *Guidelines for the NSW Site Auditor Scheme* (2nd Edition) (DEC, 2006a) state that an Environmental Management Plan is only appropriate in cases where:
        - complete clean-up of contamination is not practicable; or
        - remediation is likely to cause a greater adverse impact than would occur if the site were left undisturbed.

10.4 S-ISCO® Laboratory Treatability Study

A laboratory treatability study was undertaken by VeruTEK® Technologies (VeruTEK®) to assess the feasibility of using S-ISCO® to treat contaminated soil and groundwater at the Site. The purpose of the study was to assess optimal conditions for using S-ISCO®, S-ESCO™ and Surfactant Enhanced Product Recovery (SEPR™) technology platforms and to provide inputs to a proposed pilot trial. As discussed in **Section 10.3.5**, these processes utilise enhanced desorption and solubilisation of the gasworks organic chemicals from soils, with S-ISCO® and S-ESCO™ combining simultaneous chemical oxidation (destruction) of the solubilised chemicals.

The treatability study is detailed in the VeruTEK® report, *Treatability Study Recommendations for the Implementation of an In Situ Remedy* (21 September 2010).

10.4.1 Methodology

Soil samples from Block 4 and Block 5, a sample of DNAPL from Block 5 and a soil sample from the tar tank in Hickson Road were used in the treatability tests. The contamination present in these samples comprised of former gas works related chemicals, including several volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and total petroleum hydrocarbons (TPH).

The sequence of tests consisted of:

- A supplemental solubilisation screening, where several surfactants were tested in order to determine the optimal choice for solubilisation of the gas works related contaminants;
- A series of batch tests designed to simulate both S-ISCO® and S-ESCO™ on the Site soil, with simultaneous additions of the co-solvent/surfactant mixture and the selected oxidant/activator systems;
- A series of short term batch tests to simulate rapid ex situ S-ISCO® treatment over a 1 day period for the Block 4 soils;

- A test to generate an emulsion from a tar tank soil sample for subsequent chemical oxidation tests;
- A series of tests to determine the soil oxidant demand for sodium persulfate in Block 4 soil and Block 5 soils; and
- A series of soil column tests, using contaminated Site soil from Block 4 and Block 5, to simulate implementation of the SEPR™ and S-ISCO® treatments.

10.4.2 Results

10.4.2.1 Soil Characterisation

TPH, total PAHs and B(a)P concentrations reported in the homogenised samples used for the Block 4 treatability tests were in the upper 10 to 15 percentile of the historical soil concentrations for the area.

The Hickson Road tar tank homogenised soil sample reported similar concentrations of contaminants to the homogenised samples used for the Block 4 treatability tests.

TPH, total PAHs and B(a)P concentrations measured in the homogenised samples used for the Block 5 treatability tests were at least twice the highest reported historical soil concentrations for Block 5.

The results for Blocks 4 and 5 as well as the DNAPL sample are summarised in **Table 12** below.

Table 12 Treatability Study Samples - Contaminant Concentrations (mg/kg)

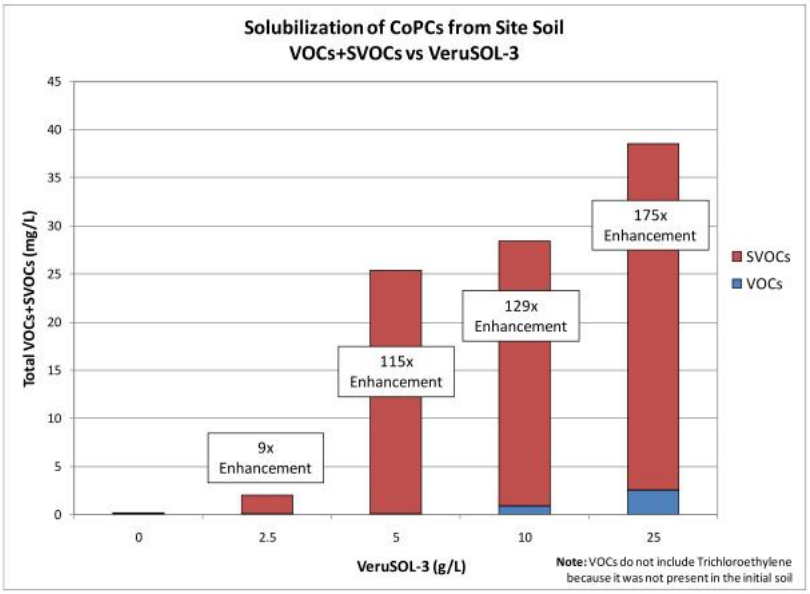
	Block 4 Sample	Block 5 Sample	DNAPL Sample
Benzene	19	0.575	5,700
Naphthalene	2,100	70.5	100,000
BaP	190	135	3,100
Total PAH	6,207	2,305	185,620
TPH	21,500	40,000	840,000
Total VOCs)	205	4.1	42,970
Total SVOCs	7,078	2,340	221,380

10.4.2.2 Solubilisation

A screening of possible solubilisation additives showed VeruSOL-3® to be the most effective surfactant, enhancing the TPH solubilisation to 1,510 times greater than water (5,060 mg/L TPH for VeruSOL-3® compared to 3.4 mg/L TPH for water).

Further trials were conducted to assess the VeruSOL-3® optimal dosing concentration. The data showed contaminant solubilisation was proportional to VeruSOL-3® dosage above 5 mg/L. As the dose of the VeruSOL-3® used in the tests increased there was an increase in desorption and solubility of VOCs and SVOCs into the overlying emulsion phase. When using VeruSOL-3® doses of 5 g/L and higher, the solubility enhancement of VOCs and SVOCs was greater than 100. The results are illustrated in **Table 13** below.

Table 13 Solubilisation of VOC + SVOC by VeruSOL-3®



10.4.2.3 S-ISCO® and S-ESCO™ Batch Tests

The best performing S-ESCO™ treatment used Fe-TAML (iron - tetra-amido macrocyclic ligand) catalysed hydrogen peroxide with VeruSOL-3®. S-ESCO™ treatment after 14 days in these tests indicated reduction of up to:

- 89% for total VOCs and SVOCs;
- 88% for total PAHs;
- 84% for benzo(a)pyrene;
- 98% for naphthalene;
- >99% for benzene; and
- 73% for TPH.

Additional batch tests on Block 4 soils, was conducted to simulate a combined SEPR™/S-ISCO® followed by S-ESCO™ ex situ treatment. S-ESCO™ treatment after only 8 days in these tests indicated reduction of up to:

- 86% for Total VOCs and SVOCs;
- 85% for Total PAHs;
- 84% for benzo(a)pyrene;
- 90% for naphthalene;
- >99% for benzene; and
- 85% for TPH.

The results suggested that both S-ESCO™ and S-ISCO® technologies are effective in the treatment of gasworks contaminants present in the Block 4 soils. Both S-ISCO® with alkaline persulfate and S-ESCO™ with hydrogen peroxide and Fe-TAML were effective during the 14 day treatment period.

10.4.2.4 SEPR™/S-ISCO® short term batch tests

Jar tests were prepared to compare a rapid sequence of *in situ* treatment of SEPR™ for a 1 hour period followed by a 24 hour S-ISCO® treatment with Fe-TAML hydrogen peroxide treatment.

The results demonstrated that a 1 day combined SEPR™/S-ISCO® process could remove up to:

- 51% of VOCs and SVOCs;

- 49% of PAHs;
- 37% of benzo(a)pyrene;
- 61% naphthalene;
- >99% of benzene; and
- 66% of TPH.

The results demonstrated the efficiency of the SEPR™ and S-ISCO® processes in reducing the level of contaminants in the Site soil over a period 25 hours and showed there was no significant advantage in using a higher dose of SEPR™ chemicals (> 10 g/L VeruSOL-3®) with respect to soil treatment.

10.4.2.5 Tar Tank Soil Emulsion Oxidation Tests

The tar tank soil was treated with VeruSOL-3® to generate an emulsion phase for a subsequent series of chemical oxidation tests. The best performing treatment was with Fe-TAML catalysed hydrogen peroxide. Treatment after 7 days indicated reduction of up to:

- 92% for total VOCs and SVOCs;
- 62% for total PAHs;
- >99% for benzo(a)pyrene;
- 62% for naphthalene;
- >99% for benzene; and
- 98% for TPH.

10.4.2.6 Sodium Persulfate Soil Oxidant Demand (SOD) Tests

As the SOD tests used Block 4 and Block 5 homogenised soils, the SOD values represent oxidant use from both the soil matrix and the gasworks contamination present in the samples.

The highest SOD measured for Block 4 soil was 58 g of sodium persulfate consumed per kilogram of soil. The highest SOD measured for Block 5 soil was 116 g of sodium persulfate consumed per kilogram of soil.

10.4.2.7 Column Tests

The tests involved various SEPR™/S-ISCO® influents pumped through columns packed with Site soil.

For Block 4 soils, the column test using hydrogen peroxide at 4% and VeruSOL-3® at 20 g/L demonstrated contaminant removal from the soil of up to:

- 83% for total PAHs;
- 93% for benzo(a)pyrene;
- 87% for naphthalene;
- >99% for benzene; and
- >99% for TPH.

The tests were run for 14 days and it is anticipated that *in situ* treatment would last 1 to 2 months. Therefore, the treatment tests are considered conservative with respect to the treatment potential that can be achieved at full scale on site.

For Block 5 soils, S-ISCO® with hydrogen peroxide (with or without Fe-TAML as a catalyst) performed better than S-ISCO® with activated persulfate. The improved treatment with peroxide is likely due to peroxide being a faster acting oxidant than sodium persulfate.

The S-ISCO® with Fe-EDTA activated persulfate treatment demonstrated contaminant reduction of up to:

- 72% for total VOCs and SVOCs;
- 72% for total PAHs;
- 87% for benzo(a)pyrene;

- 67% for naphthalene;
- >99% for benzene; and
- >99% for TPH.

The S-ISCO® with hydrogen peroxide treatment demonstrated contaminant reduction of up to:

- 84% for total VOCs and SVOCs;
- 84% for total PAHs;
- 95% for benzo(a)pyrene;
- 82% for naphthalene;
- >99% for benzene; and
- >99% TPH.

The S-ISCO® with hydrogen peroxide tests were only run for 8 days, which again illustrates the potential of the agents for full scale treatment.

10.4.3 Discussion of Treatability Study Results

Based on the soil characterisation results, Block 5 homogenised soil samples were at least twice as contaminated as any previously reported soil results from Block 5, while Block 4 results were in the upper 10 to 15 percentile of the historical soil concentrations for the area. The treatment trials can therefore be considered conservative with respect to the mass of contamination likely to be encountered during actual remediation works.

With this in mind, the Laboratory Treatability Tests indicated good treatment potential for both *in situ* and ex situ treatment applications at the Block 4 and Block 5 Sites.

VeruSOL-3® was concluded to be the optimal choice for desorption and solubilisation of the contaminants present in the Site soil. Solubilisation enhancement tests with VeruSOL-3® subsequently demonstrated the direct relationship between VeruSOL-3® dose and contaminant solubilisation.

Both S-ISCO® and S-ESCO™ Batch Tests with Block 4 soil proved to be effective with alkaline activated persulfate, as well as Fe-TAML catalysed peroxide. The tests were run for only 14 days while actual implementation would be expected to last from 1 to 2 months, after which complete or near complete reduction would be expected.

The additional batch test results demonstrated the efficiency of the SEPR™ and S-ISCO® processes in reducing the mass of contaminants in the Site soil in only 25 hours. The tests showed no significant advantage to using a higher dose of SEPR™ surfactants with respect to soil treatment.

Soil column tests, designed to simulate the implementation of S-ISCO® on a small scale showed that the SEPR™ treatment performed the best for Block 4 soil and Block 5 soil. The column tests were subject to various difficulties associated with bench scale testing, such as gas formation, clogging and uneven influent flow. These difficulties reduce performance and it is expected that the increased scale and longer duration of a pilot test and full scale remediation would allow greater efficiencies to be achieved.

10.4.4 Recommendations from Treatability Study

It was recommended that a Pilot Trial be conducted at Block 5 prior to full scale treatment to demonstrate the effectiveness of the preferred treatment process as well as enabling optimisation of the full scale treatment process (refer to **Section 16.1**).

The recommended method proposed to be tested during the Block 5 Pilot Trial comprised:

- S-ISCO® with catalysed hydrogen peroxide; followed by
- S-ISCO® with activated persulfate.

In addition, it was recommended to conduct a Pilot Trial at Hickson Road in the location of the former tar tank. The combined SEPR™ pre-treatment followed by S-ISCO® with Fe-TAML catalysed hydrogen peroxide was recommended for *in situ* treatment in the Hickson Road area in areas where gasworks NAPLs are present.

10.5 Ex situ Stabilisation Trials

EPS conducted a series of Ex situ Stabilisation Trials to assess the feasibility of treating the PAH and TPH impacted material from the Site to a standard which would facilitate either disposal to landfill or beneficial reuse at Headland Park. These works are detailed in the *Ex situ Stabilisation Trials – DECC Declaration Area, Barangaroo* (EPS, 14 March 2012).

As discussed in **Section 7.3**, it is understood that the Authority has determined that no material from the Declaration Area will be accepted for reuse within Headland Park (*Headland Park RAP* [Rev 3], JBS, 2011). Therefore the summary presented following is focused on the suitability of stabilised material for disposal to landfill.

The stabilisation trials were conducted on bulk soil samples obtained from test pits excavated in Blocks 4 and 5 and a coal tar collected from the Hickson Road tar tank (BH53) in February 2010. The test pits were excavated in areas identified by historic investigations as containing gasworks contamination.

Four types of material were targeted for the *Ex situ Stabilisation Pilot Trial* based on field observations:

- Lightly impacted material (LI);
- Moderately impacted material (MI);
- Heavy impacted material (HI); and
- Coal tar material (CT).

The main contaminants of concern considered by the trial were PAH and TPH. PAH, including benzo(a)pyrene (BaP), and TPH are also the contaminants on which waste classification of the material is determined as per the DECCW (2009) *Waste Classification Guidelines*.

10.5.1 Methodology

After collection, the bulk soil samples within each material type were composited, air-dried and mechanically mixed in order to achieve a homogeneous starting material for the stabilisation trials.

The laboratory analysis (total concentrations) indicated that all untreated material (LI, MI, HI and CT) would be classified as hazardous waste, according to the DECCW (2009) *Waste Classification Guidelines*. This classification is based largely on exceedances of the specific contaminant concentration 2 (SCC 2) criteria of 23 mg/kg for BaP. The material types were identified as: LI = 29.6 mg/kg, MI = 70.6 mg/kg, HI = 234 mg/kg, CT = 194 mg/kg). The analytical results indicate that total BaP concentrations in the coal tar sample are lower than in the highly impacted material, which may be a result of the higher water content of the coal tar sample.

Leachate tests were also performed on the untreated soil samples. The leachate tests included:

- Toxicity Characteristic Leaching Procedure (TCLP);
- Australian Standard Leaching Procedure (ASLP); and
- Multiple Extraction Procedure (MEP).

The four material types were subjected to a range of treatment regimes. The treated samples were then subject to leachate testing (TCLP, ASLP and MEP) as well as being assessed for unconfined compressive strength (UCS).

10.5.2 Discussion of Results

The general effect of treatment on contaminant leachate concentrations (compared to untreated soil leachate concentrations) and UCS are summarised following:

- Addition of Portland cement (PC) - leachate contaminant concentrations either showed no reduction or an increase. The UCS showed an increase to > 1 MPa with 5% PC (LI, MI) and with 10% PC (HI);
- Addition of 10% fly-ash - no significant effect on leachate concentrations was reported. An UCS of 3.1 MPa was achieved with the addition of 10% PC (the UCS was not determined on the fly-ash alone treatment); and

- Addition of the chemical fixative, RemBind-FO11 - a significant reduction in leachate contaminant concentrations was reported (5% RemBind-FO achieved an 80% reduction in ASLP concentrations and a 50% reduction in TCLP concentrations). The UCS of the RemBind-FO/PC blend was significantly lower than PC alone (HI material treated with 5% RemBind-FO 10% PC had a UCS of 0.4 MPa compared to a USC of 1.1 MPa for HI material treated with 10% PC alone).

The treatment trials indicated that the optimum pre-treatment with respect to leachate contaminant reduction would be the addition of 5% RemBind-FO. RemBind-FO treatment was only trialled on the HI material, however, a reduction in leachate concentrations would be expected similarly with the LI and MI material.

Conversely, the optimum pre-treatment for achieving the NSW EPA General Immobilisation Approval specification for UCS of greater than 1 MPa would be 5%PC for LI and MI materials and 10%PC for HI material.

10.5.3 Conclusions and Recommendations

Waste can be disposed of to a DECCW Licensed Landfill subject to classification of the material in accordance with the DECCW (2009) *Waste Classification Guidelines*. Based on the SCC BaP criteria the material would be classified as Hazardous Waste, however, the NSW EPA General Immobilisation Approval # 2005/14 (IA) provides specific requirements for the stabilisation of coal tar contaminated soil for the purpose of disposal to an off-site NSW EPA licensed landfill facility.

The IA specifies that if the total concentrations are within specified criteria and a UCS of greater than 1 MPa is achieved, the treated soil can be assessed on TCLP leachability alone. Of the key contaminants of concern, the waste guidelines include a TCLP leachability criterion for BaP only. Based on the TCLP BaP concentrations (below the analytical detection limit for all material), the material (LI, MI, HI and CT) would be classified as General Solid Waste, providing the minimum UCS requirement is met. A UCS of greater than 1 MPa, could be achieved by the following treatments:

- Material classified as LI and MI: 5% cement;
- Material classified as HI: 10% cement; and
- Material classified as CT: 40% - 80% fly-ash, 10% cement.

As described above, the TCLP BaP concentrations were all reported below the laboratory LOR. Therefore, these treatments would also be expected to achieve the required leachate criteria prescribed by the NSW DECCW (2009) *Waste Classification Guidelines*.

The final fly-ash percentage for the treatment of coal tar impacted material will depend on the consistency of the material and the amount of fly-ash required to achieve a spadeable consistency. EPS anticipated that the UCS requirement for CT would likely be met with a 40% -50% fly-ash treatment.

[11] RemBind-FO is a proprietary product developed by Ziltek Pty Ltd for the chemical fixation and stabilisation of hazardous waste.

11.0 Preferred Remediation Option

Based on the available information, as described above, AECOM has identified that the preferred remediation option for: (a) removal of the NSW EPA Declaration (Declaration Number 21122); and (b) to ensure that Block 4 is remediated to a standard suitable for the proposed development in Block 4, should be focussed on the remediation of material identified as SPGWT and CIM (as detailed in **Section 8.5** and **9.1.5**).

The preferred remediation options for each of Block 4 (both VMP Remediation Works and Development Remediation Works), Block 5 (VMP Remediation Works) and Hickson Road (VMP Remediation Works) (as appropriate) are detailed in the following Sections and are summarised as follows:

- Block 4 VMP Remediation Works - excavation of contaminated materials as required to facilitate removal of the NSW EPA Declaration from Block 4, followed by on-site treatment (where required) and off-site landfill disposal (refer to **Section 11.1**);
- Block 4 Development Remediation Works - excavation of contaminated materials as required to make the site suitable for the proposed future land use including construction of the basement groundwater retention wall system (refer to **Section 11.2**). It is noted that the Block 4 Development Remediation Works are not required to enable the NSW EPA Declaration to be revoked. However, completion of the Block 4 Development Remediation Works (if undertaken) will also achieve the objectives of the VMP Remediation Works and thereby also facilitate removal of the NSW EPA Declaration from Block 4; and
- Block 5 VMP Remediation Works and Hickson Road (within the Declaration Area) VMP Remediation Works (refer to **Section 11.3** and **11.4** respectively):
    - Option 1 - completion of a S-ISCO® and SEPR™ Pilot Trial and, if successful, full-scale remediation using S-ISCO® and SEPR™; and
    - Option 2 - if the Pilot Trial are unsuccessful, excavation of required contaminated materials, followed by on-site treatment (where required) and off-site landfill disposal.

It is possible that, depending on the outcome of the S-ISCO® and SEPR™ Proving Phase and/or the Pilot Trial and project requirements, the preferred remediation option adopted for the Block 5 and Hickson Road VMP Remediation Works will be a combination of Option 1 (full scale S-ISCO® and SEPR™ treatment) and Option 2 (excavation and onsite treatment). Selection of which preferred remediation option will be adopted in each part of Block 5 and Hickson Road will be undertaken in consultation with the NSW EPA Accredited Site Auditor (refer to **Section 19.2.1**).

Alternative remediation options are also considered for the VMP Remediation Works (refer to **Section 11.1.3**, **11.3.3** and **Section 11.4.3**). In particular, S-ISCO® and SEPR™ are included as an alternative options for the Block 4 VMP Remediation Works should there be significant changes to the Block 4 Development Works proposed (e.g. if basement works were no longer proposed).

It is possible that remediation of the various areas within the Site (i.e. Block 4, Block 5 and Hickson Road) may occur in separate stages (as detailed in **Section 1.8**). Consequently, the remediation options for Block 4 and Block 5 and Hickson Road are detailed individually in the following sections. It is intended that this approach will facilitate sequential remediation, validation and NSW EPA Accredited Site Auditor signoff of these site areas (if required). The following sections also serve to demonstrate that both Option 1 (subject to the outcomes of the Pilot Trial) and Option 2 are feasible approaches to remediation of Block 5/Hickson Road in accordance with the Remediation Objectives (refer to **Section 1.1**).

11.1 Block 4 VMP Remediation Works - Preferred Remediation Option

As discussed in **Section 8.5.1**, SPGWT and CIM has been identified in Block 4 and will require remediation to facilitate removal of the NSW EPA Declaration.

The preferred remediation strategy for the Block 4 VMP Remediation Works involves:

- Site establishment and preparatory works (refer to **Section 13.0**);
- Installation of an excavation retention wall as required to facilitate excavation;

- Excavation as required to achieve the VMP Remediation Goals (refer to **Section 7.1.4**). This will include removal of identified SPGWT and CIM per **Section 8.5.1** and **Figure F10** and **Figure F11** in **Appendix B** in order to address the NSW EPA Declaration (refer to **Section 1.1.1**); and
- Reuse of excavated material (where possible) (as detailed in **Section 7.3**);
- Treatment of excavated material (if required) (refer to **Section 15.0**) to facilitate off-site disposal to licensed landfill (subject to classification in accordance with the DECCW (2009) *Waste Classification Guidelines*); and
- Validation of the resultant excavation as per **Section 19.5**.

This preferred option of ex situ remediation is proposed because: (a) it is consistent with excavation that is also required for future development works in Block 4 (i.e. basement bulk excavation and construction works); and (b) it is a proven remediation technology for gasworks contamination (including SPGWT) known to be present within Block 4 in association with historic subsurface gasworks infrastructure. However, it is noted that while the preferred remediation strategy for Block 4 VMP Remediation Works would benefit from synergies associated with future development, it is not reliant on any such development proceeding. That is, the excavation strategy proposed for the Block 4 VMP Remediation Works can be undertaken independently of any future development works.

Only material that is free of SPGWT will be considered for reuse.

It is understood that the Authority has determined that no material from the Declaration Area will be accepted for reuse within Headland Park (*Headland Park RAP* [Rev 3], JBS, 2011). Therefore, the option for reuse of material from the Declaration Area within Headland Park has not been considered.

The potential for the reuse of material within other areas of Barangaroo South will be subject to the SSTC developed in relation to those areas (refer to **Section 7.3**).

For clarity, remediation of SPGWT and/or CIM undertaken as part of the bulk excavation and development of Block 4 is considered VMP Remediation Works to the extent that it would have been required in any event to remove the NSW EPA Declaration.

11.1.1 Preferred Strategy Summary

The preferred strategy for Block 4 VMP Remediation Works is summarised following:

- Excavation as required to achieve the VMP Remediation Goals (refer to **Section 7.1.4**), including selective excavation of SPGWT and CIM that is considered to represent a risk to human health or the environment as described by **Section 8.5.1**, to the extent practicable;
- Full time supervision of the remediation works will be undertaken including visual and olfactory observations of excavated material to confirm that it is consistent with that anticipated based on previous investigations;
- Physical separation of recyclable and oversize material, including timber, rock, concrete, steel and brick, from other material;
- Stockpiling of material for processing and reuse (where required or appropriate, refer to **Section 7.3**);
- Excavated material that meets the applicable reuse criteria, may be reused within the Barangaroo South development or Barangaroo Central development – subject to capacity limitations (refer to **Section 7.3**);
- If excavated materials require treatment for off-site disposal or reuse, treatment via ex situ stabilisation/ solidification and/or S-ESCO™ will be undertaken and the material's suitability assessed via validation testing. Selection of the final treatment approach (that is ex situ stabilisation / solidification or S-ESCO™) will be dependent on a range of considerations including:
    - the type of contamination that requires treatment (for example, S-ESCO™ is not suitable for remediation of heavy metals contamination);
    - the quantity of material requiring treatment; the end use of the treated material (for example, off-site disposal to landfill or reuse onsite); and
    - the timing of the material treatment.

It is anticipated that a decision regarding selection of the preferred treatment approach will be made during detailed excavation planning for the various stages of remediation works and/or as part of any applications that may be required for off-site landfill disposal (eg. Immobilisation Approval);

- Off-site disposal will be undertaken of material that exceeds the available capacity for reuse within the Barangaroo site and/or is considered unsuitable for reuse (refer to **Section 7.3**); and
- Validation of the resultant excavation as per **Section 19.5**.

It is considered likely that the SPGWT excavated as part of the remedial works will require stabilisation or S-ESCO™ prior to its offsite disposal to a NSW EPA licensed landfill facility. An Immobilisation Approval will need to be obtained from NSW EPA prior to commencement of these works (refer to **Section 14.7.10**).

It should also be noted that off-site disposal of material (including excavation spoil which is essentially "clean") under the DECCW (2009) *Waste Classification Guidelines* will require that the material be classified as a waste. Further, if treatment of the waste is required prior to off-site disposal to landfill, it will be necessary to apply for and receive an Immobilisation Approval from the NSW EPA prior to treatment and disposal of the waste.

11.1.2 Reasons for Preferred Option Selection

Feasibility

- The proposed option of ex situ remediation is consistent with the proposal to excavate a large basement within Block 4 as part of the Barangaroo South development being undertaken by Lend Lease. It is noted that while the preferred remediation strategy for Block 4 VMP Remediation Works would benefit from synergies associated with future development, it is not reliant on any such development proceeding. That is, the excavation strategy proposed for the Block 4 VMP Remediation Works can be undertaken independently of any future development works;
- The reuse and placement of treated non-SPGWT material (where possible), in accordance with the applicable SSTCs is technically sound and feasible (refer to **Section 7.3**);
- Contamination in Block 4 is expected to primarily be gas works related contamination (SPGWT, PAHs, BTEX, and TPH). Treatment of gas works related contamination using stabilisation technologies is an established remediation technology which was successfully applied as part of the adjacent Bond development in Hickson Road. The capacity of stabilisation to appropriately treat Site contamination was demonstrated by the *Ex situ Stabilisation Trial* (EPS, 2012, refer to **Section 10.5**);
- Either ex situ stabilisation/solidification and/or S-ESCO™ is likely to be the most practical, cost-effective, and established ex situ remediation technology for treatment of the excavated material prior to off-site disposal, based on the type of contaminants which have been identified at the Site;
- The reuse of treated material has been successfully implemented as part of remediation projects at a number of former industrial sites within Sydney (including the Allied Feeds and Lednez sites at Rhodes, with which AECOM personnel have had direct involvement as the NSW EPA Accredited Site Auditor); and
- The supervision of all excavation works to selectively separate the SPGWT/CIM (based on visual and olfactory observations and the sample analysis results), may enable some unimpacted material to be reused within the remediated areas.

Sustainability

The nominated option of ex situ remediation in parallel with proposed basement construction is considered a sustainable solution due to the following considerations:

- It will minimise earthworks and materials handling requirements, therefore minimising emissions from diesel operated equipment and machinery - noting that a basement is to be constructed within Block 4 as part of the Barangaroo South development;
- It maximises the opportunity for recycling and reuse of material through segregation of oversize materials, timber and steel, etc; and
- It will minimise the carbon footprint of the remediation project.

11.1.3 Alternative Block 4 VMP Remediation Option

As an alternative, and subject to the results of the Pilot Trial, S-ISCO® could be undertaken to treat the identified SPGWT/CIM in Block 4 to achieve the VMP Remediation Goals (refer to **Section 7.1.4**). If adopted, the option will be as follows:

- Confirm, based on the results of the Pilot Trial, that:
  - S-ISCO® is effective at remediating Site contamination to meet the relevant soil and groundwater remediation standards;
  - The Pilot Trial has provided sufficient information required to facilitate the conduct of full scale remediation; and
  - The Pilot Trial did not result in an unacceptable risk to human health or the environment.
- S-ISCO® treatment of SPGWT and CIM that is considered to represent a risk to human health or the environment under current land use as described by **Section 16.0**.

Consideration of whether the alternative remediation option will be implemented for the Block 4 VMP Remediation Works may be based on the following factors:

- Changes to the proposed future development requirements in Block 4;
- Practical and commercial considerations; and
- Staging and sequencing of the remediation works in other Barangaroo site areas as part of the broader development works.

11.2 Block 4 Development Remediation Works - Preferred Remediation Option

As discussed in **Section 9.2.2**, SPGWT and CIM has been identified in Block 4 and will require remediation to facilitate the proposed future development works.

It is proposed that a large basement may be excavated within Block 4 as part of the Barangaroo South development being undertaken by Lend Lease (refer to **Section 4.2**, subject to planning approval). Accordingly, the preferred remediation strategy for the Block 4 Development Remediation Works involves ex situ remediation works as follows:

- Site establishment and preparatory works (refer to **Section 13.0**);
- Install permanent, basement groundwater retention wall system (refer to **Section 4.3**). It is noted that these walls could also serve as the excavation retention wall referenced in **Section 11.1** for the Block 4 VMP Remediation Works;
- Excavation as required to remove identified SPGWT and CIM that is considered to represent a risk to human health in order to render the area suitable for the Block 4 Development Works (refer to **Section 14.0**);
- Reuse of excavated material (where possible) (as detailed in **Section 7.3**);
- Treatment of excavated material (if required) (refer to **Section 15.0**) to facilitate off-site disposal to licensed landfill (subject to classification in accordance with the DECCW (2009) *Waste Classification Guidelines*);
- Validation of the excavation as per **Section 19.5**; and
- Complete relevant basement construction elements per the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) as per **Section 19.3**.

It is noted that the remediation extent required for the VMP Remediation Works is within the boundary of the area considered by the Block 4 Development Remediation Works. Further, as described by **Section 4.3**, the basement groundwater retention wall system will effectively prevent groundwater migration from the remediated Block 4 therefore protecting the environment. Consequently, completion of the Block 4 Development Remediation Works will also achieve the objectives of the VMP Remediation Works and thereby facilitate removal of the NSW EPA Declaration from Block 4.

Only material that is free of SPGWT will be considered for reuse.

It is understood that the Authority has determined that no material from the Declaration Area will be accepted for reuse within Headland Park (*Headland Park RAP* [Rev 3], JBS, 2011). Therefore, the option for reuse of material from the Declaration Area within Headland Park has not been considered.

The potential for the reuse of material within other areas of Barangaroo South will be subject to the SSTC developed in relation to those areas. An Addendum to this RAP would be prepared and submitted to the NSW EPA Accredited Site Auditor for approval should this option be adopted (as detailed in **Section 7.3**).

11.2.1 Preferred Strategy Summary

The preferred strategy for the Block 4 Development Remediation Works is summarised following:

- Selective excavation of SPGWT and CIM that is considered to represent a risk to human health or the environment under the proposed future land use as described by **Section 9.2.2**, to the extent practicable. The excavation of SPGWT and CIM that is considered to represent a risk to human health or the environment may be undertaken as part of the bulk excavation works for basement construction within Block 4;
- Full time supervision of the remediation works will be undertaken including visual and olfactory observations of excavated material to confirm that it is consistent with that anticipated based on previous investigations;
- Physical separation of recyclable and oversize material, including timber, rock, concrete, steel and brick, from other material;
- Stockpiling of material for processing and reuse (where required or appropriate, refer to **Section 7.3**);
- Excavated material that meets the applicable reuse criteria, may be reused within the Barangaroo South development or Barangaroo Central development – subject to capacity limitations (refer to **Section 7.3**);
- If excavated materials require treatment for off-site disposal or reuse, treatment via ex situ stabilisation/ solidification and/or S-ESCO™ will be undertaken and the material's suitability assessed via validation testing. Selection of the final treatment approach (that is ex situ stabilisation / solidification or S-ESCO™) will be dependent on a range of considerations including:
  - the type of contamination that requires treatment (for example, S-ESCO™ is not suitable for remediation of heavy metals contamination);
  - the quantity of material requiring treatment; the end use of the treated material (for example, off-site disposal to landfill or reuse onsite); and
  - the timing of the material treatment.

  It is anticipated that a decision regarding selection of the preferred treatment approach will be made during detailed excavation planning for the various stages of remediation works and/or as part of any applications that may be required for off-site landfill disposal (eg. Immobilisation Approval); and
- Off-site disposal will be undertaken of material that exceeds the available capacity for reuse within the Barangaroo site and/or, are considered unsuitable for reuse (refer to **Section 7.3**); and
- Validation of the resultant excavation as per **Section 19.5**.

It is considered likely that the SPGWT excavated as part of the remedial works will require stabilisation or S-ESCO™ prior to its offsite disposal to a NSW EPA licensed landfill facility. An Immobilisation Approval will need to be obtained from NSW EPA prior to commencement of these works (refer to **Section 14.7.10**).

It should also be noted that off-site disposal of material (including excavation spoil which is essentially "clean") under the DECCW (2009) *Waste Classification Guidelines* will require that the material be classified as a waste. Further, if treatment of the waste is required prior to off-site disposal to landfill, it will be necessary to apply for and receive an Immobilisation Approval from the NSW EPA prior to treatment and disposal of the waste.

11.2.2 Reasons for Preferred Option Selection

Feasibility

- The proposed option of ex situ remediation is consistent with the proposal to excavate a large basement within Block 4 as part of the Barangaroo South development being undertaken by Lend Lease;

- The reuse and placement of treated non-SPGWT material (where possible), in accordance with the applicable SSTCs is technically sound and feasible (refer to **Section 7.3**);
- Contamination in Block 4 is expected to primarily be gas works related contamination (SPGWT, PAHs, BTEX, and TPH). Treatment of gas works related contamination using stabilisation technologies is an established remediation technology which was successfully applied as part of the adjacent Bond development in Hickson Road. The capacity of stabilisation to appropriately treat Site contamination was demonstrated by the *Ex situ Stabilisation Trial* (EPS, 2012, refer to **Section 10.5**);
- Either ex situ stabilisation/solidification and/or S-ESCO™ is likely to be the most practical, cost-effective, and established ex situ remediation technology for treatment of the excavated material prior to off-site disposal, based on the type of contaminants which have been identified at the Site;
- The reuse of treated material has been successfully implemented as part of remediation projects at a number of former industrial sites within Sydney (including the Allied Feeds and Lednez sites at Rhodes, with which AECOM personnel have had direct involvement as the NSW EPA Accredited Site Auditor); and
- The supervision of all excavation works to selectively separate the SPGWT/CIM (based on visual and olfactory observations and the sample analysis results), may enable some unimpacted material to be reused within the remediated areas.

Sustainability

The nominated option of ex situ remediation in parallel with proposed basement construction is considered a sustainable solution due to the following considerations:

- It will minimise earthworks and materials handling requirements, therefore minimising emissions from diesel operated equipment and machinery - noting that a basement is to be constructed within Block 4 as part of the Barangaroo South development;
- It maximises the opportunity for recycling and reuse of material through segregation of oversize materials, timber and steel, etc; and
- It will minimise the carbon footprint of the remediation project.

11.2.3 Alternative Block 4 Development Remediation Option

As an alternative, and subject to the results of the Pilot Trial, S-ISCO® could be undertaken to treat the identified SPGWT/CIM in Block 4 prior to excavation of the future basement. If adopted, the option will be as follows:

- Confirm, based on the results of the Pilot Trial, that:
  - S-ISCO® is effective at remediating Site contamination to meet the relevant soil and groundwater remediation standards;
  - The Pilot Trial has provided sufficient information required to facilitate the conduct of full scale remediation; and
  - The Pilot Trial did not result in an unacceptable risk to human health or the environment.
- S-ISCO® treatment of SPGWT and CIM that is considered to represent a risk to human health or the environment as described by **Section 16.0**.

Consideration of whether the alternative remediation option will be implemented in Block 4 may be based on the following factors:

- Changes to the proposed future development requirements in Block 4;
- Practical and commercial considerations; and
- Staging and sequencing of the remediation works in other Barangaroo site areas as part of the broader development works.

11.3 Block 5 VMP Remediation Works – Preferred Remediation Option

As discussed in **Section 8.5.2**, SPGWT and CIM has been identified in Block 5 and will require remediation to facilitate removal of the NSW EPA Declaration.

Planning of the Block 5 development works is currently in its preliminary stage and the nature of the development has not been defined. Therefore, remediation of Block 5 using an *in* situ approach, specifically S-ISCO®, is preferred. Accordingly, the preferred remediation option for Block 5 involves the following:

- Completion of the Pilot Trial to demonstrate the effectiveness of the S-ISCO® and SEPR™ treatment processes as well as enabling optimisation of the full scale treatment process (refer to **Section 16.1**); and
- If the Pilot Trial is successful – Option 1:
    - Site establishment and preparatory works (refer to **Section 13.0**); and
    - Full scale S-ISCO® and SEPR™ treatment of the SPGWT and CIM that is considered to represent a risk to human health or the environment to render the Declaration Area suitable for current land use and to facilitate removal of the NSW EPA Declaration (refer to **Section 16.0**).
- If the Pilot Trial is unsuccessful - Option 2:
    - Site establishment and preparatory works (refer to **Section 13.0**); and
    - Excavation to remove identified SPGWT and CIM that is considered to represent a risk to human health or the environment to render the Declaration Area suitable for current land use and to facilitate removal of the NSW EPA Declaration (refer to **Section 14.0**);
    - Treatment of excavated material (if required) (refer to **Section 15.0**) to facilitate off-site disposal to licensed landfill (subject to classification in accordance with the DECCW (2009) *Waste Classification Guidelines*).

It is possible that, depending on the outcome of the S-ISCO® and SEPR™ Proving Phase and/or the Pilot Trial and project requirements, the preferred remediation option adopted for the Block 5 VMP Remediation Works will be a combination of Option 1 (full scale S-ISCO® and SEPR™ treatment) and Option 2 (excavation and onsite treatment). Selection of the preferred remediation option that will be adopted in each part of Block 5 will be undertaken in consultation with the NSW EPA Accredited Site Auditor.

The majority of SPGWT in Block 5 is expected to be encountered within relatively shallow fill material at the interface with the underlying marine sediments (if present) and bedrock.

It is noted that the Sydney Water Pumping Station (SPS1129) located on the eastern Block 5 boundary will be retained for the future land use. As described by **Section 8.5.2** remediation beneath the pumping station structure is unlikely to be required. However, remediation works to be undertaken adjacent to this area will need to consider appropriate protection measures for the structure.

11.3.1 Preferred Option Summary - Option 1 (S-ISCO®)

The Preferred option for the remediation of Block 5 is summarised following:

- Conduct Pilot Trial to:
    - demonstrate the effectiveness of S-ISCO® at remediating contamination within the Declaration Area to meet the relevant soil and groundwater remediation standards;
    - provide sufficient information to facilitate the conduct of full scale remediation; and
    - demonstrate that the Pilot Trial did not result in an unacceptable risk to human health or the environment (refer to **Section 16.1** and **16.2** respectively).
- Site establishment and preparatory works (refer to **Section 13.0**); and
- Full scale S-ISCO® and SEPR™ remediation works to treat/destroy SPGWT and/or CIM that is considered to represent a risk to human health or the environment under the current land use (refer to **Section 16.0**).

11.3.2 Reasons for Preferred Option Selection - Option 1 (S-ISCO®)

Feasibility

- The required scope of work is focussed on removal of the NSW EPA Declaration in parallel with development of Barangaroo. Given the preliminary stage of planning for the Block 5 development works, the nature of the development has not been defined. Therefore, *in situ* remediation technologies are appropriate;

- S-ISCO® has been demonstrated to be capable of successfully remediating SPGWT and other contaminant residues associated with former gas works sites;
- Subject to the outcome of the Pilot Trial, S-ISCO® will have been specifically demonstrated as capable of the required remediation within the Declaration Area;
- S-ISCO® can be applied to remediation of soils in the unsaturated zone by adjusting the chemical oxidants used to provide for greater retention time within the unsaturated zone;
- S-ISCO® can be implemented without negative impact on water and sediment quality within the adjacent Harbour;
- S-ISCO® delivery systems can be designed to target specific contamination and can more readily accommodate the presence of debris associated with historic filling activities or former gas works infrastructure when compared to other *in situ* remediation technologies (such as *in situ* stabilisation);
- S-ISCO® is more readily able to achieve complete treatment of target contamination when compared to other *in situ* remediation technologies (such as *in situ* stabilisation);
- S-ISCO® can be implemented around existing underground services without the need for resource intensive and costly service disruption, diversion and relocation; and
- S-ISCO® is considered to a practical and cost effective remediation technology based on the type of contaminants identified in Block 5 and the specific Remediation Goals for these areas.

Sustainability

The preferred option of conducting S-ISCO® within Block 5 is considered a sustainable solution due to the following considerations:

- S-ISCO® is considered an innovative and sustainable solution to the *in situ* remediation of Block 5, whereas the ex situ remediation of tar associated with former gas works would be resource intensive and costly;
- It will minimise earthworks, materials handling, separation, dewatering and drying requirements, therefore minimising emissions from diesel operated equipment and machinery and the overall carbon footprint for the development;
- It will minimise fugitive emissions and odours from handling of contaminated material, therefore minimising the risk of adverse stakeholder concerns. This is a particular concern given the proximity of Block 5 to residences and office buildings;
- It will minimise the quantities of material that requires off-site disposal to landfill;
- It will directly remediate both soil and groundwater contamination. Ex situ remediation technologies will remove the source soil contamination and rely on natural attenuation and/or other amendments/active remediation to improve groundwater quality; and
- Resources required to implement S-ISCO® are generally limited to power and water. This is particularly relevant with respect to some other *in situ* remediation technologies which require a large energy input (for example steam stripping or thermal conductive heating).

11.3.3 Alternative Option Summary - Option 2 (Ex situ)

Subject to the results of the Pilot Trial, the Alternative Option for the remediation of materials in Block 5 is summarised following:

- Excavation as required to achieve the VMP Remediation Goals (refer to **Section 7.1.4**), including selective excavation of SPGWT and CIM that is considered to represent a risk to human health or the environment under current land use as described by **Section 8.5.2** to the extent practicable;
- Full time supervision of the remediation works will be undertaken including visual and olfactory observations of excavated material to confirm that it is consistent with that anticipated based on previous investigations;
- Physical separation of recyclable and oversize material, including timber, rock, concrete, steel and brick, from other material;
- Stockpiling of material for processing and reuse (where required or appropriate, refer to **Section 7.3**);

- Excavated material that meets the applicable reuse criteria, may be reused within the Barangaroo South development or Barangaroo Central development – subject to capacity limitations (refer to **Section 7.3**);
- If excavated materials require treatment for off-site disposal or reuse, treatment via ex situ stabilisation/ solidification and/or S-ESCO™ will be undertaken and the material's suitability assessed via validation testing. Selection of the final treatment approach (that is ex situ stabilisation / solidification or S-ESCO™) will be dependent on a range of considerations including:
  - the type of contamination that requires treatment (for example, S-ESCO™ is not suitable for remediation of heavy metals contamination);
  - the quantity of material requiring treatment; the end use of the treated material (for example, off-site disposal to landfill or reuse onsite); and
  - the timing of the material treatment.

  It is anticipated that a decision regarding selection of the preferred treatment approach will be made during detailed excavation planning for the various stages of remediation works and/or as part of any applications that may be required for off-site landfill disposal (eg. Immobilisation Approval);
- Off-site disposal will be undertaken of material that exceeds the available capacity for reuse within the Barangaroo site and/or, are considered unsuitable for reuse (refer to **Section 7.3**);
- Validation of the resultant excavation as per **Section 19.5**; and
- Backfilling of excavation with suitable fill.

It is considered likely that the SPGWT excavated as part of the remedial works will require stabilisation or S-ESCO™ prior to its offsite disposal to a NSW EPA licensed landfill facility. An Immobilisation Approval will need to be obtained from NSW EPA prior to commencement of these works (refer to **Section 14.7.10**).

A component of the Alternative remediation option for Block 5 would be to maximise the reuse of materials excavated as part of any remediation works to the extent practicable (refer to **Section 7.3**).

11.3.3.1 Reasons for Alternative Option Selection - Option 2 (Ex situ)

Feasibility

- *Ex situ Stabilisation Trials* (refer to **Section 10.5**) have demonstrated that the ex situ remediation option is an appropriate and effective alternative to remediate Block 5;
- Based on the available information, it is anticipated that contamination in Block 5 will primarily be gas works residues (tar, PAHs, BTEX, and TPH). Treatment of gas works residues using stabilisation technologies is an established remediation technology which was successfully applied as part of the adjacent Bond development in Hickson Road. The capability of stabilisation to appropriately treat the Site contamination was demonstrated by the *Ex situ Stabilisation Trial* (EPS, 2012, refer to **Section 10.5**); and
- Either ex situ stabilisation/solidification and/or S-ESCO™ is likely to be the most practical, cost-effective, and established ex situ remediation technology for treatment of the excavated material prior to off-site disposal, based on the type of contaminants which have been identified at the Site.

11.4 Hickson Road VMP Remediation Works – Preferred Remediation Option

As discussed in **Section 8.5.3**, SPGWT and CIM that is considered to represent a risk to human health or the environment under current land use has been identified in Hickson Road and will require remediation to facilitate removal of the NSW EPA Declaration.

As excavation of Hickson Road is not required, remediation of these areas using an *in situ* approach, specifically S-ISCO®, is preferred. Accordingly, the preferred remediation option for Hickson Road involves the following:

- Completion of the Pilot Trial to demonstrate the effectiveness of the S-ISCO® and SEPR™ treatment processes as well as enabling optimisation of the full scale treatment process (refer to **Section 16.1** and **16.2**); and
- If the Pilot Trial are successful – Option 1:

- Site establishment and preparatory works (refer to **Section 13.0**); and
- Full scale S-ISCO® and SEPR™ treatment of the SPGWT and CIM that is considered to represent a risk to human health or the environment to render the Declaration Area suitable for the current land use and to facilitate removal of the NSW EPA Declaration (refer to **Section 16.0**).

- If the Pilot Trial are unsuccessful – Option 2:
  - Site establishment and preparatory works (refer to **Section 13.0**);
  - Excavation to remove identified SPGWT and CIM that is considered to represent a risk to human health or the environment to render the Declaration Area suitable for the current land use and to facilitate removal of the NSW EPA Declaration (refer to **Section 14.0**); and
  - Treatment of excavated material (if required) (refer to **Section 15.0**) to facilitate off-site disposal to licensed landfill (subject to classification in accordance with the DECCW (2009) *Waste Classification Guidelines*).

It is possible that, depending on the outcome of the S-ISCO® and SEPR™ Proving Phase and/or the Pilot Trial and project requirements, the preferred remediation option adopted for the Hickson Road VMP Remediation Works will be a combination of Option 1 (full scale S-ISCO® and SEPR™ treatment) and Option 2 (excavation and onsite treatment). Selection of the preferred remediation option that will be adopted in each part of Hickson Road will be undertaken in consultation with the NSW EPA Accredited Site Auditor.

The majority of SPGWT in Hickson Road is expected to be encountered in association with the former gas works infrastructure in Hickson Road (in particular the main gas holder annulus, tar tank area and small gas holder, refer to **Section 8.5.3**). Hickson Road is known to contain a large number of services and currently provides access to the adjacent residential and commercial buildings. Therefore excavation in Hickson Road is not preferred, as it would be difficult, costly and potentially increase the risk of negative impacts to stakeholders in properties adjacent to the Site.

It is noted that some excavation work may be required in specific parts of Hickson Rd, in advance of the Hickson Road VMP Remediation Works, to allow for potential stormwater diversion work. If required, these works would be undertaken in consideration of the requirements of this RAP.

11.4.1 Preferred Option Summary - Option 1 (S-ISCO®)

The Preferred option for the remediation of Hickson Road is summarised following:

- Conduct Pilot Trial to:
  - demonstrate the effectiveness of S-ISCO® at remediating Site contamination to meet the relevant soil and groundwater remediation standards ;
  - provide sufficient information to facilitate the conduct of full scale remediation; and
  - demonstrate that the Pilot Trial did not result in an unacceptable risk to human health or the environment (refer to **Section 16.1**); and
- Site establishment and preparatory works (refer to **Section 13.0**); and
- Full scale S-ISCO® and SEPR™ remediation works to treat/destroy SPGWT and/or CIM demonstrate that the Pilot Trial did not result in an unacceptable risk to human health or the environment (refer to **Section 16.0**).

11.4.2 Reasons for Preferred Option Selection - Option 1 (S-ISCO®)

Feasibility

- The required scope of work is focussed on removal of the NSW EPA Declaration in parallel with development of Barangaroo. Excavation of Hickson Road is not required. Therefore, *in situ* remediation technologies are appropriate;
- Hickson Road contains a high density of below ground services and utilities. Therefore, *in situ* remediation technologies that do not necessitate relocation of these services are appropriate;
- Hickson Road is located immediately adjacent to a number of sensitive receptors including residential and commercial premises and a childcare centre. Therefore, *in situ* remediation technologies that will minimise

the potential for odorous or other fugitive emissions (i.e. during ex situ bulk excavation works) are appropriate;

- S-ISCO® has been demonstrated to be capable of successfully remediating SPGWT and other contaminant residues associated with former gas works sites;
- Subject to the outcome of the Pilot Trial, S-ISCO® will have been specifically demonstrated as capable of the required remediation within the Declaration Area;
- S-ISCO® can be applied to remediation of soils in the unsaturated zone by adjusting the chemical oxidants used to provide for greater retention time within the unsaturated zone;
- S-ISCO® can be implemented without negative impact on water and sediment quality within the adjacent Harbour;
- S-ISCO® delivery systems can be designed to target specific contamination and can more readily accommodate the presence of debris associated with historic filling activities or former gas works infrastructure when compared to other *in situ* remediation technologies (such as *in situ* stabilisation);
- S-ISCO® is more readily able to achieve complete treatment of target contamination when compared to other *in situ* remediation technologies (such as *in situ* stabilisation);
- S-ISCO® can be implemented around existing underground services without the need for resource intensive and costly service disruption, diversion and relocation; and
- S-ISCO® is considered to a practical and cost effective remediation technology based on the type of contaminants identified in Hickson Road and the specific Remediation Goals for these areas.

Sustainability

The preferred option of conducting S-ISCO® within Hickson Road is considered a sustainable solution due to the following considerations:

- S-ISCO® is considered an innovative and sustainable solution to the *in situ* remediation of Hickson Road, whereas the ex situ remediation of tar associated with former gas works would be resource intensive and costly;
- It minimises earthworks, materials handling, separation, dewatering and drying requirements, therefore minimising emissions from diesel operated equipment and machinery and the overall carbon footprint for the development;
- It minimises fugitive emissions and odours from handling of contaminated material, therefore minimising the risk of adverse stakeholder concerns. This is a particular concern given the proximity of Block 4 to residences and office buildings;
- It minimises the quantities of material that requires off-site disposal to landfill;
- It will directly remediate both soil and groundwater contamination. Ex situ remediation technologies will remove the source soil contamination and rely on natural attenuation and/or other amendments/active remediation to improve groundwater quality; and
- Resources required to implement S-ISCO® are generally limited to power and water. This is particularly relevant with respect to some other *in situ* remediation technologies which require a large energy input (for example steam stripping or thermal conductive heating).

11.4.3 Alternative Option Summary - Option 2 (Ex situ)

Subject to the results of the Pilot Trial, the Alternative Option for the remediation of materials in Hickson Road is summarised following:

- Excavation as required to achieve the VMP Remediation Goals (refer to **Section 7.1.4**), including selective excavation of SPGWT and CIM that is considered to represent a risk to human health or the environment under current land use as described by **Section 8.5.3** to the extent practicable;
- Full time supervision of the remediation works will be undertaken including visual and olfactory observations of excavated material to confirm that it is consistent with that anticipated based on previous investigations;

- Physical separation of recyclable and oversize material, including timber, rock, concrete, steel and brick, from other material;
- Stockpiling of material for processing and reuse (where required or appropriate, refer to **Section 7.3**);
- Excavated material that meets the applicable reuse criteria, may be reused within Hickson Road – subject to capacity limitations (refer to **Section 7.3**);
- If excavated materials require treatment for off-site disposal or reuse, treatment via ex situ stabilisation/ solidification and/or S-ESCO™ will be undertaken and the material's suitability assessed via validation testing. Selection of the final treatment approach (that is ex situ stabilisation / solidification or S-ESCO™) will be dependent on a range of considerations including:
    - the type of contamination that requires treatment (for example, S-ESCO™ is not suitable for remediation of heavy metals contamination);
    - the quantity of material requiring treatment; the end use of the treated material (for example, off-site disposal to landfill or reuse onsite); and
    - the timing of the material treatment.

  It is anticipated that a decision regarding selection of the preferred treatment approach will be made during detailed excavation planning for the various stages of remediation works and/or as part of any applications that may be required for off-site landfill disposal (eg. Immobilisation Approval);
- Off-site disposal will be undertaken of material that exceeds the available capacity for reuse within Hickson Road and/or, are considered unsuitable for reuse (refer to **Section 7.3**);
- Validation of the resultant excavation as per **Section 19.5**; and
- Backfilling the excavated areas with suitable fill and reinstating the excavated portion of Hickson Road.

It is considered likely that the SPGWT excavated as part of the remedial works will require stabilisation or S-ESCO™ prior to its offsite disposal to a NSW EPA licensed landfill facility. An Immobilisation Approval will need to be obtained from NSW EPA prior to commencement of these works (refer to **Section 14.7.10**).

A potential component of the alternative Option 2 remediation works for Hickson Road would be to facilitate the reuse of materials excavated from other Site remediation works (outside Hickson Road) to the extent practicable. In consideration of this there may be opportunity to reuse some of the excavated material (eg. overburden or rock removed to facilitate deep excavation as part of the Block 4 Development Works within Hickson Road, refer to **Section 7.3**).

It should also be noted that for the purpose of waste classification under the DECCW (2009) *Waste Classification Guidelines* Hickson Road is considered off-site from Block 4 and Block 5. Therefore, the reuse of material from Block 4 or Block 5 within Hickson Road would require that the material be classified as a waste or receipt of a Resource Recovery Exemption under clauses 51 and 51A of the *Protection of the Environment Operations (Waste) Regulation* (2005).

11.4.3.1 Reasons for Alternative Option Selection - Option 2 (Ex situ)

Feasibility

- Ex situ Stabilisation Trials (refer to **Section 10.5**) have demonstrated that the ex situ remediation option is an appropriate and effective alternative to remediate Hickson Road.
- Based on the available information, it is anticipated that contamination in Block 5 and Hickson Road will primarily be gas works residues (tar, PAHs, BTEX, and TPH). Treatment of gas works residues using stabilisation technologies is an established remediation technology which was successfully applied as part of the adjacent Bond development in Hickson Road. The capability of stabilisation to appropriately treat the Site contamination was demonstrated by the *Ex situ Stabilisation Trial* (EPS, 2012, refer to **Section 10.5**; and
- Either ex situ stabilisation/solidification and/or S-ESCO™ is likely to be the most practical, cost-effective, and established ex situ remediation technology for treatment of the excavated material prior to off-site disposal, based on the type of contaminants which have been identified at the Site.

11.5 Groundwater Contamination and the Adjacent ORWS Retention Wall System

A groundwater basement retention wall system has been constructed around the perimeter of the basement to be constructed within Barangaroo South Blocks 1 to 3 (also referred to as the ORWS Area or Stage 1a basement). The approximate alignment of the wall is shown on **Figure F4** in **Appendix B**. The groundwater basement retention wall system comprises a diaphragm wall constructed to and keyed into bedrock and is designed to effectively isolate material within it from the surrounding environment. The northern boundary of the ORWS Area corresponds (in part) with the southern boundary of the Site.

As discussed in **Section 4.3** and detailed in **Figure F4** in **Appendix B**, a perimeter retention wall system is proposed to be constructed around Block 4 should the proposed Block 4 Development proceed.

Based on the groundwater monitoring data available for Barangaroo South and surrounding areas (as provided in various reports by AECOM, ERM and others), groundwater contamination within the Site will not be impacted by the presence of the adjacent ORWS perimeter retention wall system (and Block 4 basement groundwater retention wall system, if constructed) because:

- Groundwater flow in and around the area is tidally influenced. The amount of seawater infiltrating into the Site twice per day with the incoming tide is far greater than the amount of terrestrial groundwater flowing onto the Site from up gradient areas in the fill material, natural sediments and sandstone bedrock;
- Terrestrial groundwater flow around the ORWS and proposed Block 4 retention wall system from the east will be low because the limiting factors are the nature of the up gradient urban catchment for groundwater recharge and the sandstone bedrock. The majority of rainfall becomes surface water runoff due to the presence of pavements and buildings, leaving little water to infiltrate and recharge the groundwater system; and
- The highest concentrations of contamination in groundwater at the Site exist cross gradient to the ORWS retention wall system. The migration of groundwater contamination at the Site will not change because of the construction of the ORWS retention wall system for the following reasons:
    - Overall groundwater flow is towards Darling Harbour, not towards the ORWS retention wall system;
    - Although terrestrial groundwater flow around the ORWS retention wall system may flow into the Site, the flux will be low as discussed above and will therefore not cause additional appreciable migration of contamination; and
    - Contamination present in the ORWS basement area will be removed and managed in accordance with the *ORWS Amended Remedial Action Plan* (AECOM, 2011b) and will therefore not impact on Darling Harbour or the surrounding residential premises.

12.0 Remediation Works Overview

12.1 General Works Program Overview

The following sections provide an overview of the remediation approach for both the VMP Remediation Works and Block 4 Development Remediation Works. Where there is a distinction between the two, the difference is highlighted in the text.

The following sections do not include consideration of planning requirements which are described in **Section 2.2.2**. The planning process will necessarily be concluded prior to execution of the full scale remediation works.

12.2 Project Schedule

12.2.1 Block 4 VMP Remediation Works

The proposed Block 4 VMP Remediation Works will be scheduled under the following tasks:

- Approvals process, including concept, project and development approval and Immobilisation Approval, (if required) for off-site disposal of excavated material to landfill (refer to **Section 14.7.10**);
- Site Establishment and construction of treatment plant (if required);
- Installation of an excavation retention wall as required to facilitate excavation works. Note that if Block 4 Development Remediation Works are conducted along with the VMP Remediation Works, this would comprise the basement perimeter retaining wall described in **Section 4.3**);
- Construction of odour control structures (refer to **Section 15.1**) including associated piling works (if required);
- Excavation and treatment (as required);
- Tracking of all excavated materials in accordance with the Materials Tracking Procedure (refer to **Section 14.7.2**);
- Validation to demonstrate compliance with the requirements of this RAP;
- Reporting;
- Decommissioning and demobilisation; and
- Groundwater monitoring will be undertaken and the groundwater results compared to the Remediation Goals developed by the *VMP Remediation Extent Report* (AECOM, 2013c) in accordance with the Groundwater Monitoring Plan (GMP) to be prepared for the Site (refer to **Section 17.4**).

12.2.2 Block 4 Development Remediation Works

The proposed Block 4 Development Remediation Works will be scheduled under the following tasks:

- Approvals process, including concept, project and development approval and Immobilisation Approval, (if required) for off-site disposal of excavated material to landfill (refer to **Section 14.7.10**);
- Installation of the Block 4 basement groundwater retention wall system (refer to **Section 4.3**);
- Construction of odour control structures (refer to **Section 15.1**) including associated piling works (if required) and construction of additional structures (if required) for further basement excavation;
- Excavation and treatment (as required);
- Tracking of all excavated materials in accordance with the Materials Tracking Procedure (refer to **Section 14.7.2**);
- Validation to demonstrate compliance with the requirements of this RAP;
- Reporting;
- Decommissioning and demobilisation; and

- Groundwater monitoring, if required, in accordance with the GMP to be prepared for the Site (refer to **Section 17.4**).

12.2.3 Block 5 and Hickson Road VMP Remediation Works

The proposed Block 5 and Hickson Road VMP Remediation Works will be scheduled under the following tasks:

- Completion of the S-ISCO® and SEPR™ Pilot Trial and the related S-ISCO® and SEPR™ Pilot Trial Report which will be issued to the Site Auditor and NSW EPA for review (refer to **Section 13.1.3**, **16.1** and **16.2**); and
- If the Pilot Trial is successful – Option 1:
    - Approvals process, including concept, project and development approval;
    - Preparation of the S-ISCO® and SEPR™ Detailed Work Plan (refer to **Section 13.1.3**) and issue to the Site Auditor and NSW EPA for review;
    - Site Establishment and construction of the required support equipment;
    - *In Situ* remediation, to the extent practical, of SPGWT and CIM using S-ISCO® and SEPR™ that is considered to represent a risk to human health or the environment under the current land use;
    - Tracking of all materials in accordance with a Materials Tracking Procedure (refer to **Section 14.7.2**);
    - Validation to demonstrate compliance with the requirements of this RAP;
    - Reporting;
    - Decommissioning and demobilisation; and
    - Groundwater monitoring will be undertaken and the groundwater results compared to the Remediation Goals developed by the *VMP Remediation Extent Report* (AECOM, 2013c) in accordance with the GMP to be prepared for the Site (refer to **Section 17.4**).
- If the Pilot Trial is unsuccessful – Option 2:
    - Approvals process, including concept, project and development approval;
    - Site Establishment and construction of the required plant;
    - Installation of an excavation retention wall as required to facilitate excavation works;
    - Construction of odour control structures (refer to **Section 15.1**) including associated piling works (if required);
    - Excavation and treatment (as required);
    - Tracking of all materials in accordance with a Materials Tracking Procedure (refer to **Section 14.7.2**);
    - Validation to demonstrate compliance with the requirements of this RAP;
    - Reporting;
    - Decommissioning and demobilisation; and
    - Groundwater monitoring will be undertaken and the groundwater results compared to the Remediation Goals developed by the *VMP Remediation Extent Report* (AECOM, 2013c) in accordance with the GMP to be prepared for the Site (refer to **Section 17.4**).

12.3 Remediation Works

12.3.1 Block 4 VMP Remediation Works

Summary detail of the proposed Block 4 VMP Remediation Works via ex situ stabilisation (and possibly S-ESCO™ if proven viable) is described following:

- Installation of an excavation retention wall as required to facilitate excavation works. Note that if Block 4 Development Remediation Works are conducted along with the VMP Remediation Works, this would comprise the basement groundwater retention wall system described in **Section 4.3**).
- Construction of odour control structures (refer to **Section 15.1**) including associated piling works (if required);
- Excavation as required to achieve the VMP Remediation Goals (refer to **Section 7.1.4**), including selective excavation of SPGWT and CIM that is considered to represent a risk to human health or the environment as described by **Section 8.5.1**, to the extent practicable (refer to **Section 7.1.4**). The SPGWT and CIM will be identified through a combination of:
    - assessment of the soil analytical results against the Remediation Goals;
    - visual and olfactory observations during excavation; and
    - correlation with analytical data to facilitate visual confirmation of materials characterisation.
- Physical separation of recyclable and oversize material, including timber, rock, concrete, steel and brick from contaminated material;
- Characterisation of excavated SPGWT and CIM to confirm treatment requirements and appropriate end use (including consideration of reuse options, refer to **Section 7.3**);
- Tracking of all excavated materials in accordance with the Materials Tracking Procedure (refer to **Section 14.7.2**);
- Validation (progressive and concurrent with remediation excavation and treatment) to demonstrate compliance with the requirements of this RAP; and
- Groundwater monitoring and assessment of groundwater CoPC concentrations against the Remediation Goals developed by the *VMP Remediation Extent Report* (AECOM, 2013c) in accordance with the GMP to be prepared for the Site (refer to **Section 17.4**).

12.3.2 Block 4 Development Remediation Works

Summary detail of the proposed Block 4 Development Remediation Works via ex situ stabilisation (and possibly S-ESCO™ if proven viable) is described following:

- Installation of the Block 4 basement groundwater retention wall system (refer to **Section 4.3**);
- Construction of odour control structures (refer to **Section 15.1**) including associated piling works (if required) and construction of additional structures (if required) for further basement excavation;
- Selective excavation of SPGWT and CIM that is considered to represent a risk to human health or the environment under the proposed future land use as described by **Section 9.2.2**, to the extent practicable. The excavation of SPGWT and CIM that is considered to represent a risk to human health or the environment will likely be undertaken as part of the bulk excavation works for basement construction within Block 4. The SPGWT and CIM will be identified through a combination of:
    - assessment of the soil analytical results against the Remediation Goals;
    - visual and olfactory observations during excavation; and
    - correlation with analytical data to facilitate visual confirmation of materials characterisation.
- Physical separation of recyclable and oversize material, including timber, rock, concrete, steel and brick from contaminated material;
- Characterisation of excavated SPGWT and CIM to confirm treatment requirements and appropriate end use (including consideration of reuse options, refer to **Section 7.3**);

- Tracking of all excavated materials in accordance with the Materials Tracking Procedure (refer to **Section 14.7.2**);
- Validation (progressive and concurrent with remediation excavation and treatment) to demonstrate compliance with the requirements of this RAP; and
- Groundwater monitoring, if required, in accordance with the GMP to be prepared for the Site (refer to **Section 17.4**).

12.3.3 Block 5 and Hickson Road VMP Remediation Works

12.3.3.1 Option 1 - S-ISCO®

Pending the results of the proposed Pilot Trial, implementation of the Block 5 and Hickson Road VMP Remediation Works using S-ISCO® are described following while further detail is provided in **Section 16.0**:

- Based on the identified presence of SPGWT and CIM that represents a risk to human health or the environment under current land use in Block 5 and Hickson Road it is likely that the works will be conducted as follows:
  - Mobilisation and establishment of Site facilities;
  - Service location of underground services in the remediated areas;
  - Installation of injection wells, groundwater monitoring wells and related infrastructure. Extraction wells will also be installed within the Hickson Road former gasworks infrastructure to facilitate SEPR™; and
  - Injection of surfactants and oxidants at optimal rates, volumes and durations based on the findings of the full scale pilot trial.
- Groundwater monitoring, and soil gas and soil sampling will be conducted prior to and during all stages of the works to ensure the S-ISCO® is operating within optimal working conditions;
- The SEPR™ works within the Hickson Road former gasworks infrastructure will consist of injections and subsequent extractions aimed at removing the SPGWT present;
- Soil validation (progressive and concurrent with remediation) to demonstrate compliance with the requirements of this RAP; and
- Groundwater monitoring and assessment of groundwater CoPC concentrations against the Remediation Goals developed by the *VMP Remediation Extent Report* (AECOM, 2013c) (refer to **Section 17.4**).

12.3.3.2 Option 2 - Ex situ Stabilisation

Summary detail of the proposed Block 5 and Hickson Road VMP Remediation Works using ex situ stabilisation (and possibly S-ESCO™ if proven viable) is described following:

- Based on the identified presence of SPGWT and CIM that represents a risk to human health or the environment under current land use in Block 5 and Hickson Road, selective excavation, to the extent practicable, to achieve the VMP Remediation Goals (refer to **Section 7.1.4**);
- Identification of CIM during excavations and selective over-excavation through a combination of:
  - assessment of the soil analytical results against the Remediation Goals;
  - visual and olfactory observations during excavation; and
  - correlation with analytical data to facilitate visual confirmation of materials characterisation.
- Physical separation of recyclable and oversize material, including timber, rock, concrete, steel and brick from contaminated material;
- Characterisation of excavated SPGWT and CIM to confirm treatment requirements and appropriate end use (for possible backfilling of remediated areas);
- Tracking of all excavated materials in accordance with the Materials Tracking Procedure (refer to **Section 14.7.2**);
- Validation (progressive and concurrent with remediation excavation and treatment) to demonstrate compliance with the requirements of this RAP; and

- Groundwater monitoring and assessment of groundwater CoPC concentrations against the Remediation Goals developed by the *VMP Remediation Extent Report* (AECOM, 2013c) (refer to **Section 17.4**).

13.0 Site Establishment

13.1 Work to be Completed Prior to Site Establishment

13.1.1 Planning Approvals

The assessment and approvals process for the proposed S-ISCO® and SEPR™ Pilot Trial and remediation works are described by **Section 2.0**.

13.1.2 Project Approvals

Approvals and licenced required to facilitate both the VMP Remediation Works and Block 4 Development Remediation Works will include:

- An Immobilisation Approval from the NSW EPA, if the ex situ treatment of soils is required prior to off-site disposal (if required);
- A variation to the existing Environment Protection License (EPL, as required, refer to **Appendix E**) to facilitate the proposed remediation works, for example:
  - discharge of treated groundwater from the wastewater treatment system to Darling Harbour (refer to **Section 17.3**);
  - emissions from odour control structures required as part of ex situ stabilisation (refer to **Section 15.1**);
  - emissions from the selected remediation approach (for example vapour emissions from the SVE system required as part of S-ISCO); or
  - if treatment of material is required - refer to **Section 2.2**.
- A Trade Waste Licence from Sydney Water for disposal to sewer (if required); and
- Consent from an appropriately licenced landfill(s) to receive waste generated by the remediation works.

13.1.3 Project Documentation

Prior to site establishment, all plans, programs, certificates and other documents necessary for the commencement of work will be completed. These documents will include, but not be limited to the following:

Table 14 Project Documentation

Report Title	Approval Party	Approval Prerequisite	Relevant Section of this Report
Occupational Health and Safety (OH&S) Plan	Lend Lease	Site Establishment	Section 21
Community Consultation Plan	Lend Lease	Site Establishment	Section 22
Environmental Management Plan	Lend Lease and NSW DoPI	Site Establishment	Section 20
Project Management Plan	Lend Lease	Site Establishment	-
Quality Management Plan	Lend Lease	Site Establishment	-
Asbestos Management Plan	Lend Lease	Site Establishment	Section 7.2.4.2 and new Section 14.8
Emergency Response and Contingency Plan	Lend Lease	Site Establishment	Section 13.4.7
Excavation Plans	Lend Lease	Site Establishment	Section 9.3 and 14.3
S-ISCO®/SEPR™ Pilot Trial Report	Site Auditor and NSW EPA	S-ISCO® and SEPR™	Section 16.2
Reuse Materials Management Plan (to be prepared by the BDA)	BDA	Reuse of material elsewhere on Barangaroo	Section 7.3 and 14.7.2
S-ISCO®/SEPR™ Detailed Work Plan	Site Auditor and NSW EPA	S-ISCO® and SEPR™	Section 16.3

Report Title	Approval Party	Approval Prerequisite	Relevant Section of this Report
Validation SAQP	Site Auditor	VMP Remediation Works / Block 4 Development Remediation Works	Section 19.2.3
VMP Remediation Works Groundwater Monitoring Plan	Site Auditor and NSW EPA (if required)	VMP Remediation Works	Section 17.4.2
Block 4 Development Remediation Works GMP	Site Auditor	Block4 Development Remediation Works	Section 17.4.3

In addition, the following will be undertaken:

- Preparation of a detailed work program and logic diagram (including Excavation Plans);
- Submission of all WorkCover Authority notifications;
- Commissioning and Mobilisation of Plant;
- An Immobilisation Approval from the NSW EPA, if the treatment of soils is required prior to off-site disposal; and
- Preparatory works required for utilities connections and supply agreements.

13.2 Site Preparation

Works to be undertaken prior to remediation works include:

- Establishment of site offices;
- Demolition of existing infrastructure and removal of concrete pavements, where required;
- Installation of excavation retention walls, as required to facilitate excavation works. In the case of the Block 4 Development Remediation Works, installation of the basement groundwater retention wall system;
- Establishment of exclusion zones;
- Establishment of an Excavation Enclosure (EE) and related Emissions Control System (ECS) (if required for Option 2 works) for those areas where excavation within an enclosure is required to manage odorous materials; and
- Establishment of the Remediation Enclosure (RE) (if required, refer to **Section 15.1**) and Ex situ Treatment Facility and related ECS, where required.
- Establishment of the plant and supporting infrastructure as required for the S-ISCO® and SEPR™ works, where required.

13.3 Site Facilities and Procedures

Site facilities required for the remediation works (either *in situ* and/or ex situ and both VMP Remediation Works and Block 4 Development Remediation Works) will be established in compliance with the relevant regulations. These facilities will be connected to appropriate utilities as required. All connections and reticulations will be carried out by licensed and qualified personnel in accordance with statutory requirements and standards.

The following facilities will be established for the remediation works at the Site:

- Ex situ treatment facility (if required);
- EE and related ECS (if required) for the management of odours and volatile emissions associated with the excavation of SPGWT and CIM and any other odorous materials; and
- RE and related ECS (if required) for the ex situ treatment facilities (if required).

It is intended that the ex situ treatment facility will be established in a suitable location on Barangaroo, potentially adjacent to Block 5. Material excavated from the Site requiring treatment will be transferred to this facility or

transferred to a licensed offsite facility for treatment in accordance with applicable regulations and NSW EPA requirements.

Other activities will involve set-up of site offices adjacent to the RE, fencing, decontamination stations, environmental control measures and other associated facilities include:

- Wheel wash zones at the entrance and exit points to the EE and RE;
- Stores, work sheds, lunchrooms and changing areas for the use of subcontractors and consultants;
- Temporary site sheds, first aid and emergency facilities, bathroom facilities and decontamination units, and

Any additional site facilities, to facilitate work in other areas of the Site, or in areas requiring additional safety measures.

The following S-ISCO® related tasks would also be conducted:

- Set-up of injection system and associated equipment;
- Installation of monitoring and injection wells, and soil vapour monitoring points;
- Installation of trenches for the injection system (i.e. as required for Hickson Road);
- Connection of injection wells to the injection system;
- Connection of soil vapour monitoring points to the soil vapour extraction system; and
- Collection of pre-injection monitoring data.

13.3.1 Exclusion Zone

Exclusion Zones are areas of the Site that will be outlined in the occupational health and safety plan (OHSP) that either require additional protective measures or may require the adoption of additional OH&S requirements and work practices. Exclusion Zones may also include other areas affected by emissions from the works being undertaken at any point in time. All Exclusion Zones will incorporate a buffer area along the boundary of the zone.

The boundaries of the Exclusion Zones will be defined by fencing and safety signs erected at regular intervals around each exclusion zone warning of the boundary of the exclusion zone, the nature of the hazard associated with it and access restrictions that apply for entry into the zone. Access of personnel into and out of the Exclusion Zones, will be controlled at a Decontamination Station, and will depend on the personnel classification. The location and extent of Exclusion Zones will be detailed in the OHSP and outlined in the Site-Specific Safety Induction.

The EE, ex situ treatment facility and RE will be nominated as an Exclusion Zone at the Site.

13.4 Site Access and Security

13.4.1 General

Only authorised personnel and equipment will be allowed into the exclusion zones and other areas associated with the remediation works. Access will be strictly controlled throughout the course of the remediation works using the following procedures.

13.4.2 Working Hours

It is anticipated that construction and demobilisation hours would be between the hours of 7am and 6pm Monday to Friday, and 7am to 5pm Saturdays. No construction work would occur on Sundays and Public Holidays.

Operation hours for the excavation activities would be between 7am to 5pm, six days per week. Operation hours for the ECS would be 24 hours per day, seven days a week.

13.4.3 Site Haul Roads & Parking Areas

Existing concreted areas will be utilised as haul roads to the extent practicable. Traffic movements on-site will be directed around areas that are the subject of remediation works.

13.4.4 Site Access

The primary access route to the Site will be either via Hickson Road (to be confirmed as part of the application process and determined as part of the site staging). The entry point will control access to and around the Site during the remediation works.

All site personnel entering and leaving the Remediation works will be required to pass through the clean/dirty zone and the decontamination station.

13.4.5 OHS Signage

Signage will be installed at the site entrance detailing the location of the site offices, Remediation works, decontamination units, first aid facilities and parking. Traffic restrictions will be installed to limit access further into the Site to the north and ensure the safety of site visitors.

Signage at the main gate will include after-hours contact details.

As detailed in **Section 13.3.1**, additional signage will be erected along Exclusion Zone boundaries to restrict access to these areas to authorised personnel only.

13.4.6 Fencing

Security fencing will be established around the remediation works areas. Additional fencing will be erected where necessary to secure portions of the Site.

13.4.7 Control of Site Entry and Exit

Entry to any designated remediation works areas will be controlled through the use of a sign-on/sign-off log system at the main gate. Only authorised personnel will be allowed into the remediation works area.

Personnel will gain access to the remediation works area only after they have:

- Attended and completed a site safety induction briefing (applicable to all site workers and visitors);
- Are wearing all applicable PPE as detailed in the OHSP; and
- Been inducted into the OHSP.

All construction vehicles and delivery vehicles will enter the Site through the nominated main gate.

In the event of an emergency on-site and the need for emergency services personnel to access the site works, the site access process may be expedited. In these situations, which require the need to minimise delays in accessing injured site personnel, prior arrangement will be made for special site access procedures. However, given the nature of the remediation works, all PPE and decontamination protocols will remain in effect at all times.

An Emergency Response Plan will be developed prior to site establishment detailing the specific procedures relating to site emergencies.

14.0 General Remediation Excavation and Materials Management (Ex situ Remediation)

14.1 Background

This section addresses works associated with the excavation of SPGWT and CIM that represents a risk to human health and/or the environment (ex situ remediation works) under either:

- In the case of the VMP Remediation Works, current land uses (refer to **Section 7.1**); and
- In the case of the Block 4 Development Remediation Works, future land uses following the proposed development (refer to **Section 4.0**).

SPGWT and CIM that require treatment will be transferred to the ex situ treatment facility and treated in accordance with the processes outlined in **Section 15.3** and/or **Section 15.4**. If S-ESCO™ is proven to be an effective technology in treating the SPGWT or CIM; this treatment would also be undertaken at the ex situ treatment facility.

Materials requiring treatment may also be transferred to a licensed offsite facility for treatment in accordance with applicable regulations and NSW EPA requirements.

The following general remediation excavation and material management activities are described as part of the following sections:

- Control and minimisation of emissions from the excavation area (refer also to **Section 20.3**);
- Control and treatment of water from the remedial excavations (**Section 14.5** and **Section 17.0**);
- Excavation of the SPGWT and CIM (**Section 14.3** and **Section 14.4**); and
- Loading of excavated materials for transport (**Section 14.7**).

It is noted that any potentially contaminated spoil removed as part of the construction of excavation retention walls required to facilitate excavation works (including the basement groundwater retention wall system required as part of the Block 4 development works) or piling works would also be managed in accordance with this RAP.

14.2 Pre Treatment of Materials

Prior to excavation of materials, some preparation and pre-treatment of material may be necessary as summarised in **Section 14.7.3**.

14.3 Excavation Planning

The materials to be excavated comprise heterogeneous fill materials, soil, bedrock, SPGWT, as well other potential gas works related waste (for example ash). Therefore, prior to commencement of excavations, detailed Excavation Plans will be prepared outlining the anticipated classification of materials and the results of the site investigations. Correlations between field observations (both visual and olfactory) and analytical data will also be used to guide the visual characterisation of fill materials during excavation.

All remediation excavation works will be undertaken in accordance with the following procedures, in sequence:

- Prior to commencement of excavations on each work shift, all necessary environmental, OH&S measures and related equipment will be established and all worker PPE and respiratory controls will be checked to ensure they are in full working order in accordance with the OH&S Management Plans;
- All excavation plant operators, haulage operators and supervisors will be made familiar with the excavation strategy, and all workers will be made aware of their responsibilities prior to the commencement of each shift;
- Stockpile areas will be prepared with adequate capacity to receive the contaminated materials after excavation prior to the commencement of excavation;
- Exclusion zones will be set up around the active remediation works areas and as required;
- All truck haulage roads will be made suitable for transportation and haulage of the excavated materials;

- All haulage trucks will be covered prior to exiting the exclusion zone/excavation area and will be decontaminated at the end of each shift of haulage operations in accordance with the Environmental Management Plan (EMP). All haulage trucks will be fitted with liquid seals which will be inspected daily to ensure their integrity; and

All personnel, vehicles and equipment leaving the excavation enclosure will be properly decontaminated in accordance with the EMP.

14.4 Excavation Operations

Where SPGWT and CIM requiring remediation is identified, excavation operations will commence by the removal of overburden material. The overlying material will be classified based on the available soil analytical data set to determine whether it meets the applicable SSTCs for reuse onsite (refer to **Section 19.5.6**).

Excavations will be regularly inspected by a suitably experienced environmental engineer or scientist to confirm that the visual and olfactory characteristics of the excavated materials are consistent with expectations. These regular inspections will also serve to identify additional hotspots of SPGWT or CIM that may not otherwise have been identified by the previous site investigations.

Odorous materials will be managed as per the requirements of **Section 15.0** and **20.3**.

All excavated CIM will be kept separate from other materials. Depending on the level of contamination in excavated material (relative to the SSTCs for reuse onsite), excavated CIM will be either:

- Designated for reuse within remediated areas (refer to **Section 7.3**);
- transferred to the RE for treatment; or
- removed directly offsite to a licensed landfill facility.

All SPGWT excavated will be similarly kept separate from other materials. All SPGWT will be transferred to the RE for treatment prior to disposal offsite to a licensed landfill facility.

14.5 Dewatering of Excavations

De-watering during the remediation, excavation & construction works will be undertaken for any ex situ remediation works. Management of water and groundwater within excavations will be undertaken in accordance with the procedures outlined in **Section 17.0**.

14.6 Excavation Support

14.6.1 VMP Remediation Works

As part of any bulk earthworks required as part of the VMP Remediation Works, excavation retention walls will be installed around the proposed remediation areas as required to facilitate excavation. The walls will be constructed to a specification which prevents significant groundwater ingress to the proposed remediated areas and prevents the cross contamination of remediated areas from adjacent un-remediated areas. Final wall structure details will be finalised during the detailed design phase of the project so may be subject to adjustment and change.

The excavation retention walls will also be designed with due consideration for: (a) the sequencing/staging of the VMP Remediation Works (across Block 4, Block 5 and Hickson Road); and (b) the final selected remediation strategy. The perimeter walls will connect with the existing ORWS basement groundwater retention wall system as appropriate.

14.6.2 Block 4 Development Remediation Works

As described by **Section 4.3**, a basement groundwater retention wall will be constructed around the perimeter of Block 4 as a precursor to the Block 4 Development Remediation Works. The groundwater retention wall will connect with the existing ORWS basement groundwater retention wall system and will be designed to facilitate excavation within it.

14.6.3 Eastern Site Boundary

While it is proposed to remediate contaminated soil and groundwater within the main gasholder annulus and tar tank on the eastern side of Hickson Road, the position of this underground infrastructure (which may extend

beyond the Site boundary to the east) may result in residual contamination remaining offsite, directly to the east of the Site (refer to **Section 10.3.2**). Consequently, permanent perimeter walls will be installed in areas where there is potential for the future remediated Site to be impacted by potential SPGWT or CIM in the offsite area directly to the east. The wall will be constructed to be resistant to degradation by SPGWT.

14.7 Materials Handling

14.7.1 Background

This section outlines the procedures for materials handling following excavation, specific procedures relating to materials tracking and the required environmental controls.

14.7.2 Materials Tracking

All materials handled during the remediation works will be tracked in order to allow verification of the correct movement and handling. The system will track materials from cradle-to-grave, and will provide detailed information on the location and quantity of all material movements both on and off-site, so that the material being handled can be identified and accounted for. The tracking system shall include accurate tracking of stockpiles throughout the entire material handling stage and will included confirmation of stockpile locations via registered survey. This is to reduce the risk of cross-contamination between stockpiles.

As part of this process, accurate records shall be kept to ensure that backfilling of excavations (where required) and reuse of material only occurs following the successful validation of the subject materials. Plans will be made with respect to the extent of each excavation. A register of all analytical results for stockpiles and excavations will be maintained throughout the validation works.

Standard forms shall be prepared as part of the Materials Tracking Procedure. The forms and their function shall include, but not be limited to:

- **Off-site Transport/Disposal Form** - Providing a record of materials removed from the Site and including the material type, quantity, origin, shipping destination and an approval by the nominated environmental consultant that the material meets the disposal requirements;
- **Imported Fill Form** - Providing a record of materials imported to the Site including the date, material type, quantity, point of origin, intended use and the suitability of the material for use as backfill at the Site;
- **Material Excavation Form** - Providing a record of excavated materials for each excavation on the Site including the date, material type, excavated quantity, origin and intended destination;
- **Material Treatment Form** – Providing a record of material treatment including the date, material type, treatment regime, stockpile of origin and destination stockpile;
- **Material Stockpiling Form** - Provides a record of all materials placed in stockpiles. The form will include the date, material type, stockpiled quantity, origin and intended end use; and
- **Material Placement Form** - This form provides a record of all materials backfilled on the Site and includes the date, material type, quantity backfilled and origin.

Each form shall be completed on a weekly basis and collated into a cumulative log for each process on a weekly basis.

The movement of materials from the Site for reuse within Barangaroo Central will be managed in accordance with the *Reuse Materials Management Plan* to be prepared for the Authority (as recommended by the *Barangaroo Independent Remediation Review Panel Report* (Barangaroo Independent Remediation Review Panel, 2011).

14.7.3 Material Preparation

Excavated materials may require preparation prior to transport to stockpiles and the RE.

Material preparation may include, but not be limited to:

- Mixing of saturated material *in situ* to make the material spadeable prior to excavation. This may be achieved by either mixing with other soils or by addition of fly ash, lime or cement;
- Drainage and drying of saturated excavated materials. This will require installation of appropriate measures to control run off; and

- Screening of material to separate oversize and/or materials suitable for recycling (e.g. steel, concrete footings/historic sea walls, brick and rock fill, timber piles, construction and demolition waste). Physical separation will be achieved by a combination of:
    - Manual separation using excavators fitted with grabs or skeleton buckets; and
    - Power screens.

Odorous materials will be managed as per the requirements of **Section 15.0** and **20.3**.

It is recognised that the proposed approach to material preparation (in particular the addition of lime and or cement) may result in increased volatile emissions and/or odour generation. In consideration of this, where preparation of materials with potential for volatile or odorous emissions is required, the management and mitigation measures described in **Section 15.0** and **20.3** will be implemented. Specific management and mitigation measures may include:

- preparation of materials within an EE (refer to **Section 15.0**);
- minimisation of the quantity or surface area of materials;
- conduct of activities during favourable weather conditions;
- use of surface covers (soil and / or tarps); and/or
- use of odour suppressant sprays or foams (refer **Section 20.3**).

14.7.4 Crushing/Shredding of Materials

The crushing of oversize excavated materials may be necessary to ensure that the excavated materials can either be reused on-site or can be treated.

14.7.5 On-site Transportation of Materials

Materials at the Site will be excavated, handled, moved, treated and stockpiled in a manner designed to minimise exposure to the environment. The following materials handling requirements will be developed for trucks transporting materials within the Site:

- Trucks carrying excavated materials will be covered and decontaminated in the wheel wash facility within the excavation area before exiting the area;
- Trucks will proceed directly to the on-site RE or soil stockpile area, as appropriate, along the predetermined haul roads;
- Trucks carrying contaminated materials will not be permitted to drive over areas of the Site which have previously been excavated, validated or reinstated;
- Trucks carrying contaminated materials will remain covered until authorised to unload within the RE. The trucks will be decontaminated at the RE and the truck body covered before exiting the area;
- Empty trucks will return directly to the excavation are along predetermined haul roads; and
- The validated excavation will be effectively isolated from contaminated areas of the Site by the use of physical means such as the placement of clean material bunds, temporary fences and by use of signage.

14.7.6 Off-site Transportation of Materials

The following materials handling requirements will be developed for trucks transporting materials off the Site:

- Trucks carrying excavated materials will be covered and decontaminated in the wheel wash facility before exiting the excavation area and exiting the Site;
- Trucks carrying contaminated materials will be covered prior to exiting the Site and will remain covered until authorised to unload at the destination;
- Trucks will be fitted with seals to ensure that the movement of potentially saturated materials is undertaken appropriately. The integrity of the seals will be inspected and tested prior to commencement of each day's haulage works;
- Trucks will not wait in the streets surrounding the Site or within the CBD; and

- Trucks will exit the Site through predetermined exit points on Hickson Road and will follow a predetermined transport route to the destination (landfill or other) via Sussex Street, Anzac Bridge and the City West Link or across the Harbour Bridge.

14.7.7 Stockpiling of Materials

14.7.7.1 Stockpile Locations

Treated and validated soil materials will be stockpiled within a designated stockpile area. The stockpiled soil will then be transported directly from the stockpile area to the remediated areas for placement and compaction as backfill (as appropriate) or removed offsite to a licensed landfill facility. The location of stockpiles will be confirmed via registered survey as part of the Materials Tracking System.

Where possible and if required, further *in situ* testing of material may be undertaken prior to excavation, to pre-classify materials and minimise interim stockpiling requirements.

14.7.7.2 Stockpile Area Preparation

During site establishment, stockpile areas will be prepared using the following methods:

- Noting that the majority of the Barangaroo Stage 1b Development site is covered by an existing hardstand surface, works will be undertaken initially to clear the area of rubbish, rubble, infrastructure and vegetation;
- Diversion drains and bunds will be constructed around the perimeter of the stockpile areas. Additional sediment and erosion control measures including silt fencing and hay bales will be installed where necessary (refer to **Section 17.1**);
- Signs will be erected at the entrance to the stockpile area and at locations around the stockpile specifying individual stockpile numbers and the type of materials stored; and
- Buffer zones will be established around each stockpile area to enable access to the stockpiles and minimise impacts of the stockpile area on the surrounding facilities.

14.7.7.3 Stockpile Construction and Maintenance

The drainage, sediment and erosion control measures installed within stockpiling areas at the commencement of the project will be maintained, repaired and replaced where necessary for the duration of the stockpiling activities.

Where necessary, all long term soil stockpiles on-site will be covered or stabilised with spray grass seeding or other suitable measures to reduce dust generation and erosion.

Measures will be taken to reduce the generation of dust from stockpiles through the use of wetting and covers (refer to **Section 20.3**). Run-off will be managed by the use of surface bunding, silt fences and drainage diversions (refer to **Section 17.1**).

If stockpiling of SPGWT or odorous CIM is required, the stockpiles will be managed as follows:

- The SPGWT will be stockpiled separately to all other materials and clearly identified with signage;
- If required, odour suppressant sprays or foams will be sprayed onto stockpile surfaces to mitigate odours during construction of the stockpile;
- The SPGWT will be securely covered with a high density polyethylene (HDPE) liner and surface water controls will be constructed around the perimeter (as required for all stockpiled materials); and
- Daily monitoring of the SPGWT stockpile will be undertaken and will include qualitative assessment of odour around the perimeter of the stockpile.

All stockpiles will be maintained in a tidy and safe condition with stable batter slopes.

14.7.8 Classification of Treated Materials

Following treatment of materials within the RE, materials will be classified for off-site disposal in accordance with the DECCW (2009) *Waste Classification Guidelines* and the requirements of the Immobilisation Approval (if any, refer to **Section 14.7.10**).

14.7.9 Classification for On-site Reuse

Stockpiled and treated material will be assessed for its suitability for reuse on-site by collection of representative samples and chemical analysis for the relevant CoPC (refer to **Section 19.6**).

Where possible/practicable, *in situ* testing of material may be undertaken prior to excavation, to pre-classify materials directly for on-site reuse and minimise stockpiling requirements.

The analytical results will be assessed against the relevant SSTCs referenced by this RAP, for materials to be reused (refer to **Section 7.3**).

14.7.10 Waste Classification for Off-site Disposal

Materials deemed not suitable for reuse at the Site (refer to **Section 7.3**) will be assessed for off-site disposal in accordance with the DECCW (2009) *Waste Classification Guidelines* or Part 4 of those guidelines in the case of potential acid sulphate soils (PASS) and acid sulphate soils (ASS).

If required, *in situ* testing of material may be undertaken prior to excavation, to pre-classify materials directly for off-site disposal and minimise stockpiling requirements. If treatment of excavated material is required to facilitate offsite disposal, an Immobilisation Approval will be sought from the NSW EPA prior to offsite disposal.

14.8 Management of Asbestos Containing Materials

Based on information obtained during the ORWS bulk excavation works (located directly south of the Site) the identification of ACM during ex situ remediation excavation works is considered probable. Consequently, ACM impacted material will be managed in accordance with an Asbestos Management Plan (refer to **Section 1.7** and **13.1.3**).

Identified ACM which requires removal under the Asbestos Management Plan will be collected and disposed of by a licensed Asbestos Removal Contractor (ARC) in accordance with the requirements of the following:

- *NSW Work Health and Safety Act* 2011;
- *NSW Work Health and Safety Regulation* 2011;
- *Code of Practice: How to Safely Remove Asbestos,* Safe Work Australia 2011; and
- *Code of Practice: How to manage and control asbestos in the workplace,* Safe Work Australia 2011.

The ACM removal works, where required by the Asbestos Management Plan, would be undertaken as follows:

- The remediation contractor would establish appropriate barriers and signage around the area where ACM has been identified;
- The ACM will be suitably removed from the Site by an ARC;
- Airborne asbestos fibre monitoring will be undertaken around the working area during the works to confirm that the ACM is being removed in an appropriately controlled manner;
- Validation soil samples will be collected at 10 m lineal intervals along the walls and base of any identified ACM impacted excavation areas and analysed for asbestos. Should the soils beneath the ACM be impacted with asbestos fibres, the impacted soils will be excavated for appropriate off-site disposal; and
- An ARC will conduct a visual inspection of the affected area to confirm that it is free of all visible ACM fragments. A clearance certificate will be prepared to document these works.

If ACM is encountered and removed during the remediation works, residual soils must not contain asbestos (bonded or otherwise) as determined by the following:

- A visual inspection of the remediated area to confirm the removal of all visible ACM fragments; and
- No detection of asbestos in samples collected from the residual soils and submitted for analysis.

The requirements for validation of materials to remain *in situ* below the proposed Block 4 basement are described by **Section 19.5.3**. The additional works (including over-excavation if required) for management of ACM identified in residual soils for the protection of construction workers will be determined by the Asbestos Management Plan.

The requirements for validation of materials in the base of excavations completed as part of the VMP Remediation Works are described by **Section 19.5.1**. The additional works required (if any) for management of ACM for the protection of construction workers will be determined by the Asbestos Management Plan.

The Asbestos Management Plan and any associated ACM removal works will include consideration of construction worker protection and the following independent report commissioned and endorsed by the NSW EPA:

- Associate Professor Tim Driscoll, Sydney School of Public Health, Sydney Medical School, University of Sydney (March 2013). *The Use of Asbestos-Contaminated Soils on Barangaroo, Report to the Environment Protection Authority.*

14.9 Material Fate

14.9.1 Recycling

The remediation contractor will endeavour to maximise recycling of all excavated materials to the extent practicable. Where practicable, materials won from the screening of excavated materials will be assessed for their recycling suitability as follows:

- Steel materials will be transported to appropriate off-site steel recyclers;
- Concrete, brick and rock may be crushed to create fill for use in other areas of the development (as required) and for construction of haul roads or recycled off-site; and
- Timber will be recycled off-site, where possible.

14.9.2 Reuse of Materials On-Site

Materials deemed suitable for reuse on-site will be either stockpiled for future use or used directly (refer to **Section 7.3**).

14.9.3 Reinstatement

Where material is used for reinstatement purposes (as part of the VMP Remediation Works), it will be placed in accordance with specific geotechnical requirements which will be dependent on the area of reinstatement.

14.9.4 General Solid Waste

If off-site disposal is required, materials classified as General Solid Waste in accordance with the DECCW (2009) *Waste Classification Guidelines* will be transported off-site and disposed of at a landfill licensed to accept General Solid Waste.

14.9.5 Restricted Solid Waste

If off-site disposal is required, materials classified as Restricted Solid Waste in accordance with the DECCW (2009) *Waste Classification Guidelines* will be transported off-site and disposed of at a landfill licensed to accept Restricted Solid Waste.

If treatment of excavated material is required to facilitate offsite disposal, an Immobilisation Approval will be sought from the NSW EPA prior to off-site disposal.

15.0 Ex situ Remediation

In addition to the general excavation and materials management outlined in **Section 14.0**, any works related to the treatment of SPGWT and/or CIM at the Site will be subject to particular controls due to the nature of the contamination.

This section outlines the proposed additional controls that will be implemented to manage materials that require treatment at the Site as well as outlining the proposed methodology.

15.1 Excavation Enclosure and Emissions Control System

Part of the proposed odour management system for works will include a Remediation Enclosure (RE) for an onsite treatment area and, if required, an Excavation Enclosure (EE). An Emissions Control System (ECS) will be used to manage volatile emissions within both the RE and EE (if required). An EE may be used, where practical, during excavation of particularly odorous areas or areas where it is anticipated that fugitive emissions will be significant.

Given the potentially odorous nature of the materials to be excavated at the Site, significant SPGWT/CIM excavation works will be undertaken within an EE, where practical. The purpose of the EE will be to mitigate, to the extent practical, uncontrolled emissions during excavation and truck loading processes and to ensure these emissions are vented to atmosphere through an ECS.

It is noted that an EE may not be practical in all excavation areas, particularly in areas where CIM may have been identified in a series of discontinuous hotspots. In the event that an EE is not considered practical, additional, alternative rigorous odour control measures will be implemented as described by **Section 15.2**.

Operation of the EE and associated ECS will be in accordance with operation and maintenance management systems developed on completion of the final design of the system. An overview of the controls to be designed into the system is provided below.

- The EE will be a temporary structure that can be erected over relevant parts of the SPGWT / CIM excavation area. The final design of the EE will be developed prior to the start of the remediation works. The structure is likely to include a negative pressure working enclosure with an air-lock doorway and an air extraction system for the control of odours and diesel exhaust;
- Where practical, excavations for remediation of identified SPGWT / CIM will be undertaken within the EE. Excavated material will be placed into temporary stockpiles within the EE by use of tracked excavator and a rubber tyred loader prior to be hauled to the RE for treatment (as required). The structure will be equipped with personnel entrances and a truck entrance. The truck entrance will comprise an automated door to minimise any impact on negative air pressure whilst the truck exits and enters the EE. The negative air pressure will be maintained for the duration of the excavation works;
- The ECS for the EE and RE will consist of a ductwork system, induced draft fan, particulate control device, activated carbon adsorption system and stack. The ECS would be designed with sufficient capacity to provide a safe working environment within the EE and RE. The ductwork system will consist of a central header that will be suspended along the centreline of the EE and RE. There will be hoods located along the length of the header;
- The air exhausted from the EE and RE will first pass through a particulate control device (bag-house or pleated paper filter system) to remove fugitive dust. The particulate control system will include a system to remove particulates from the filter media. Dust removed will be collected in enclosed drums or hoppers;
- After the exhaust gas exits the particulate filter, it will pass through an activated carbon adsorption system;
- The activated carbon system will be equipped with a number of monitoring ports;
- A monitoring protocol will be developed for the various ports along the activated carbon adsorption system. This protocol will form the basis for deciding when activated carbon beds need to be replaced. Air would be exhausted to the atmosphere via a stack; and
- Emissions from the ECS stack will be required to be licensed as part of the EPL for the Barangaroo site (refer to **Section 13.1.2** and **Appendix E**).

15.2 Excavation Operations

To the extent practical, excavation of SPGWT / CIM will be conducted within an EE with an associated ECS. As above, the plant operating within the EE is likely to comprise a tracked excavator and a loader for excavation, interim stockpiling and truck loading purposes.

Excavation operations will commence by the removal of the overburden material (if present). The overburden material will be classified based on the available analytical data to determine whether it meets the SSTCs for reuse.

The management of odours is recognised as a critical aspect of the management of the proposed remediation works. Based on the results of historical investigations at the Site, it is considered likely that odorous materials will be encountered across much of the Site.

Specific management and mitigation measures for odorous materials may include (refer to **Section 20.3**):

- excavation within an EE (refer to **Section 15.1**);
- minimisation of the quantity or surface area of exposed odorous materials;
- covering of exposed odorous materials progressively or at the completion of each work period;
- conduct of activities during favourable weather conditions; and/or
- the use of odour suppressant sprays or foams.

Selection of the appropriate management and mitigation measures will be based on consideration of:

- the quantity of odorous materials that require remediation;
- the duration of the required remediation works;
- the proximity of the proposed remediation works to sensitive receptors;
- the prevailing and forecast weather conditions; and/or
- other activities being undertaken at the Site in parallel with the remediation work.

As above, it is noted that an EE may not be practical in all excavation areas where odorous materials are encountered; for example, in areas where CIM has been identified in a series of discontinuous hotspots. In the event that an EE is not practical, additional and/or alternative rigorous odour control measures will be implemented over and above the environment control measures provided during excavation of non-odorous materials. As described above, additional measures may include: minimisation of exposed excavation surfaces, limiting excavation to favourable weather conditions; and the use of odour suppressants and covers (refer to **Section 20.3** for further details).

Anchors which extend into the Site have been constructed to support the ORWS groundwater basement retention wall system and which is present at the southern end of Block 4. These anchors are temporary in nature and are programmed to be destressed following construction of sufficient structural works in the adjacent ORWS basement (scheduled for early 2014). It is proposed that the Block 4 excavation works in areas where the anchors are present would only occur after the anchors have been distressed and are no longer required (and would not constrain Block 4 excavation works).

15.3 Ex situ Treatment - Stabilisation

15.3.1 Background

As detailed in **Section 10.5**, ex situ stabilisation is one of the preferred remedial technologies for ex situ treatment of SPGWT / CIM which requires treatment prior its offsite disposal.

This section describes the methodologies to be employed for preparing and treating the nominated materials using ex situ stabilisation onsite. Materials requiring treatment may also be treated at an offsite licensed facility in accordance with applicable regulations and NSW EPA requirements.

The suitability of ex situ stabilisation was assessed by a treatability study undertaken by EnviroPacific Services (2010) (refer to **Section 10.5**).

15.3.2 Pre-Treatment of Materials

The pre-treatment of SPGWT / CIM, if required, will be undertaken in two stages.

- Initially, the excavated material may be blended at the excavation face to make the material 'spadeable' (as detailed in **Section 14.7.3**); and
- SPGWT / CIM requiring treatment will be transported to the RE, where further screening and testing of this material will take place.

The SPGWT / CIM will be stockpiled in the RE using a front end loader before undergoing secondary screening through a screen to achieve a grade of 40 mm minus. This is the minimum size requirement for material to feed into a pug mill. All screened overburden material will be set aside into type for potential crushing/recycling. The screening of the contaminated material will achieve a relatively homogenous feed material prior to being loaded into the feed hopper of the pug mill and minimise the quantity of material which requires treatment.

15.3.3 Remediation Enclosure and Emission Control System

The ex situ stabilisation equipment will be enclosed within a RE. The purpose of the RE is to control emissions during remediation treatment activities and ensure these emissions are vented to atmosphere through an ECS. Operation of the RE and associated ECS will be in accordance with operation and maintenance management systems developed on completion of the final design of the system. An overview of the controls to be designed into the system is provided below.

- The RE will be a clear span shed constructed of a steel frame with metal sheeting (or equivalent). The building will be sized to contain the powerscreen and pugmill and have sufficient room for truck access, machinery and stockpiles. It will include doors, lights, electrical, adjustable louvers and other ancillary facilities that are required for safe and efficient operation.
- The building will contain approximately a 2-3 day working inventory of feed soil plus a sufficient buffer for soil curing and other pre-treatment activities. This inventory volume is designed to provide adequate storage capacity to feed the treatment plant during periods when unforeseen conditions interfere with normal excavation activities.
- ECS will consist of a ductwork system, induced draft fan, particulate control device, activated carbon adsorption system and stack. The ECS would be designed with sufficient capacity to provide a safe working environment within the RE. The ductwork system will consist of a central header that will be suspended along the centreline of the RE. There will be hoods located along the length of the header.
- The final design of the RE will be developed prior to the start of the remediation works. The structure is likely to include a negative pressure working enclosure with an air-lock doorway and an air extraction system for the control of odours and diesel exhaust.
- The air exhausted from the RE will first pass through a particulate control device (bag-house or pleated paper filter system) to remove fugitive dust. The particulate control system will include a system to remove particulates from the filter media. Dust removed will be collected in enclosed drums or hoppers.
- After the exhaust gas exits the particulate filter, it will pass through an activated carbon adsorption system. The activated carbon system will be equipped with a number of monitoring ports. A monitoring protocol will be developed for the various ports along the activated carbon adsorption system. This protocol will form the basis for deciding when activated carbon beds need to be replaced. Air would be exhausted to the atmosphere via a stack.
- The ECS for the RE will operate in the same way as the system for the EE, as described in **Section 15.1**.

15.3.4 Pug Mill Treatment Plant

Ex situ stabilisation of SPGWT / CIM during the full scale remediation phase is intended to be accomplished by using a pugmill fed by a loader/excavator. The nature and quantity of agents used for stabilisation was the subject of a stabilisation trial (refer to **Section 10.5**).

The pugmill mixing chamber and computer controlled weight cells will allow the complete mixing of the additives with the soil matrix. A pugmill has been selected in recognition that the NSW EPA prefers aggressive mixing techniques (such as a pugmill) because they provide for complete mixing of the materials.

Analytical results will be used to demonstrate that the treated material is suitable for disposal to an appropriately licensed off-site landfill (in accordance with the NSW EPA (2009) *Waste Classification Guidelines*).

Pug mill plants typically have a rated capacity of 600-1,000 tons per hour. This rate will vary depending on the physical properties of the soil, amount and type of additive, and the desired production rate.

The type of treatment plant will be based on the final design by the treatment contractor. Below is a description of the potential major components that may comprise a plant system.

Self-erecting Silo

The silo is filled pneumatically from bulk tankers. Additives such as cement, fly ash, lime and bentonite are blown into the silo.

The silo is equipped with a dust control system.

Material feed hopper

This hopper is fed with the soil(s) to be processed. It may be divided so as to accommodate two types of soil or aggregate. The hopper and may be fed one of three ways. First, a front-end loader can feed the hopper directly by building a ramp perpendicular to the hopper. Second, material may be conveyed into the hopper. Third, a screen can process directly into the hopper.

Twin shaft paddle pugmill

The pugmill is designed to achieve a violent mixing action throughout its length resulting in a well-mixed homogeneous product. This type of mixing, with no slump or low moisture products, is more effective than a drum type mixer that merely folds the product.

Hydrostatic cleated belt additive feeder

The additive is fed to the pugmill at the beginning of the mixing operation by means of the computer controlled cleated belt. Accuracies of better than plus/minus 2% of the design proportioning of the additive are achieved.

Water tank

The water requirement is determined by the mix design and the native water in the material to be mixed. Water is fed from an outside source into the plant's onboard water tanks. This water is fed at the design rate into the mixing chamber by two hydraulic pumps which are computer controlled.

Discharge belt

The mixed product is discharged from the pugmill on this conveyor belt. The finished product is continuously and cumulatively weighted on a Ramsey belt scale.

Gob Hopper

The gob hopper is utilized to interrupt the continuous flow of mixed material allowing trucks to enter and exit the loading area. If trucks are used to transport the mixed material away from the plant, the direction of travel of the trucks should be with the driver's side closest to the plant so that he/she may see the plant operator. The gob hopper maybe left open continuously so that a conveyor may be used to remove the finished product from the mixing plant.

Particulate Additive

Fine particulate additives such as cement, fly ash, lime and bentonite are pneumatically transferred from bulk tankers and stored in the self-erecting silo. If more than one type of additive is required, an optional self-erecting auxiliary silo may be set up next to the plant. The silos are equipped with negative pressure dust control systems, which filter and evacuate the pressurized air entering the silo. This process maintains constant silo pressure so as not to affect the consistency of the feeder.

Mixing Chamber

All ingredients enter simultaneously at the beginning of the mixing chamber allowing them maximum mixing time. The mixing chamber houses an interlaced twin shaft variable speed paddle pugmill designed to achieve a violent mixing action throughout its length resulting in a well-mixed homogeneous product. This type of mixing, with no slump or low moisture products, is greatly more effective and efficient than a drum type mixer that merely folds the product.

Control System

The Programmable Logic Controller and colour active matrix Operator Interface is directed by control software. Designed for harsh industrial environments, this versatile and reliable system has extensive self-diagnostics and is completely modular, making diagnosing and repairing problems as easy as plugging in a new module.

The software provides fully automated plant control and monitoring of all plant systems including engine, flow meters, sensors and switches. Displays indicate all flow rates, set points, feeder speeds, totals and status of all feeds and processes. All critical mechanical systems are monitored to alleviate damage and prevent down time. Inventory of fine particulate and admixture are computed and tracked.

15.3.5 Treated Soil

The RE will have a base capacity to stockpile between 2-3 days of treated soils from the pug mill. Treated materials stored in this area will undergo validation testing and classification to determine whether the treatment process has been effective. Materials that have not been treated to an acceptable level will be retreated.

Stockpiles would be then moved outside of the RE to a main stockpile area. Where required, stockpiles will be covered with suitable material or wetted to control dust.

15.4 Ex situ Treatment - Surfactant Enhanced Ex situ Chemical Oxidation (S-ESCO™)

15.4.1 Background

As detailed in **Section 11.0**, surfactant enhanced ex situ chemical oxidation (S-ESCO™) is an alternative treatment technology of SPGWT / CIM for excavated material, which may be adopted for treatment of material prior to landfill disposal (where required).

This section describes the methodologies to be employed for preparing and treating the nominated materials using S-ESCO™.

The suitability of S-ESCO™ was assessed by a bench scale treatability trial undertaken by VeruTEK (2011) (refer to **Section 10.4**).

15.4.2 Pre-treatment of Materials

The pre-treatment of CIM, if required as a precursor to S-ESCO™ would be as described for ex situ stabilisation in **Section 15.3.2**.

15.4.3 Remediation Enclosure (RE) and Emission Control System (ECS)

As for the ex situ stabilisation option, the S-ESCO™ ex situ treatment equipment will be enclosed within a RE that will control emissions during remediation the treatment and ensure that these emissions are vented to atmosphere through an ECS.

The design and operation of the RE and ECS for S-ESCO™ will be generally as described for ex situ stabilisation in **Section 15.3.2.**

15.4.4 Treatment Plant

As for the ex situ stabilisation treatment option, S-ESCO™ treatment will be affected using a pugmill.

The design and operation of the pugmill is expected to be generally similar to that described in **Section 15.3.2** for ex situ stabilisation with the exception that additives (surfactants, oxidants and catalysts) will be dosed in liquid form using specially designed injection equipment.

The rate of chemical dosing will be adjusted to accommodate variations in the feed material quality and contaminant concentration.

15.4.5 Treated Soil

Soil treated by S-ESCO™ will be generally managed in accordance with the procedures described in **Section 15.3.2** for ex situ stabilisation.

16.0 In situ Remediation (S-ISCO® and SEPR™)

As described by **Section 11.2** and **11.4**, S-ISCO® (and SEPR™) is considered to be the preferred remediation approach for SPGWT / CIM requiring remediation in Block 5 and Hickson Road.

The suitability of S-ISCO® and SEPR™ were considered by the bench scale trial summarised in **Section 10.4**. Selection of S-ISCO® and SEPR™ as the preferred remediation approach will be subject to the outcomes of an onsite Pilot Trial. The findings of the Pilot Trial and the resultant preferred remediation strategy will be detailed in the S-ISCO® and SEPR™ Pilot Trial Report (refer to **Section 13.1.3**).

S-ISCO® (and SEPR™) may also be considered for remediation of SPGWT / CIM requiring remediation in Block 4 as an alternative approach to ex situ treatment. Any proposed use of S-ISCO® (and SEPR™) in Block 4 would be dependent on the future development requirements, the outcome of the Proving Phase and/or the Pilot Trial and agreement with the NSW EPA Accredited Site Auditor.

16.1 Proving Phase

A Proving Phase is proposed in a portion of Block 4 (i.e. the BH55 area) to demonstrate the efficacy of S-ISCO® and SEPR™ as a remediation approach in the Declaration Area and as a precursor to the Pilot Trial described by **Section 16.2**.

16.1.1 Objectives

The objective of the Proving Phase is to demonstrate that the combined S-ISCO® and SEPR™ treatment process can remediate the gasworks related contamination within the Proving Trial treatment area to meet the risk-based criteria developed by the *VMP HHERA* (AECOM, 2012c, refer to **Section 7.1.2**) for both soil and groundwater in the Declaration Area. Specifically, the Proving Phase will:

- Evaluate the effectiveness of the S-ISCO® and SEPR™ remedy to reduce CoPC concentrations in the soil within the Proving Trial treatment area;
- Evaluate the effectiveness of the S-ISCO® and SEPR™ remedy to reduce CoPC concentrations in groundwater within the Proving Trial treatment area;
- Acquire data to inform the optimal design of further S-ISCO® and SEPR™ Pilot Trials; and
- Evaluate environmental impacts resulting from implementation of the S-ISCO® and SEPR™ treatment process within the Proving Trial treatment area.

16.1.2 Scope of Work

The Proving Phase will be undertaken by VeruTEK. It is proposed that the Proving Phase will be undertaken as follows:

- Early works:
  - Well installation (2 clustered injection wells, 1 extraction well, 7 monitoring wells, 2 soil vapour monitoring points);
  - Collection of baseline soil & groundwater samples; and
  - Baseline environment monitoring.
- Mobilisation:
  - System compound establishment;
  - Equipment & chemical delivery;
  - SEPR™ injection & extraction system set-up, including the soil vapour extraction (SVE) system; and
  - S-ISCO® injection system set-up.
- SEPR™:
  - Injections & extraction. Specifically, injections will comprise:

  - a proprietary blend of plant-based surfactants and co-solvents (VeruSOL) designed to form weak emulsions with NAPL to enable ready separation of SPGWT from extracted groundwater following recovery; and
  - hydrogen peroxide at concentrations of between 2 and 4%;
- Treatment of extracted fluid; and
- Groundwater and soil vapour monitoring.

- S-ISCO®:
  - S-ISCO® injections with sodium persulfate and S-ISCO® injections with hydrogen peroxide. The S-ISCO® portion of the treatment will consist of injections of VeruSOL and alkaline-activated sodium persulfate, followed by injections of VeruSOL and peroxide activated by VeruTEK's patented Green Nano Activation; and
  - Groundwater and soil vapour monitoring.
- Post-injection Monitoring:
  - One week of daily monitoring, followed by weekly monitoring;
  - Collection of interim soil & groundwater samples after 2 weeks;
  - Optional contingency injections (up to 3 weeks);
  - Collection of final soil and groundwater samples when the S-ISCO® chemistry has completed reactions in the subsurface; and
  - Site demobilisation.
- Validation reporting.

16.1.3 Evaluation of Proving Phase Success

A *S-ISCO® and SEPR™ Proving Phase SAQP* (AECOM, 2013a) has been prepared to document the criteria against which success of the Proving Phase will be assessed. The Proving Phase success criteria will be based on the VMP Remediation Goals detailed in **Section 7.1.4**.

At the time this RAP was prepared, the Proving Phase had been completed and a separate report describing the results of the Proving Phase was being prepared. Final evaluation of the Proving Phase results will inform a decision to proceed with or optimise design of further Pilot Trials (refer to **Section 16.2**). If the S-ISCO® and SEPR™ treatment approach is not preferred in all or parts of Block 5 or Hickson Rd, the ex situ remediation approach (as described by **Section 15.0**) will be implemented as described by this RAP.

16.2 Pilot Trial

If the Proving Phase is demonstrated to be successful, a Pilot Trial is proposed demonstrate the efficacy of S-ISCO® and SEPR™ as a remediation approach in Block 5 and Hickson Road. As above, selection of S-ISCO® and SEPR™ as the preferred remediation approach will be subject to the outcomes of an onsite Pilot Trial.

16.2.1 Objectives

The objectives of the proposed Pilot Trial are:

- Field verification of the effectiveness of S-ISCO® and SEPR™ at achieving SPGWT removal and reducing contaminant concentrations in soil and groundwater to achieve the Remediation Goals at the Site and in the context of the actual physical and chemical conditions at the Site;
- Demonstrate that S-ISCO® and SEPR™ can be implemented at the Site without impact to sensitive receptors including Darling Harbour and the basements of adjacent buildings;
- Acquiring data for design of the full scale implementation (if appropriate);
- Evaluate the effectiveness of risk mitigation measures implemented to control chemical migration and volatile emissions from the trial; and

- Evaluation the effectiveness of proposes, performance and groundwater monitoring programs.

16.2.2 Scope of Work

The Pilot Trial will be undertaken by VeruTEK. It is proposed that the Pilot Trial will be undertaken in two parts:

- A S-ISCO® Pilot Trial at a location within Block 5 that is:
  - representative of typical contaminant and lithological conditions,
  - is proximate to utilities and Hickson Road, and
  - is away from Darling Harbour.
- A SEPR™ and S-ISCO® Pilot Trial within the historic tar tank located below Hickson Road. This location was selected as it:
  - Contains material that is considered to be representative of SPGWT contamination;
  - It is a semi confined / confined structure; and
  - It is proximate to adjacent basements.

The scope of the Pilot Trial is described by the *S-ISCO® and SEPR™ Revised Work Plan and Trial Management Plan* (WPTMP, VeruTEK, 2011). The *Pilot Trial WPTMP* has been reviewed and accepted by the NSW EPA Accredited Auditor and the NSW EPA. It should be noted that the *Pilot Trial WPTMP* may be revised based on the outcomes of the Proving Phase (refer to **Section 16.1**).

In summary:

- Block 5:
  - Primary Phase S-ISCO® (6 weeks) using VeruSOL-3® (as the surfactant); hydrogen peroxide (as the oxidant) and iron-tetra-amido macrocyclic ligand (Fe-TAML, as the catalyst);
  - Secondary Phase S-ISCO® (2 weeks) using VeruSOL-3® (as the surfactant, sodium persulfate (as the oxidant), and high pH (using sodium hydroxide as the catalyst); and
  - Process, performance, groundwater and environmental monitoring (surface water quality, air quality and noise and vibration).
- Hickson Road:
  - Primary Phase SEPR™ (2 weeks) using VeruSOL-3® (as the surfactant); hydrogen peroxide (as the oxidant) and extraction of the emulsified tar (and injected chemicals);
  - Secondary Phase S-ISCO® (4 weeks) using VeruSOL-3® (as the surfactant); hydrogen peroxide (as the oxidant) and Fe-TAML (as the catalyst); and
  - Process, performance, groundwater and environmental monitoring (surface water quality, air quality and noise and vibration).

16.2.3 Evaluation of Pilot Trial Success

The success of the Pilot Trial will be independently assessed by AECOM (and other stakeholders including the Authority and EPA) against the following criteria:

- Block 5:
  - Post injection soil analysis results are less than the SSTCs described by the *VMP HHERA*; or
  - There is a trend in reducing contaminant concentrations in soil and groundwater that can be extrapolated to demonstrate that S-ISCO® can achieve the Remediation Goals.
- Hickson Road:
  - Emulsified tar is present in extracted SEPR™ fluids (based on visual inspection and analytical results); and
  - The estimated reduction in contaminant mass in the tar tank is approximately 25% based on the post-injection sampling regime described by the revised WPTMP (VeruTEK, 2011); or

- There is a trend in mass reduction that can be extrapolated to demonstrate that SEPR™ / S-ISCO® can achieve the target mass reduction of at least 25%.

- General objectives applying to both Pilot Trial locations:
  - Demonstrate control of injection front in accordance with the parameters described by the Pilot Trial WPTMP;
  - Confirm that the Pilot Trial does not result in any unexpected / uncontrolled by-products; and
  - Confirm that environmental monitoring results demonstrate low impact to the environment and community.

At the completion of the Pilot Trial, and prior to full-scale remediation, a S-ISCO® and SEPR™ Pilot Trial Report (refer to **Section 13.1.3**) will be prepared and issued to the NSW EPA and NSW EPA Accredited Site Auditor for their review, to confirm if any modifications to the preferred remediation strategy are required.

16.2.4 Independent Review of Revised WPTMP

It is noted that the City of Sydney (2011) and the Barangaroo Independent Remediation Review Panel (2011) have reviewed the *S-ISCO® and SEPR™ Revised WPTMP* (VeruTEK, 2011). Comments from this review process were considered and incorporated into the document as appropriate.

16.3 Full Scale S-ISCO® and SEPR™ Treatment Process

S-ISCO® is an innovative technology which has successfully been implemented at former gas works sites. The key design considerations are: which surfactants and oxidants work best in combination; whether they should be added simultaneously or in sequence; and, what conditions, such as might be provided by the addition of a catalyst, will enhance the reaction.

The Block 5 and Hickson Road S-ISCO® works are likely to be implemented with the following phases:

- Preparation of the S-ISCO® and SEPR™ Detailed Work Plan (refer to **Section 13.1.3**). The S-ISCO® and SEPR™ Detailed Work Plan will describe the processes to be implemented during the S-ISCO® and SEPR™ treatment process including:
  - the enabling works requried to facilitate full scale S-ISCO® and SEPR™ treatment works;
  - the design and operation of the injection system;
  - the design and operation of the soil vapour extraction system;
  - the monitoring program (including process monitoring, performance monitoring, soil and groundwater monitoring and soil vapour monitoring); and
  - the plans and procedures to be implemented for the protection of human health and the environment.
- Mobilisation and set-up, including installation of the following on site:
  - A treatment compound incorporating reagent storage, injection pumps, safety shower and eyewash stations and extraction pumps;
  - monitoring wells; and
  - soil vapour extraction systems.
- Pre-injection baseline monitoring;
- S-ISCO® and SEPR™ injections/extractions (as appropriate);
- Process and performance monitoring during the course of the post-injection performance monitoring; and
- Reporting.

16.3.1 Treatment Compound

A treatment compound will be established to house the infrastructure required to support the S-ISCO® implementation. The treatment compound will incorporate:

- Site office;

- On-site laboratory;
- Storage for dilute and pure surfactant,
- Storage for oxidant - peroxide;
- Storage for oxidant - persulfate solid and solution;
- Storage for catalyst;
- Batching equipment for making up the required oxidant solutions;
- Soil vapour extraction (SVE) / multiphase extraction (MPE) systems;
- Injection system;
- Waste storage facilities; and
- Safety shower/eyewash station.

Chemical storage tanks required in support of S-ISCO® will be located within a lined containment bund. Areas used to contain and treat (as appropriate) liquid wastes including fluid extracted as part of the SEPR™ process and potentially contaminated surface water will be similarly contained within lined containment bunds. Containment bunds will be designed in accordance with the requirements of NSW DECCW (2007) *Storing and Handling Liquids: A guide to managing environmental risks associated with the storage and handling of liquid substances.*

The Treatment Compound and the equipment contained within it will be secured and locked to minimise the risk of vandalism. All equipment will be chemically compatible with the required oxidants, surfactants and catalysts. Chemical storage containers and equipment will be inspected on a regular basis to confirm their integrity.

Prior to injection, chemicals will be batched to create stock solutions that will be added to the water stream that will be injected at the well heads. The batching will be conducted within the bermed areas of the Treatment Compound. Where batching operations will require use of dry chemicals (for example, in the case of sodium persulfate) the operations will be undertaken with appropriate enclosures to prevent the dispersion of dust. Personnel conducting the batching operations will wear appropriate personnel protective equipment (PPE) including respiratory protection as required.

Surfactants, oxidants and catalyst will be dosed using high accuracy metering pumps placed directly into the water feed line leading to the injection wells.

A SVE/MPE system for use in the SEPR™ phase of treatment (principally in Hickson Road) will also be located within the Treatment Compound. This system will include a liquid ring pump that will be used primarily to extract the SEPR™ fluid generated during treatment in Hickson Road, but will also be able to be mobilised at additional wells as a mitigation and contingency measure. During set-up, the wells for use in extraction will be connected to the extraction system. The extracted fluid will be collected and carefully measured.

16.3.2 Enabling Works

From the injection system within the treatment compound, the combined chemical feed stream will travel through PVC pipe located:

- above ground to injection wells located within Block 5 (or Block 4); or
- within a below ground trench network to injection wells located within Hickson Road.

The below ground trench network within Hickson Road will be constructed such that traffic flow within Hickson Road can continue during the full scale S-ISCO® and SEPR™ treatment works. The trench network will contain:

- the injection lines, conveying the surfactant and oxidant to injection wells;
- the lines connecting monitoring wells to the MPE pump (to enable extraction of SEPR™ fluid or in the case of contingency actions); and
- the lines connecting the soil vapour monitoring points to the SVE system.

Where the trenches are located in trafficable areas (including both vehicle and pedestrian traffic) they will be backfilled to grade and finished with asphalt (or equivalent) to remove any potential tripping hazards or obstructions to users of the road or footpath. As for the road, the footpath will remain open and accessible to the

public (with the exception of short term disruption necessary to construct the soil vapour monitoring points, monitoring wells, injection wells and associated trenches). All trenches and well heads will be routinely monitored for evidence of leaks. Appropriate erosion control and mitigation measures will be applied during construction of the trench.

Groundwater monitoring wells will be used both to track the SEPR™ and S-ISCO® chemicals as they disperse through the treatment area to:

- analyse the effectiveness of the planned injection program in treating the contamination;
- track that the chemistry does not reach such sensitive receptors as Darling Harbour or neighbouring buildings; and
- track its movement relative to subsurface assets.

Groundwater monitoring wells will be installed and developed to accomplish these objectives. Monitoring wells in Hickson Road will also function as extraction wells during SEPR™. All monitoring wells will be able to function as extraction wells if needed.

Soil vapour monitoring points will be installed to augment the points already existing in the vicinity of the treatment areas. The depths of the screens in the soil vapour monitoring points will be selected to enable monitoring of the vapour in the shallow fill materials as well as the vapour being generated from the shallow groundwater. The points will be installed and sampled in general accordance with guidance from the Interstate Technology & Regulatory Council (ITRC, 2007), *Vapour Intrusion Pathway: A Practical Guideline*.

16.3.3 Injection Wells

Design of an oxidant delivery system that provides for the most efficient and effective distribution of surfactants, oxidising agent and catalyst within the soil is an important consideration and will be a key outcome of the S-ISCO® and SEPR™ Pilot Trial.

The oxidant will likely be delivered to the contaminant through a network of injection wells. The spacing of the injection wells will be a function of the pilot trial. An important consideration in design of the network will also be the presence of below ground obstructions which may locally influence the groundwater flow regime.

Based on experience at other former gas works sites, the injection well spacing is likely to be in the order of 3 to 10 m, and will likely vary across the treatment areas based on:

- Contaminant concentrations;
- Contaminant depth;
- Groundwater flow direction (taking into consideration changes that may occur as a result of the proposed groundwater control system); and
- The presence of below ground obstructions.

Depending on the impact to the local hydrogeology of the groundwater control infrastructure proposed in association with the Barangaroo South development, it may be necessary to include extraction wells (over and above those required in relation to SEPR™) in addition to injection wells. Extraction wells would be used in combination with injection wells to establish flow cells to facilitate delivery of the required chemicals to the contamination at the most efficient and optimal rates.

Based on the available information, and subject to confirmation following the proposed S-ISCO® and SEPR™ Pilot Trial, it is expected that the below ground infrastructure that will be required in support of S-ISCO® within Block 5 will include:

- Injection wells installed at 39 locations (with up to 17 containing injection ports at two elevations);
- Extraction wells installed a 9 locations (down hydraulic gradient of the target treatment areas);
- Monitoring wells installed at 19 locations (with up to 12 containing multiple monitoring ports for a total of between 30 and 40 individual monitoring wells); and
- Soil vapour monitoring wells installed at 14 locations.

Based on the available information, and subject to confirmation following the proposed S-ISCO® and SEPR™ Pilot Trial, it is expected that the below ground infrastructure that will be required in support of SEPR™ and S-ISCO® within Hickson Road will include:

- Injection wells installed at 40 locations (with up to 12 containing injection ports at two elevations) and which, in some instances, will also serve as extraction wells;
- Monitoring wells installed at 20 locations; and
- Soil vapour monitoring wells installed at 34 locations.

16.3.4 Surfactant and Oxidant Injection

S-ISCO® and SEPR™ works during the proposed full scale S-ISCO® and SEPR™ will be facilitated by an injection system with a continuous injection schedule of approximately 10 to 12 hours each day, 6 days per week. The purpose of the injection system will be to deliver individual chemical streams to injection wells to optimally contact the contaminants in the subsurface. Each injection well will have a dedicated pumping system to deliver the S-ISCO® chemicals. The injection system will be designed to deliver oxidant, activator, and surfactant to the subsurface with control of flow rates and chemical concentration. Chemical delivery from the system to each injection well will be independent of other wells, allowing for great flexibility in chemical delivery. This flexibility will allow for optimisation of chemical delivery to the contaminated soil zones by varying flow rates and density, and consequently maximising the contact time during which chemical reactions will take place.

For the purpose of S-ISCO® chemicals injections, the treatment area will be divided into a series of zones or areas. Injections will be undertaken in each of the areas or zones, in turn. Following a period of injection, the subject area will be monitored to confirm the success of the treatment process. Additional injections will be undertaken as required. Depending on commercial considerations, it is possible that more than one injection system will operate at any one time and that multiple areas or zones will be treated in parallel. The duration of the treatment process will depend on the chemical mass, the number of injection systems operating and their capacity. The selected injection location and strategy will be based on staging plans, the number of systems, system capacity and groundwater monitoring data. Monitoring data in particular will inform dosage and sequencing in each area.

Injections in a given area will begin slowly and gradually reach the desired parameters. This format will enable the effectiveness of the monitoring program and the safety of the implementation process to be demonstrated. During start-up, injection amounts, concentrations and rates will be reduced, and the monitoring program will be assiduously followed to develop a comprehensive understanding of where and how fast the chemistry moves.

16.3.5 Soil Vapour Extraction

A series of independent soil vapour extraction (SVE) units will be utilised for the full scale implementation. As above, the units will be located in the treatment compound and used to extract soil vapour from various treatment areas independently. Each SVE system unit will consist of pumps that extract, condense and treat vapours that may be displaced by peroxide decomposition in the subsurface. Two granular activated carbon (GAC) filters arranged in series will be used to treat the vapours prior their release from each unit. Emissions from the SVE treatment system will be required to be licensed as part of the EPL for the Barangaroo site (refer to **Section 13.1.2** and **Appendix E**).

Hoses will run from the pumps to the soil vapour monitoring points to be installed on the Site.

The SVE system will be operated continually to extract from these locations, throughout the duration of the S-ISCO® and SEPR™ injections and extractions. Soil vapour extraction will continue during the post-injection monitoring period until the results of monitoring indicate that its operation can be scaled back.

It should be noted that the purpose of the SVE system is not to actively draw soil vapour from the ground, as is the case when a SVE system is used for remediation. The SVE system is a risk mitigation measure designed to manage the generation of soil vapour that might occur during the trial, rather than actively remediate the soil. To achieve this mitigation objective, the flow rate of the system can be adjusted as needed based on the results of field and laboratory analyses of soil vapour monitoring and sampling, to ensure that any soil vapour that is generated by the trial is subsequently extracted and treated. The SVE system is designed and will be operated in order to create a gradient that draws soil vapour from the injection areas toward the system where it can be safely and effectively treated and released. The system will function as a contingency measure that will minimise the risk that soil vapour that might be generated as a result of the full scale treatment works.

16.3.6 Monitoring

An important component of S-ISCO® and SEPR™ is monitoring. Monitoring will be undertaken in three phases:

- Pre-Injection Monitoring;
- Concurrent-Injection Monitoring; and
- Post-Injection Monitoring.

These phases will be comprised of five components:

- Process monitoring;
- Performance monitoring;
- Groundwater sampling;
- Soil gas sampling; and
- Soil sampling.

An overview of the various components of the proposed monitoring program is provided below.

16.3.6.1 Process Monitoring

Process monitoring consists of monitoring the S-ISCO® and SEPR™ chemistry at the system and in the injection wells. This monitoring data is used to track the parameters of the system and subsequently to inform modifications to the operational parameters, including injection rate, concentration and pressure, in order to optimise treatment.

16.3.6.2 Performance Monitoring

Monitoring of the injected chemicals in monitoring wells provides information as to where the injected chemicals are travelling and the nature of their reactions. This is a critical component to the success of S-ISCO® and SEPR™. Monitoring data collected is used to understand the success of contacting the contaminant mass with the injection chemicals and to document the chemical reactions taking place. In addition it will be used to inform and refine the injection regime being employed for full-scale implementation.

Using laboratory equipment and *in situ* water quality data logger devices, groundwater and process water parameters such as pH, oxidation reduction potential (ORP), Dissolved Oxygen (DO), conductivity, head, temperature, oxidant concentrations, TPH (C_{10}-C_{36}) (using a Site Lab Fluorescence Analyser[12]) and inter facial tension (IFT) will be measured from groundwater and various locations in the injection system.

Measured parameters of pH, ORP and DO provide witness to the presence of the chemical reactions. During the course of oxidation reactions pH is expected to decrease slightly in the short term and in the immediate vicinity of the injected chemistry as protons are generated by the destruction of the oxidant. ORP, an indication of the capacity of an environment to undergo redox reactions, is expected to increase, providing a direct indication of the presence of reactions, specifically with peroxide. Because this relationship is stronger when hydrogen peroxide rather than sodium persulfate is used, ORP is most significant in tracking the peroxide front. ORP may be detected much earlier than peroxide at a given location since the oxygen released from decomposition of hydrogen peroxide diffuses throughout the groundwater at a much faster rate than the injected oxidant. Similarly, DO is expected to increase in response to peroxide treatment, and its increase may also significantly precede the arrival of the peroxide front.

The significance of pH depends on the S-ISCO® system. For example:

- During alkaline-activated S-ISCO® with sodium persulfate, elevated pH (alkaline conditions) will indicate that sodium hydroxide is adequately dosed to create alkaline conditions that will activate the persulfate oxidant.
- During Fe-TAML activated S-ISCO® with hydrogen peroxide pH is monitored to ensure that it is elevated sufficiently to optimise the catalyst (approximately pH 9).

[12] Specific Technical Requirements for Northwest Growth Centres Initial Release Infrastructure Package 1, Design and Construct Contract to Deliver Water Related Infrastructure

- In S-ISCO® systems in which peroxide is being used and in which there is a possibility for pH levels to become acidic (in a localised area and over a short time period), pH measurements will indicate that monitoring should increase and/or that injection parameters may need to be modified.
- Finally, pH measurements also play a role in selection of weekly groundwater performance monitoring samples for metals and TPH analysis.

Measured parameters of conductivity, Interfacial Tension (IFT), pH, TPH (C_{10}-C_{36}) and concentrations of oxidant are good indicators of chemical transport and allow for adjustment in system flow rates and chemical delivery concentrations based on monitoring well results. Conductivity is a conservative tracer that indicates where chemistry is present, specifically persulfate, since it is directly related to the total dissolved solids in solutions, including sulfates. Measured concentrations of oxidant (persulfate) lag behind the conductivity front because it is reacting and being consumed during transport. IFT indicates the presence of VeruSOL-3®. As mentioned above, during S-ISCO® with alkaline-activated persulfate, pH will be used to track that sodium hydroxide is being adequately dosed and transported to activate the persulfate.

Measurements of the hydraulic head and depth-to-groundwater will indicate the impact of injections on the water level in the treatment area and also will provide data relating the movement and transport of the injected chemistry to the tides in Darling Harbour. This data will also be used to regulate fluid levels in the tar tank and other historical infrastructure within Hickson Road to confine the injected chemistry to this area.

Finally, temperature in groundwater samples is expected to increase as a result of S-ISCO® injections. During S-ISCO® with peroxide, specifically, since reactions of peroxide, with contaminants are exothermic, heat will be produced that elevates groundwater temperature. Although temperature is expected to increase in response to the S-ISCO® treatment and can indicate chemical reactions, the extent to which temperature increases is affected by numerous factors, including: the temperature of the injected fluid; and the heat capacity of the groundwater and subsurface. Therefore, temperature is not an extremely strong or direct indicator of the treatment front. Notwithstanding, it is essential to monitor to ensure that increases do not threaten the groundwater system or subsurface materials / services.

Performance monitoring also plays a pivotal role in the mitigating risks to the environment and sensitive receptors.

16.3.6.3 Soil and Groundwater Sampling

Soil and groundwater collected during the full scale S-ISCO® and SEPR™ treatment works will be analysed for CoPCs, including TPH, VOCs and SVOCs. Groundwater will also be sampled for metals, total organic carbon (TOC), sulphates and total residual chlorine analysis. Sampling of groundwater and soil for CoPCs enables a comparison of conditions before and after the full scale S-ISCO® and SEPR™ treatment works that will ultimately be used to assess the effectiveness of the treatment. The final objectives of the full scale S-ISCO® and SEPR™ treatment works are to reduce soil concentrations of identified CoPCs, specifically TPH, PAHs and BTEX, below the relevant SSTC, and to also reduce the groundwater flux of CoPCs leaving the treatment area to concentrations below the relevant SSTC.

Soil sampling for CoPCs after the full scale S-ISCO® and SEPR™ treatment works, in particular, provides an estimate as to the magnitude of contaminant reduction at the Site.

The final analysis of the effectiveness of the application also involves the sampling and analysis of groundwater to develop CoPC flux comparisons before and after the S-ISCO® and SEPR application.

Groundwater sampling for PAHs, TPH and metals throughout the S-ISCO® and SEPR™ injections will take place to confirm both that the treatment is proceeding and also that neither contaminants nor metals are mobilised by the treatment. In addition groundwater sampling a for TOC and sulphates will take place to demonstrate that increased biological oxygen demand isn't a risk for Darling Harbor due to the injection of surfactants and oxidants and that significant chlorinated hydrocarbons won't be generated due to the reaction of persulphate with saline groundwater.

16.3.6.4 Soil Vapour Sampling

Soil vapour sampling will be conducted to monitor the presence and safety of soil vapours generated as a result of S-ISCO® and SEPR™ oxidation reactions. Soil vapour monitoring is a significant component the environmental monitoring and risk mitigation strategies for S-ISCO®.

Soil vapour monitoring will target areas near: the basements of the nearby buildings that are both close to the soil and accessed by people; the sewerage pumping station SP1129 in Block 5 (to be retained for the future land

use); underground service pits and service access points, particularly those within Hickson Road. This monitoring will be used to evaluate the success of the SVE system in extracting vapours to mitigate exposure, as well as whether the system needs to be extended to locations in addition to those in use.

Soil vapour monitoring will be conducted before injections, to establish baseline conditions, as well as during and after injections. Further detail regarding the proposed soil vapour monitoring works will be detailed in the S-ISCO®/SEPR™ Detailed Work Plan (refer to **Section 13.1.3**).

17.0 Management of Water

17.1 Surface Water Management Methods

17.1.1 Surface Water Management from Undisturbed Areas

Clean water will be generated from surface water collected from remediated and undisturbed areas of the Site. Undisturbed surface water runoff will continue to follow existing drainage patterns, unless diversion from active site areas is warranted. Surface water drainage will also be arranged so that surface water run-off from disturbed or contaminated areas does not enter remediated or undisturbed areas.

Clean water collected from undisturbed areas will be retained on-site and used to the maximum extent possible for dust suppression. Excess clean water will be discharged to stormwater or sewer in accordance with the discharge conditions for the site. Formal discharge criteria for surface waters will be negotiated with Council and the NSW EPA as part of the remediation works and likely included as a condition of the POEO license and Trade Waste License for the project. It is anticipated that the discharge criteria will be based on the contaminant concentrations, sediment and turbidity levels of existing surface water runoff from the site.

To assist in the collection of surface waters from undisturbed areas of the site, a sediment basin may be constructed in a suitable location to be determined during site establishment. The location of the basin will be selected to provide for the whole remediation works.

17.1.2 Surface Water Management from Disturbed Areas

Surface water management is critical to successful remediation of the Site and reduction of cross contamination issues and to prevent impact to the Harbour. Successful management of site water is also essential for materials handling and management.

Surface water flows and stormwater will be managed by segregating clean water from impacted water and preventing the inflow of surface water to excavation areas using surface bunds, silt fences and drainage diversions. The preferred hierarchy for management of water on-site is as follows:

- Minimise volume of contaminated water during the works wherever possible by directing surface water away from excavations, depressions, pits and stockpiles by the construction of drainage works such as bunds and diversion drains. These measures will minimise the flow of clean water into other areas of the Site that contain contaminated materials;
- Recycling water where possible by using on-site as dust suppression for other site operations including wheel washing and truck washing. To ensure that the use of recycled water does not impact on surrounding areas, the following data will be obtained prior to undertaking these activities:
- Chemical data which demonstrates that the water to be recycled complies with the reuse criteria, including consideration of potential for odour generation;
- Definition of the area where the water is to be discharged;
- Details of environmental protection measures installed to ensure that the use of recycled water will have no adverse environmental impact;
- Appropriate tracking of recycled water reused at the Site; and
- Discharge to stormwater or sewer, with or without treatment, as per regulatory guidelines and in accordance with an EPL and Trade Waste License (refer to **Section 13.1.2**) to be obtained for the project.

17.2 Groundwater Management Methods

Groundwater encountered during excavation (as part of remedial works) will require management.

Control walls will be installed to minimise groundwater infiltration into excavations, where required. Dewatering and control of groundwater seepages will also be required.

Groundwater collected from the excavations will be transferred to the on-site water treatment plant (where required), prior to discharge to Darling Harbour with appropriate approvals. If required, limited contaminated water may be disposed off-site with use of truck tankers.

If required, limited contaminated water may be disposed off-site with use of truck tankers and/or disposed of to sewer (with or without treatment) in accordance with a Sydney Water trade waste licence.

17.3 Wastewater Treatment System

A wastewater treatment system will be established for the remediation works and is likely to consist of at least the following process units:

- Pumps and a buffer storage for transferring flows to the plant;
- Dissolved Air Flotation unit for the removal of fats, oils, greases and hydrocarbons which might also include a coagulant and surfactant dosing to assist with solids removal;
- A chemical dosing step to adjust the pH and promote chelation and precipitation of heavy metal complexes;
- Reaction & mixing vessels to facilitate the metals removal process providing flow buffering and adequate reaction times;
- Activated carbon filtration, as required to polish specific residual or trace contaminants from the groundwater and ensure compliance with specific trade waste requirements;
- Sludge handling and/or sludge thickening equipment (or at least a tank, sludge separator) to minimise the residuals that require disposal off-site; and
- Effluent balancing storage (in holding tank) prior to pumping to the transfer sump.

Duty / standby pumps (variable speed drives) will control the pumped outflow to Darling Harbour, following approval of a variation to the existing EPL (refer to **Appendix E**) to the Sydney Water sewerage system or stormwater if appropriate testing is conducted and approvals obtained (refer to **Section 13.1.2**).

17.4 Groundwater Management

17.4.1 Groundwater Monitoring Plan(s)

A GMP will be prepared to detail the required groundwater monitoring works during and after completion of the remediation works. The requirement, or otherwise, for a GMP will be dependent on the remediation option adopted. In particular:

- for the VMP Remediation Works, a GMP will be required in areas where:
  - *in situ* remediation is adopted (i.e. Block 5 and Hickson Road if the preferred remediation option is adopted and Block 4 if the alternate remediation option is adopted); and
  - ex situ remediation is adopted (i.e. Block 4 if the preferred remediation option is adopted and Block 5 and Hickson Road if the alternate remediation option is adopted).
- for the Block 4 Development Remediation Works, a GMP:
  - will not be required where the preferred ex situ remediation option is adopted; and
  - may be required where the alternate *in situ* remediation is adopted, depending on whether or not the basement groundwater retention wall system has been constructed (which will negate the need for groundwater monitoring).

It is expected that some of the existing groundwater monitoring well network will be removed as part of the remediation works. Therefore, a groundwater monitoring well network will be installed at the Site to confirm the validation requirements of **Section 19.8**.

The GMP will include the following information:

- Monitoring objectives;
- Scope of works;
- The groundwater monitoring schedule and network;
- The construction details required for the groundwater monitoring wells (including the required screen intervals);

- Groundwater sampling methodology;
- QA/QC assessment;
- DQO/DQI assessment; and
- Reporting requirements.

17.4.2 VMP Remediation Works GMP

For the purpose of the VMP Remediation Works GMP, the point of compliance will be considered to the down-hydraulic boundary of the Declaration Area (refer to **Section 7.1.3**). Existing monitoring wells will be retained for ongoing monitoring wherever possible.

The objectives of the GMP will be to:

- measure the effectiveness of the remedial works that have been undertaken (specifically source removal and subsequent groundwater quality improvement) with respect to groundwater quality migrating from the Declaration Area boundary and the associated risk to aquatic ecosystems (i.e. ultimately groundwater migrating to Darling Harbour);
- make provision for any necessary management measures (contingency measures) that may be required to respond to the monitoring results (refer to **Section 23.9**); and
- Comply with legislative requirements and the appropriate requirements of NSW EPA (i.e. NSW DEC, 2007) including the requirement for implementation of a GMP in cases where the extent of remediation is based on CUTEP.

It is noted that if Block 4 Development Remediation Works proceed, it would not be possible to monitor groundwater quality at the down-hydraulic boundary of the Declaration Area. If this was the case, groundwater monitoring required for the VMP Remediation Works would be undertaken adjacent to the Block 4 basement wall (i.e. outside the alignment of the basement wall to the west).

17.4.2.1 During Remediation Works

Groundwater monitoring will be undertaken from the groundwater monitoring well network (along the Declaration Area boundary) in accordance with the GMP on a quarterly basis during the remediation works to build a robust data set for groundwater quality at the down hydraulic gradient Declaration Area boundary and to demonstrate that the continuing remediation works are not having a detrimental impact on the environment.

All groundwater samples will be analysed for the relevant groundwater CoPCs and compared to the applicable groundwater SSTCs and MWQCs (as required). The methodology for the groundwater sampling is detailed in **Section 19.10**.

17.4.2.2 Post-Remediation Works

Following completion of the remediation works, the groundwater monitoring discussed in **Section 17.4.1** will be continued at the Site to assess whether CoPC concentrations in groundwater are consistent with the applicable groundwater SSTCs and MWQCs (as required, refer to **Table T2**).

The post-remediation groundwater monitoring program at the Site will consist of quarterly groundwater monitoring of the monitoring well network (refer to **Section 17.4.1**) for a period of 6 months (i.e. three sampling rounds) following completion of the remediation works. It is noted that, as described by the Contingency measures detailed in **Section 23.9**, further monitoring may be required to demonstrate that the remedial goals have been achieved.

Specific details of the post-remediation groundwater monitoring program (including the groundwater monitoring network) will be detailed in the GMP that will be developed prior to commencement of the remediation works and in consultation with the NSW EPA Accredited Site Auditor and the NSW EPA.

17.4.3 Block 4 Development Remediation Works GMP

As described by **Section 17.4.1**, if the preferred ex situ remediation option is adopted for the Block 4 Development Remediation Works a GMP will not be required.

If the alternate *in situ* remediation option is adopted for the Block 4 Development Remediation Works, the requirement for a GMP will be determined based on the presence (or otherwise) of the basement groundwater retention wall system. In particular, if the retention wall system:

- has been constructed, a GMP will not be required;
- has not been constructed, a GMP similar to that described in **Section 17.4.2** will be required.

17.4.4 Groundwater Monitoring Plan Reporting

A groundwater monitoring report will be prepared within 8 weeks of completing each monitoring event for provision to the NSW EPA Accredited Site Auditor. If the groundwater monitoring relates to VMP Remediation Works, the document would also be submitted to the NSW EPA for review and approval (if required). The report will include the following:

- Details of groundwater monitoring program methodology and scope of works;
- Construction details and logs of any new or replaced groundwater monitoring wells;
- Results of groundwater monitoring well levels, field parameters and laboratory analysis, including NATA certified laboratory reports and chain of custody records;
- Comment on laboratory and field quality assurance / quality control program and analytical data validation;
- Interpretation of the data, including quality of groundwater with respect to the applicable SSTC and MWQCs;
- Interpretation of groundwater elevation contours across the Declaration Area/Site;
- Conclusions and recommendations with respect to continuation or otherwise of the groundwater monitoring program; and
- Conclusions and recommendations on whether Groundwater Monitoring Plan or other related documents/programs need to be updated.

18.0 Imported Materials

18.1 VMP Remediation Works

Due to the extent of excavations required for the proposed VMP Remediation Works, it is possible that materials will need to be imported to the Declaration Area for backfilling of the remediated areas. Materials imported to the Declaration will be required to meet the environmental and geotechnical requirements specified for the particular end use.

It is expected that materials imported to the Declaration Area as part of the VMP Remediation Works will generally meet the requirements of:

- Virgin Excavated Natural Material (VENM) in accordance with the DECCW (2009) *Waste Classification Guidelines*;
- Excavated Natural Material (ENM) in accordance with the *Protection of the Environment Operations (Waste Regulation 2005 – General Exemption under part 6, Clause 51 and 51A* (2012); and
- the relevant soil SSTC (refer to **Table T1**).

The frequency of validation sampling will be dependent on the source of the fill material. If the material is brought onto the Declaration Area from a quarry, and the material is homogeneous, validation will consist of:

- a certificate warranting that the material is VENM or demonstrating the physical and chemical quality of the fill, including supporting test data; and
- visual confirmation that the material is free from contamination as it is imported to the Declaration Area.

If the imported material (including landscaping materials such as mulch) cannot be certified as VENM or clean quarry material, the following works will occur:

- Site inspection of the source site and the reporting of these findings in the relevant validation reports; and
- Inspection of the imported material upon arrival/stockpiling at the Site to confirm it is consistent with the material observed at the source site;
- One sample per 100m^3 will be collected and analysed or a minimum of 3 samples per source. This sampling density may be decreased depending on the quantity of material to be imported from a given source and the initial laboratory analytical results. Any change in sampling density will be determined in consultation with the NSW EPA Accredited Site Auditor; and
- Visual confirmation that the material is free from contamination as it is imported to the Declaration Area.

Whenever possible, samples will be collected from the source location, prior to import of the material to the Declaration Area.

All soil samples will be analysed for the following suite of potential contaminants as a conservative measure to ensure that only suitable materials are imported to the Declaration Area:

- Metals (As, Cd, Cr, Cu, Ni, Pb, Zn and Hg);
- PAHs and phenols;
- TPH/BTEX;
- OPPs and OCPs;
- PCBs; and
- Asbestos.

18.2 Block 4 Development Remediation Works

It is considered unlikely that the Block 4 Development Remediation Works will require the import of material to Block 4. This is because the Block 4 Development Works will include excavation of the entire Block 4 footprint to facilitate construction of a future basement.

In the event that the import of material to Block 4 is required, the procedures described by **Section 18.1** will be implemented.

19.0 Validation Strategy

This section outlines the proposed validation strategy and protocols required to demonstrate that the remedial action has met the remediation objectives.

19.1 Remediation Goals

19.1.1 VMP Remediation Works

The Remediation Goals developed by the *VMP Remediation Extent Report* (AECOM, 2013c) for the protection of human health and the environment based on the recommendations of the *VMP HHERA* (AECOM, 2012c) are:

- As a primary goal, removal / remediation of SPGWT to the extent practicable as required by the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination* (refer to **Section 6.6.1**); and
- As a secondary goal, removal / remediation of soil, to the extent practicable:
    - That is representative of CIM, which is defined as:
        - Unsaturated soil concentrations exceeding the soil SSTC; and/or
        - Unsaturated or saturated soil concentrations that are considered to be the source of groundwater concentrations exceeding the groundwater SSTCs in fill material; and
    - Such that groundwater quality within fill material leaving the Declaration Area (measured at the down hydraulic gradient Declaration Area boundary) approaches the MWQC (refer to **Section 7.1.3**).

The standard of remediation (as developed by the *VMP Remediation Extent* report [AECOM, 2013c]) to be achieved within the proposed Remediation Extent should equal the higher of:

- Removal of SPGWT to the extent practicable, for the protection of human health and the environment;
- Removal/remediation of soil and groundwater concentrations present within fill material exceeding the relevant $SSTC^{VMP}$, to the extent practicable; and
- Removal/remediation of contaminated fill materials such that the contaminant mass within the Remediation Extent fill material is reduced, on average, by 90%, to the extent practicable (calculated based on the estimated mass of naphthalene and TPH C_{10} - C_{14}).

If the standard of remediation can not be practicably achieved, the Contingency measures detailed in **Section 23.0** of this RAP will be considered.

19.1.2 Block 4 Development Works

As described by **Section 9.2**, the Remediation Goals required to be achieved to remediate Block 4 to be protective of human health are based on:

- As a primary goal, removal/remediation of SPGWT to the extent practicable; and
- As a secondary goal, removal/remediation of identified CIM (as detailed in **Section 9.1**), to the extent practicable based the removal of soil contamination that is considered to be the source of groundwater concentrations exceeding the groundwater $SSTC^{DEV}$.

19.2 Validation Principles

Both the *VMP HHERA* (AECOM, 2012c) and *Declaration Site HHERA* (AECOM, 2011a) recommend that soil validation data be assessed in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure*, *National Environment Protection Council, 1999*. This will involve demonstrating that relevant SSTCs for either VMP Remediation Works or Block 4 Development Remediation Works have been achieved through the:

- use of systematic sampling patterns;

- collection of an appropriate number of samples for estimation of the arithmetic average concentration of contaminant(s) within relevant environmental media and exposure areas; and
- estimation of the 95% upper confidence limit (UCL) of the arithmetic average concentration for soils.

Where applicable, the above statistical analysis will be applied to separate areas of the Site if staged remediation and validation works are to be conducted. This will also apply if different strata (i.e. fill materials, natural soils and bedrock) are excavated and are proposed to be reused onsite as part of the remediation works. Consequently, the analytical data obtained from the validation of materials to be reused onsite will be assessed separately as per the requirements of the *National Environment Protection* (Assessment *of Site Contamination) Measure*, *National Environment Protection Council (1999)*.

It is noted that the use of statistics will not be used in the assessment of groundwater analytical data sets obtained during the validation works.

19.2.1 Staging of the Remediation Works

As discussed in **Section 1.2** and **Section 1.8** the sequence of remediation works may vary. That is, the staging and sequencing of the remediation works (specifically: VMP Remediation Works in each of the Block 4, Block 5 and Hickson Road portions of the Declaration Area; and Block 4 Development Remediation Works) may vary depending on final logistical and other requirements associated with the broader Barangaroo development. Staged remediation works may also be required within key site areas (for example within Block 4) to accommodate the required development and construction sequence and methodology.

Final validation requirements for the remediation works will be dependent on:

a) the outcomes of the S-ISCO® and SEPR™ Proving Phase and Pilot Trial;

b) which of the preferred remediation options is adopted; and

c) the sequence of remediation works in the various Site areas as described above.

It is possible that, depending on the above factors, the preferred remediation option adopted for the Block 5 and Hickson Road VMP Remediation Works will be a combination of Option 1 (full scale S-ISCO® and SEPR™ treatment) and Option 2 (excavation and onsite treatment). Selection of which preferred remediation option will be adopted in each part of Block 5 and Hickson Road will be undertaken in consultation with the NSW EPA Accredited Site Auditor. A Validation Sampling Analysis and Quality Plan (SAQP, refer to **Section 19.2.3**) will be prepared, based on the actual sequence of remediation works and preferred remediation option that is implemented, to detail specific requirements for demonstrating that the remediation works have been undertaken in accordance with the requirements of this RAP.

Similarly, Site Audit Statements will also be staged to progressively validate the various stages of remediation in Block 4, Block 5 and Hickson Road Site areas against the applicable Remediation Goals.

It should be noted that depending on the sequence of remediation works, validation of particular Site areas may require consideration of contamination concentrations both within the subject area and in adjacent areas. For example, if the Block 4 Development Remediation Works are undertaken in advance of remediation works in Block 5 and Hickson Road, the validation process would be required to demonstrate that both:

- Contaminant concentrations within Block 4 are consistent with the Block 4 Development Remediation Works goals; and
- Groundwater contaminant concentrations adjacent to and outside the Block 4 groundwater retention wall system are also consistent with the Block 4 Development Remediation Works goals.

19.2.2 Validation of Mass Removal

A recommendation of the *VMP Remediation Extent report* (AECOM, 2013c) was that removal/remediation of contaminated soil such that the contaminant mass within fill material is reduced, on average, by 90% within the Remediation Extent (calculated based on the estimated mass of naphthalene and TPH C_{10}-C_{14}) was considered to be protective of the environment to the extent practicable.

Mass removal will be demonstrated as follows:

- Ex situ remediation works – based on confirmation that removal of all material within the nominated remediation extent has been accomplished; and

- In situ remediation works – by calculation of the mass of contaminant (specifically naphthalene and TPH C_{10}-C_{14}) removed based on comparison of the average concentration reported before and after completion of the remediation (based on relevant data obtained from the previous investigations and from the S-ISCO® validation sampling as described in the following sections).

Additional details specifying how mass removal will be demonstrated will be included in the Validation SAQP to be prepared (refer to **Section 19.2.3)**.

It is noted that Block 4 Development Remediation Works (which will include construction of the basement groundwater retention wall system around Block 4) will provide close to a 100% mass removal from Block 4 because:

- the development works will include excavation to a depth of approximately 8 m bgl (refer to **Section 4.2**) which will remove the majority of fill material and all of the contamination identified as requiring remediation; and
- the groundwater retention wall will effectively prevent the migration groundwater from within Block 4 to the receiving environment, effectively removing pathway for the migration of any residual contaminant mass.

19.2.3 Validation Planning

As discussed in **Section 1.2** and **Section 19.2.1**, a Validation SAQP will be prepared by a suitably qualified environmental consultant for each of the remediation stages (as required) and will be implemented for the duration of the soil validation testing program (i.e. for either *in situ* or ex situ validation works). The Validation SAQP will include a description of how the statistical analysis recommended by the *VMP HHERA* (AECOM, 2012c) and *Declaration Site HHERA* (AECOM, 2011a) will be adopted by the soil validation testing program.

The GMP (refer to **Section 17.4.1**) will also be prepared for the duration of the required groundwater monitoring works.

Both Plans will be endorsed by NSW EPA Accredited Site Auditor each remediation stage (as required).

If new guidelines/legislation are introduced or endorsed by NSW EPA during the course of the remediation and validation works, consideration will be given to modifying the validation program in consultation with the NSW EPA Accredited Site Auditor.

The NSW EPA Accredited Site Auditor will be invited to undertake regular site inspections during the excavation works.

19.3 Validation of HHERA Assumptions - Block 4 Development Remediation Works

An important element of the validation process for the Block 4 Development Remediation Works will be confirmation that the key assumptions regarding the proposed development and on which the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) are based (as described by **Section 7.2.3**) have been or will be implemented.

To this end, validation will include review of appropriate documentation confirming that the key assumptions either have been or will be constructed. Appropriate documentation may include:

- “Issue for Construction” Drawings that verify that the key elements of the Block 4 Development Works relied on by the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) will be constructed; and/or
- “As Constructed” Drawings that document that the key elements of the Block 4 Development Works relied on by the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) have been constructed.

This review will also assess any potential implications of changes to the design of the depth of the Block 4 basement and/or the final alignment of the basement groundwater retention wall system (refer to **Section 4.2** and **4.3**. Any significant changes to the final development plans will require confirmation that:

- the analytical data set and sampling density for the materials of potential concern (specifically additional soil which may remain below basements [as appropriate]) are adequate for assessing the suitability of the materials affected by the design changes;

- any required additional site investigations are suitable to supplement the current analytical data set. If required, the scope of these works will be endorsed by the NSW EPA Accredited Site Auditor; and
- confirmation that the assumptions of the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) are still valid (refer to **Section 7.2.3**).

As discussed previously, the basement groundwater retention wall system is subject to ongoing refinement and development as part of the design process. Consequently, minor changes to the depth of basements and/or the final alignment of the basement groundwater retention wall system may be required. If the final development design is changed which affects the assumptions of the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d) and this RAP, an Addendum will be prepared, as required, and submitted to the NSW EPA Accredited Site Auditor for approval.

19.4 Soil Validation (*In situ* Remediation)

Collection and analysis of soil samples will be undertaken prior to and following completion of *in situ* remediation works to validate the effectiveness of S-ISCO® and SEPR™ in reducing the CoPC concentrations to achieve the remediation criteria (refer to **Section 7.1**) and to confirm the requirements of this RAP have been met.

The soil sampling and analysis events will be conducted at the following times:

- **Round 1**: Prior to initiation of the S-ISCO® and SEPR™ injections; and
- **Round 2**: Approximately one month after the completion of the S-ISCO® and SEPR™ injection processes or when the Remediation Contractor has evaluated the *in situ* data trends during post-injection performance monitoring and determined that the S-ISCO® chemistry is no longer reacting with contaminants in the subsurface.

The details of the soil validation works provided herein will be subject to confirmation based on the outcomes of the proposed S-ISCO® Pilot Trial Proving Phase (refer to **Section 16.1**)and Pilot Trial (refer to **Section 16.2**). Any refinement of the approach described following will be detailed in the SAQP (refer to **Section 19.2.3**).

Validation will also include collection and analysis of groundwater samples which is described in **Section 19.8**.

19.4.1 Round 1 Soil Validation Testing

If required, prior to the S-ISCO® and SEPR™ injections, additional validation soil samples will be collected across each of the proposed remediation areas to ensure that a sampling frequency of at least one borehole per 20 m grid interval has been achieved and that soil samples have been analysed for the CoPC at appropriate vertical intervals based on the identified vertical extent of SPGWT or CIM. Therefore, a full data set will be obtained from each borehole across the depth range where SPGWT and/or CIM has been identified by the site investigations (either within the unsaturated or saturated fill materials). Soil samples collected within the unsaturated zone will be sampled at depths of 0.5 and 1.5 m bgl. Soil samples will be collected from within the saturated zone at depths of 1.0 m. If required, a final 'base sample' will also be collected within the top 0.5 m of natural residual material (unless sandstone bedrock is encountered).

Soil samples will be collected and analysed from zones of highest impacts based on field observations (including visual/olfactory observations and PID readings). In all cases the depth interval selected for sampling will not exceed 1.0 m.

All soil samples will be analysed for the CoPC detailed in per **Section 19.6**.

As detailed in **Section 19.1**, a statistical assessment approach will be adopted in validating specific remediated areas and different material types (as required) and will be detailed in the SAQP to be prepared. That is, statistical analysis will be conducted for all samples collected and analysed from fill materials within each remediated areas to allow assessment against the relevant SSTCs to either the unsaturated or saturated fill materials/soils. This will include all existing data from the environmental site investigations collected within each remediation area to enable statistical analysis of all materials of the same material type (i.e. either unsaturated or saturated fill material).

19.4.2 Round 2 Soil Validation Testing

Once the Remediation Contractor has assessed *in situ* data trends during post-injection performance monitoring and determined that the S-ISCO® chemistry is no longer reacting with contaminants in the subsurface, the Round 2 soil validation testing will be undertaken.

This will involve soil sampling at similar locations and in accordance with the same requirements as the Round 1 soil sampling event. However, to increase the likelihood that the validation sampling is representative of CoPC concentrations within the treated Remediation Area, the positioning of the Round 2 soil validation boreholes will be as follows:

- The borehole will be located approximately 500 mm from any original site investigation borehole and Round 1 soil validation boreholes to avoid sampling disturbances from re-instated boreholes; and
- The borehole will be located at least 5 m away from any S-ISCO® and SEPR™ injection points. It is anticipated that S-ISCO® and SEPR™ injection points will be installed on a 10 m (approximately) grid (subject to the outcomes of the proposed S-ISCO® Pilot Trial, refer to **Section 16.2**).

Statistical analysis of post-treatment CoPC concentrations within each Remediation Area will be undertaken, as detailed in the SAQP, to confirm that the *in situ* remediation works have meet the requirements of this RAP. This statistical data set will include the same data set as per the Round 1 soil validation event with the exception of Round 2 sample results replacing the Round 1 results (i.e. obtained from the same borehole location and depth).

19.5 Soil Validation (Ex situ Remediation)

Ex situ remediation works will require the validation of:

- remediated areas - excavation walls and bases (if data gaps are present in the current data set);
- stabilised materials for off-site disposal;
- excavated materials for reuse; and
- the treatment area and stockpiling areas.

The NSW EPA Accredited Site Auditor will be invited to undertake regular site inspections during the excavation works.

19.5.1 Remedial Excavation Bases – VMP Remediation Works

If ex situ remediation works are undertaken, any residual soil remaining in the excavation base following completion of the proposed vertical remediation extent will be validated / characterised by a combination of visual observations and representative sampling with analytical testing.

The frequency and type of sampling will be dependent on the exposed material on the base of the excavation (e.g. bedrock, natural soil, fill, etc). The current analytical data set from previous site investigations will also be used to validate excavation bases to the extent that they are representative of the conditions observed in the base of the excavation. These works will be conducted in the remediation areas (as detailed in **Figure F10** to **Figure F12** in **Appendix B**, as required).

All remedial excavation bases founded in fill or residual soils/bedrock will be inspected by a qualified environmental engineer/scientist to confirm that the excavated surface is visually free from:

- SPGWT; and
- ACM to ensure residual soils are suitably validated for the protection of construction workers.

Where the excavation is founded in rock, the excavation base will be validated by visual observation and photographic documentation.

If there is visual evidence of potential SPGWT being present at the base of the bulk excavation, validation samples will be collected. If required, excavation base samples (discrete only) will be collected and analysed at a frequency of one sample per 20 m grid intervals across the base of the remedial excavation, within footprint of the potential SPGWT. Excavation base validation samples will be collected using a trowel below a depth of 100 mm (to minimise the potential loss of volatiles). All soil samples will be analysed for PAHs to allow comparison to the TCM criteria (as defined in **Section 6.6.1**). The analytical results from excavation base validation samples will be used to confirm the absence of SPGWT at the base of the excavation.

Validated areas will be clearly marked and identified to ensure that cross contamination is mitigated.

If SPGWT is encountered within fill material at the base of the Remediation Area, it will be over excavated to the extent practicable or until marine sediment or bedrock is encountered. For the purpose of the VMP Remediation Works, over excavation to the extent practicable will be limited to an increase in vertical extent of remediation of:

- 2 m if permeable fill is used to reinstate the over excavation area; or
- 1 m if clay will be used to reinstate the over excavation area.

The increase to the vertical extent of remediation required is based on consideration of:

- the practicabilities of increasing the depth of remediation including:
  - the depth that can be reasonably achieve by a single excavation lift; and
  - minimising the requirement for increased excavation shoring, dewatering and associated water management; and
- the requirement to demonstrate (as required by DEC 2007) that SPGWT has been remediated to the extent practicable (noting that it would be expected that the contaminant mass within the remediation extent would have already been reduced by 90% as required by the Remediation Goals).

If ACM is identified in the base of the excavation, it will be managed as described by **Section 14.8**.

If required, the contingency actions detailed in **Section 23.11** will also be considered.

19.5.2 Remedial Excavation Walls – VMP Remediation Works

If ex situ remediation works are undertaken, excavation walls in soil will typically be supported (and effectively retained) by excavation retention cut-off walls. As a consequence, it will not be possible to directly sample materials remaining in excavation walls. The approach to validation of these residual materials will be as follows:

- Where the excavation wall is comprised of rock (which will be unsupported), the excavation wall will be validated by visual observation and photographic documentation; and
- Where the excavation wall is comprised of fill or natural soil (supported behind a cut-off wall such that visual observation or validation sampling will not be possible):
  - if the cut-off wall is located on the Site boundary, such that there is effectively no Site material remaining behind it, the excavation wall will not be subject to any validation testing; and
  - if the cut-off wall is located within the Site boundary such that it is retaining Site material behind it, the excavation wall and the material it retains will be validated using the available groundwater data set and field observations reported on borehole logs relating to the potential for SPGWT to be present in proximity to both the inside and outside of the excavation wall.

This approach to validation of excavation walls is considered appropriate because, as detailed in **Section 7.1.4**:

- There are no Remediation Goals ($SSTC^{VMP}$) for saturated soil. Therefore, even if soil samples were collected from the walls of the excavation, there would be no criteria to compare the results against; and
- The standard of remediation to be achieved is (among other things) remediation / removal of 90% of the contaminant mass from within the extent of remediation, to the extent practicable (calculated based on the estimated mass of naphthalene and TPH C_{10}-C_{14}). As described by **Section 19.2.2**, validation that this remediation goal has been achieved will not require reference to analytical data outside the extent of remediation.

As detailed in **Section 19.2**, a statistical assessment approach will be adopted in validating excavation walls and different material types (as required).

All excavation walls founded in bedrock will be inspected by a qualified environmental engineer/scientist to confirm that the excavated surface is visually free of ACM to ensure residual materials are suitably validated for the protection of construction workers. If ACM is encountered during these works, removal and validation works will be undertaken to the extent practicable as per **Section 14.8**.

19.5.3 Validation of Materials to Remain *In Situ* Below Basements – Block 4 Development Remediation Works

The groundwater and fill material to remain *in situ* below the proposed Block 4 basement is considered to have been adequately characterised and validated by the site investigations detailed in **Section 5.0**. Further, as described by **Section 7.2.3**, the standard of remediation within the groundwater basement retention wall system is based on achieving the groundwater $SSTC^{DEV}$ only. As such, the collection of soil validation samples within the saturated zone is not required.

Reliance on the existing groundwater data set for material to remain *in situ* below the proposed Block 4 basement is considered appropriate because:

- As described by **Section 9.2.2.3**, groundwater concentrations exceeding the groundwater $SSTC^{DEV}$ were reported in only two of the six groundwater monitoring wells located within Block 4, but outside the proposed extent of remediation. Both of these the exceedances (BH405/IT03 and MW40) were reported within the marine sediment from which contaminant flux has been shown to be negligible. All other sampling ports, located within the fill material reported CoPC concentrations less than the $SSTC^{DEV}$;
- As described by **Section 9.2.2.3**, the existing groundwater monitoring data has demonstrated that exceedances of the $SSTC^{DEV}$ are typically associated with the presence of SPGWT. The proposed approach to validation of materials to remain *in situ* below the Block 4 basement is based on visual identification of SPGWT in fill (as described following); and
- Contaminant flux modelling undertaken by AECOM in support of the *VMP Remediation Extent* report (AECOM [2013c] refer to **Section 6.6.5**) has demonstrated that the reduction in contaminant mass that is expected to occur as a result of the proposed VMP remediation works will result in a significant improvement to groundwater quality (between 250% and 380%) in fill. A similar improvement in groundwater quality in fill would be expected to be realised by the proposed Block 4 Development Works extent of remediation.

The *Declaration Site HHERA* (AECOM, 2011a) assumes that SPGWT will be removed from the immediate vicinity of the outer basement walls to the extent practicable.

In consideration of this, all bulk excavation bases founded in fill or residual soils/bedrock will be inspected by a qualified environmental engineer/scientist to confirm that the excavated surface is visually free from:

- SPGWT; and
- ACM to ensure residual soils are suitably validated for the protection of construction workers.

If there is visual evidence of potential SPGWT being present at the base of the bulk excavation, validation samples will be collected. If required, excavation base samples (discrete only) will be collected and analysed at a frequency of one sample per 20 m grid intervals across the base of the remedial excavation, within footprint of the potential SPGWT. Excavation base validation samples will be collected using a trowel below a depth of 100 mm (to minimise the potential loss of volatiles). All soil samples will be analysed for PAHs to allow comparison to the TCM criteria (as defined in **Section 6.6.1**). The analytical results from excavation base validation samples will be used to confirm the absence (or otherwise) of SPGWT at the base of the excavation.

In areas where SPGWT or CIM is known to be present at depths greater than depth of the basement excavation (which is currently proposed to be 8 m bgl) (i.e. BH49 and BH119), or where SPGWT is observed in the base of the completed basement excavation, the vertical extent of remediation will be increased in the vicinity of the impact to the depths following:

- 2 m from the underside of the basement floor slab if permeable fill will be used to backfill the over excavation area; or
- 1 m from the underside of the basement floor slab if clay will be used to backfill the over excavation area.

The increase to the vertical extent of remediation required is based on consideration of:

- the practicabilities of increasing the depth of remediation including:
  - the depth that can be reasonably achieved by a single excavation lift; and
  - minimising the requirement for increased excavation shoring, dewatering and associated water management; and
- provision of adequate separation between the underside of the basement slab and any SPGWT or CIM remaining *in situ* beneath it such that there is no unacceptable risk to occupants of the basement.

Removal of the additional material shall be validated through visual observations and validation documented via field notes and photographs.

If ACM is encountered during these works, it will be managed as described by **Section 14.8**.

Where the basement excavation is founded in rock, the excavation base will be validated visually. In particular, visual validation will be based on observations that:

- the final surface is generally free of SPGWT, specifically:
    - any SPGWT present is contained within rock defects;
    - any SPGWT present is not mobile (that is it does not migrate out of the defects under normal weather conditions); and
    - the area of SPGWT impacted defects is less than 5% of the exposed rock face; and/or
- surface waters are free of a sheen associated with contamination.

These observations will be confirmed via visual observation and photographic documentation. Where the above requirements are not met, the contingency measures detailed in **Section 23.11** will be considered.

All soil and groundwater analytical data relevant to characterising materials to remain below the Block 4 basement will be included in the Block 4 Validation report (refer to **Section 19.12**).

19.5.4 Validation of Basement Excavation Walls – Block 4 Development Remediation Works

It is expected that excavation walls in soil required for construction of the Block 4 basement will be supported (and effectively retained) by excavation retention cut-off walls. As a consequence, it will not be possible to directly sample materials remaining in excavation walls. Notwithstanding, the *Declaration Site HHERA* (AECOM, 2011a) assumes that SPGWT will be removed from the immediate vicinity of the outer basement walls to the extent practicable.

Figure F6 of the RAP indicates that there is potential for SPGWT to be present in the vicinity of the currently proposed Block 4 basement walls. In particular, SPGWT has been identified in the vicinity (i.e. within 30m) of the wall at the following locations:

- Within Hickson Road:
    - BH15/MW15 - DNAPL was observed in the groundwater at this location. This borehole is located within the proposed extent of VMP Remediation Works in Hickson Road;
    - BH10/MW10 - DNAPL and TCM were reported at a depth of 4.9-9.4 m bgl. This borehole is located within the former gasholder annulus and within the proposed extent of Remediation Works in Hickson Road.
    - DNAPL and TCM identified reported at the above locations will be addressed as part of the VMP Remediation Works.
- Outside the proposed alignment of the Block 4 basement wall:
    - BH403 - TCM was observed in the marine sediments at a depth of 9-17 m bgl. This borehole is located approximately 20 m north of the proposed Block 4 basement. TCM reported at this location is not considered to pose an unacceptable risk to human health because of:
        - its location relative to the wall;
        - its limited extent (noting that TCM was not reported at adjacent locations); and
        - its presence within the underlying marine sediment (refer to **Section 6.6.5**).
- Within the proposed alignment of the Block 4 basement well:
    - BH404 - TCM was observed in the marine sediments at a depth of 15-16 m bgl. This borehole is located approximately 10 m south of the proposed Block 4 basement wall alignment. The TCM is approximately 7 m below the currently proposed Block 4 basement;
    - BH406 - TCM was observed in the fill and marine sediments between depths of 14.3 and 16.8 m bgl. This borehole is located approximately 15 m east of the proposed Block 4 basement wall alignment. These impacts are approximately 6.3 m below the currently proposed Block 4 basement;
    - BH48 - TCM was observed in the marine sediments at a depth of 14.5 m bgl. This borehole is located approximately 10 m east of the proposed Block 4 basement wall alignment. These impacts are approximately 6.5 m below the currently proposed Block 4 basement; and
    - TCM reported at the above locations is not considered to pose an unacceptable risk to human health because of:

- its location within the basement extent (noting that TCM identified within the base of the excavation will be removed as per **Section 19.5.3**);
- its limited extent (TCM was not reported at adjacent investigation locations – with the exception of BH406 and BH48); and
- its presence at significant depth below the proposed Block 4 basement and largely within the underlying marine sediment (refer to **Section 6.6.5**).

As described above, the occurrence of SPGWT in the vicinity (i.e. within 30m) of the excavation retention cut-off wall is not considered to represent an unacceptable risk to human health and remediation of the soils in these areas is not considered to be warranted.

It is noted that the alignment of the currently proposed Block 4 basement walls passes through the inferred location of the 1870 gasholder annulus (refer to **Figure F3** in **Appendix B**). The timing of remediation of the 1870 gasholder annulus relative to construction of the Block 4 groundwater retention wall system is yet to be confirmed. However, it is possible that the gasholder will not have been remediated prior to installing the Block 4 retention wall. The timing of remediation within the 1870 gasholder relative to construction of the retention wall will be considered as part of the Validation SAQP (refer to **Section 19.2.3**). In the event that remediation and validation of Block 4 is required prior to remediation and validation of Hickson Road, the following options will be considered:

1) Remediation of SPGWT within the 1870 gasholder in Hickson Rd prior to validation of Block 4; or
2) Further assessment of whether the presence of SPGWT within the 1870 gasholder in Hickson Road represents an unacceptable risk to human health or the environment. This assessment would be undertaken in consultation with the Site Auditor and may consider:
    - the outcomes of additional investigations undertaken to more accurately delineate the presence of SPGWT within the gasholder and the gasholder design (for example, the gasholder is thought to consist of an annulus excavated into rock); and,
    - the design and construction methodology of the retention wall (including how the retention wall will be constructed within the gasholder annulus).

19.5.5 Validation of Stabilised Materials for Off-site Disposal

Materials requiring stabilisation (or treatment using S-ESCO™) will be tested and validated in accordance with NSW EPA General Immobilisation Approval (approval number 2005/14 or a specific approval for the Site, where required). This will involve the collection and analysis of validation samples from treated and untreated materials at a rate of 1 sample per 500 m^3. The validation samples will be analysed for the following:

- Untreated materials:
    - Heavy metals;
    - PAH and phenols;
    - TPH/BTEX;
    - Cyanide; and
    - Asbestos.
- Treated materials:
    - TCLP (Heavy metals)
    - TCLP (PAH and phenols);
    - TCLP (Cyanide); and
    - Unconfined Compressive Strength.

In addition to the above laboratory analysis:

- the composition of the reagent and ratio of reagent to untreated waste (mass/mass) used during the treatment works will be monitored and reported appropriately; and
- material requiring stabilisation will be inspected by a qualified environmental engineer/scientist to confirm whether it contains SPGWT and/or ACM and the results of this inspection documented.

If ACM is identified, it will be managed in accordance with **Section 14.8**.

19.5.6 Validation for Reuse On-site

Based on the available analytical data some excavated materials may require validation to facilitate reuse (refer to **Section 7.3**). Any overburden material which requires excavation to enable the excavation and remediation of impacted materials will be selectively excavated for potential reuse based on excavation plans. The excavation plans will be based on:

- the findings of the site investigations detailed in **Section 5.0**;
- the remediation extent as described in **Section 8.0** and **9.0** (as applicable to either the VMP Remediation Works or Block 4 Development Remediation Works); and
- field observations during the remediation works (visual and olfactory).

All material excavated for reuse must be inspected by a qualified environmental engineer/scientist to confirm that the excavated material is visually free of SPGWT and ACM.

If ACM is encountered, removal and validation works will be undertaken as per **Section 14.8**.

Wherever possible, the excavated material will be taken directly to a designated area for stockpiling. If field observations during the excavation works indicate that the excavated material is significantly different from that anticipated by the available analytical data, the material will be stockpiled and additional discrete validation samples collected and analysed from each stockpile at a sampling frequency of 1 sample per 400 m^3.

The adequacy of the proposed sample density will be confirmed once the material proposed to be reused has been identified, and the relevant available analytical data set for the subject material reviewed. This assessment will be undertaken in consultation with the NSW EPA Accredited Site Auditor and the outcome documented in the Validation Report (refer to Section **19.12**).

All soil samples will be analysed as per **Section 19.6**.

19.5.7 Validation of Treatment Area and Stockpiling Areas

Activities within the RE, including the treatment and stockpiling works, will be undertaken on appropriately sealed hardstand areas in a designated area, with diversion drains and bunding constructed around the perimeter of the area. Consequently, the soil beneath the hardstand is unlikely to be impacted by the stockpiling activities and subsequently, validation testing of these areas, once the hardstand is removed, is not proposed.

As a precautionary measure, before removal of hardstand is commenced, a careful inspection of these areas will be undertaken to identify the presence of contamination. If this inspection indicates the visual presence of any contamination relating to treatment operations, validation of the soil beneath the hardstand will be undertaken. These works will comprise the collection and analysis of validation samples on a 20 m sampling grid. Validation samples will be collected from the soil surface (0.0 to 0.15m depth) underlying the hardstand and analysed as per **Section 19.6**.

19.6 Validation Laboratory Analysis

All soil and groundwater validation samples will be analysed by National Association of Testing Authorities (NATA) accredited laboratories. The suite of analysis required for will be as follows:

- VMP Remediation Works:
  - Remediated areas – analysis for the relevant soil SSTCs (refer to **Table T1**, **Appendix A**);
  - Material proposed to be reused at the Site - analysis for the relevant soil SSTCs (refer to **Table T1**, **Appendix A**); and
  - Groundwater monitoring on the down hydraulic gradient Declaration Area boundary - determined by the relevant groundwater SSTCs and MWQCs detailed in **Section 7.1**.
- Block 4 Development Remediation Works:
  - Remediated areas – analysis for the relevant soil SSTCs (refer to **Table T1**, **Appendix A**);
  - Material proposed to be reused - analysis for the relevant soil SSTCs (refer to **Table T1**, **Appendix A**); and

- Groundwater monitoring on the down hydraulic gradient Block 4 boundary (if required, refer to **Section 17.4.3**) - determined by the relevant groundwater SSTCs detailed in **Section 7.2.4.3**.

- VMP and Block 4 Remediation Works:
  - Validation of treatment area and stockpiling areas - analysis for the relevant soil SSTCs (refer to **Table T1**, **Appendix A**).

If field observations during the remediation works indicate that ACM are present within the Site's fill materials, validation soil samples will also be analysed for asbestos in appropriate areas and in accordance with **Section 14.7.8**.

19.6.1 Analytical Methods

Two laboratories will analyse original, duplicate and triplicate soil samples using NATA registered methods. Both laboratories must undertake the required analytical testing in accordance with the requirements of the *NEPM* (1999). Details regarding the analytical methods to be used will be discussed with the NSW EPA Accredited Site Auditor and the appropriate analytical laboratory engaged to undertake the works.

19.7 Soil Sampling Methodology

Fieldwork will be conducted in accordance with written standard operating procedures, copies of which will be maintained in a register on-site during the remedial works. This will ensure that representative samples of materials are collected and the sampling methodology remains consistent throughout the duration of the remedial works.

19.7.1 Soil Sampling Methodology

Sample collection will be by:

- split spoon sampler (or equivalent) for:
  - validation of S-ISCO® treated material to remain *in situ* (refer to **Section 19.4.1** and **19.4.2**); and
  - *in situ* characterisation / validation of fill materials (if required).
- sampling trowel from excavation bases and walls (refer to **Section 19.5.1** and **19.5.2**); and
- grab samples directly from the centre of an excavator bucket from the centre of stockpiles for validation of treated material (refer to **Section 19.5.5**).

All validation sample points will be surveyed.

Materials will be described in accordance with the Unified Soil Classification System (USCS), with soil type, descriptive properties (colour, particle size, moisture content, sorting), as well as discolouration, staining, odours and other indications (if any) being noted. The information will be recorded on field logs completed for each location.

On-site screening of samples for volatile organic compounds (VOCs) in the field will be undertaken using a portable photoionisation detector (PID). The PID will be calibrated at least once daily (at the start of each sampling day) with a known concentration of isobutylene.

Soil samples will be placed into laboratory supplied glass jars as soon as practicable after collection. The jar size will be sufficient to meet the laboratory requirements for the requested analysis. All sample containers will be filled completely using a method such that the loss of volatile components is minimised. All sample containers will be clearly labelled with information such as sample number, sample location, depth, date collected and sampler's identification. After filling, sample containers will then be transferred to a chilled esky for sample preservation prior to and during shipment to the testing laboratory. The sample preservation requirements are listed in **Table 15** below.

Table 15 Soil Sample Preservation and Storage

Analyte	Preservation	Storage
Inorganics		
Metals (General)	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, analysis within 6 months.
Metals (Chromium VI by alkali digestion)	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, extract within 28 days, analyse within 7 days.
Metals (inorganic Mercury)	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, analysis within 28 days.
Cyanide	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, extraction within seven days, analyse within 14 days.
Organics		
TPH C_6-C_9	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, nil headspace, analysis within 14 days.
TPH C_{10}-C_{36}	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, extraction within 14 days, analysis within 40 days.
BTEX	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, nil headspace, analysis within 14 days.
PAHs	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, extraction within 14 days, analysis within 40 days

A sample register will be updated daily to manage and track the validation process.

19.7.2 Sampling Equipment Decontamination

Equipment decontamination will be undertaken as described below. The following equipment will be needed for the detergent wash and water rinse decontamination process:

- laboratory (phosphate-free) detergent or Decon 90;
- tap water and deionised water;
- buckets or tubs (sufficient for size of equipment to be cleaned); and
- stiff brushes for cleaning.

Equipment that cannot be thoroughly decontaminated using the detergent wash and water rinse should be steam cleaned, or if a steam cleaner is not available, not used for further sampling (and marked clearly "not decontaminated") or discarded. Equipment decontaminated using the high pressure steam cleaner will be further decontaminated as described above.

19.7.3 Quality Control samples

The following quality control (QC) samples will be collected as part of the field quality control procedures:

- Intra-Laboratory Duplicates – are identical to field samples, but both samples are sent anonymously to the primary laboratory. Blind duplicates provide an indication of the analytical precision of the main testing laboratory, but may also be affected by sampling techniques and inherent heterogeneity in the sample medium;
- Inter-Laboratory Duplicates – are identical to blind duplicates, but the duplicate sample is sent to the second (check) laboratory. Split duplicates provide an indication of the accuracy of the main testing laboratory;
- Trip Blanks/Spikes – are samples of soil or water prepared by the laboratory with either zero or known anolyte concentration. Trip blanks/spikes are a check on the sample contamination originating or lost from sample transport and handling, and shipping. One Trip Blank/Spike will be analysed per sample batch;
- Field Blanks – are similar to trip blanks except the water is transferred to sample containers on-site. Field blanks are a check on sample contamination originating from sample transport, handling, shipping, site conditions or sample containers. One Field Blank will be analysed per water sample batch; and

- Rinsate blanks - one rinsate blank sample (from an item of sampling equipment) will be collected per day of sampling by running distilled water over the selected item and decanting directly into the sample bottle. The rinsate will be taken from the final rinse of the equipment after decontamination.

Procedures for duplicate sampling will be identical to those used for routine sampling and duplicate samples will be despatched for analysis for the same parameters using the same methods as the routine sample. Duplicate soil samples will be collected from directly adjacent to original samples (i.e., from the adjacent area of the excavation base or wall). No homogenisation of samples will occur to reduce the loss of volatile compounds.

Duplicates and equipment blank samples will be collected as follows:

- Intra-Laboratory duplicate samples will be collected at a rate of approximately 1 in 10 soil samples and analysed for the full analyte suite. At least one blind duplicate sample will be included in each batch of samples;
- Inter-Laboratory duplicates samples will be collected at a rate of approximately 1 in 20 soil samples and analysed for the full analyte suite. At least one split duplicate sample will be included in each batch of samples; and
- One equipment blank of soil sampling equipment will be collected for every day of sampling and analysed for the full analyte suite. At least one equipment blank will be included in each batch of samples.

19.7.4 Laboratory QA/QC

The laboratories will undertake the analyses utilising their internal procedures and their test methods (for which they are NATA, or equivalent, registered) and in accordance with their quality assurance (QA) system which forms part of their registration.

Laboratory quality control procedures, which will be used during the project, will comprise the following:

- Laboratory Duplicate Samples – these are sub-samples taken from one sample submitted for analytical testing in a batch. A laboratory duplicate provides data on analytical precision. The rate of duplicate analysis will be according to the requirements of the laboratory's accreditation but will be at least one per batch;
- Matrix Spiked Samples – the purpose of the matrix spike is to monitor the performance of the analytical methods used, and to determine whether matrix interferences exist. A sample is spiked by adding an aliquot of known concentration of the target analyte(s) to the sample matrix prior to sample extraction and analysis. A spike documents the effect of the sample matrix on the extraction and analytical techniques. These will be analysed at a rate of approximately 5% of all analyses. At least one per batch will be reported;
- Laboratory Blank – this is usually an organic or aqueous solution that is as free of analyte as possible and contains all the reagents in the same volume as used in the processing of the samples. The reagent blank must be carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The reagent blank is used to correct for possible contamination resulting from the preparation or processing of the sample. Blanks will be analysed at a rate of once per process batch, and typically at a rate of 5% of all analyses;
- Laboratory Control Samples – these comprise either a standard reference material or a control matrix fortified with analytes representative of the analyte class. Recovery check portions should be fortified at concentrations that are easily quantified but within the range of concentrations expected for real samples. These will be analysed at a rate of one per process batch, and typically at a rate of 5% of analyses; and
- Surrogates – surrogate spikes are known additions to each sample, blank and matrix spike or reference sample analysis, of compounds which are similar to the analytes of interest in terms of:
    - extraction;
    - recovery through clean-up procedures; and
    - response to chromatography or other determination;

    but which:

    - are not expected to be found in real samples;
    - will not interfere with quantification of any analyte of interest; and

- may be separately and independently quantified by virtue of, for example, chromatographic separation or production of ions of different mass in a GC/MS analyser.

Surrogate spikes are added to the analysis before extraction. The purpose of surrogates is to provide a means of checking, for every analysis, that no gross errors have occurred at any stage of the procedure leading to significant analyte losses. Other internal laboratory quality control procedures, as required for NATA, or equivalent, registration, will also be performed.

Results of the QC analyses for both laboratories will be reported with each batch.

19.8 Groundwater Validation - VMP Remediation Works

19.8.1 GMP Compliance Monitoring

As detailed in **Section 17.4.1**, a GMP will be prepared to detail groundwater monitoring requirements for the Declaration Area both during and following the remediation works. The groundwater monitoring will be undertaken to assess groundwater quality migrating from the Declaration Area against:

- the relevant groundwater $SSTC^{VMP}$ across the Declaration Area; and
- the MWQCs on the down hydraulic gradient boundary of the Declaration Area (in accordance with NSW EPA policy, refer to **Section 7.1.3**).

As per the *VMP Remediation Extent Report* (AECOM, 2013c), the VMP Remediation Works groundwater monitoring will include the following identified SSTCs CoPCs (refer to **Section 7.1.1**):

- Benzene;
- TPH C_{10}-C_{28};
- naphthalene and acenaphthylene; and
- cPAHs; and
- ammonia.

Groundwater monitoring to confirm whether groundwater quality at the down hydraulic gradient Declaration Area boundary is approaching the MWQC (in accordance with NSW EPA policy, refer to **Section 7.1.3**) will include the following CoPCs (refer to **Section 7.1**):

- PAHs – acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene and phenanthrene;
- Phenols;
- Benzene, Toluene, Ethylbenzene and Xylene;
- TPH C_6 –C_9, C_{10} -C_{14}, C_{15}-C_{28} and C_{29}-C_{36}; and
- Ammonia.

The validation program included in the GMP will serve to validate that the remediation (either S-ISCO® or ex situ) has achieved the remediation objectives with respect to groundwater quality at the Declaration Area boundary.

19.8.2 Groundwater Validation (*In situ* Remediation)

If S-ISCO® remediation works are undertaken within the remediation areas, the following groundwater validation works will be undertaken:

- Compliance groundwater monitoring wells will be installed at 40 m intervals (or existing wells used if appropriate) across the S-ISCO® treatment areas;
- The groundwater monitoring well network may include monitoring wells required for the S-ISCO® treatment and new wells installed to provide the required minimum coverage (as required);
- Groundwater monitoring wells will be installed at 40 m intervals (or existing wells used if appropriate) along the down hydraulic gradient Declaration Area boundary;
- Groundwater monitoring wells may be constructed with multiple screen intervals to allow sampling from various depths. The required screen intervals will be informed by the findings of the S-ISCO® and SEPR™ Pilot Trial Report (refer to **Section 16.2**) and will be detailed in the GMP (refer to **Section 17.4.1**);

- Groundwater samples collected from groundwater monitoring wells:
    - within the Declaration Area will be analysed for analytes corresponding with the groundwater SSTCs (refer to **Section 7.1.2**); and
    - at the down gradient Declaration Area boundary will be analysed for analytes corresponding with the MWQCs (refer to **Table T2**, **Appendix A**); and
- Groundwater samples will be collected using the methodologies detailed in **Section 19.10**.

In accordance with the approach outlined in the *VMP Remediation Extent report* (AECOM, 2013c) upon completion of the VMP Remediation Works, final groundwater CoPC concentrations:

- within the S-ISCO® treatment area(s) should:
    - not exceed the relevant groundwater SSTCs; and
    - demonstrate an asymptotic decrease relative to the baseline and interim CoPC concentrations reported from monitoring during the remediation works; and
- at the down hydraulic gradient Declaration Area boundary should approach the MWQC.

The details of the groundwater validation works provided herein will be subject to confirmation based on the outcomes of the proposed S-ISCO® Pilot Trial Proving Phase (refer to **Section 16.1**)and Pilot Trial (refer to **Section 16.2**). Any refinement of the approach described following will be detailed in the GMP (refer to **Section 17.4.2**).

19.8.3 Groundwater Validation (ex situ remediation)

It is considered that the groundwater analysis undertaken as part of the GMP compliance monitoring (refer to **Section 19.8.1**) will demonstrate validation of ex situ remediation works should they be implemented as part of the VMP Remediation Works.

19.9 Groundwater Validation – Block 4 Development Remediation Works

19.9.1 Groundwater Validation (ex situ remediation)

If the preferred ex situ remediation option is adopted, groundwater monitoring will not be required within Block 4 for the following reasons:

- As detailed in **Section 9.2.2**, the proposed extent of remediation works includes removal of the identified SPGWT and CIM from the eastern portion of Block 4. This approach is consistent with the remediation strategy of removing the source of potential groundwater contamination;
- The required bulk excavation works (extending to a depth of 8 m bgl) will include removal of a significant depth of bedrock. Consequently, much of the basement excavation will be founded directly in bedrock where groundwater flows are very low;
- Engineering mitigation measures will be considered to address residual SPGWT identified in the excavated bedrock surface as per the contingency requirements detailed in **Section 23.11**;
- The basement groundwater retention wall system (refer to **Section 4.3**) will largely prevent groundwater flow from Block 4 to other site areas; and
- It will not be practical to install and monitor groundwater monitoring wells within Block 4 once the basement has been constructed.

19.9.2 Groundwater Validation (*In situ* Remediation)

If the alternative remediation strategy of *in situ* remediation is undertaken in Block 4 (refer to **Section 11.1.3**), the groundwater validation works will be undertaken in accordance with **Section 19.8.2**.

19.10 Groundwater Sampling Methodology

Groundwater sampling will be conducted in accordance with written standard operating procedures, copies of which will be maintained in a register on-site during the remedial works. This will ensure that representative

groundwater samples are collected and the sampling methodology remains consistent throughout the duration of the remedial works.

A summary of the groundwater monitoring methodology is provided in **Table 16** following. Further details of the groundwater sampling methodology will be detailed in the GMP (refer to **Section 17.4.1**).

Table 16 Groundwater Sampling Methodology

Activity/Item	Details
Monitoring Parameters	Monitoring should include the following: - Groundwater depth (converted to m Australian Height Datum); and - Field parameters (including temperature, electrical conductivity, pH, dissolved oxygen and redox potential). Laboratory Analysis for the groundwater SSTCs detailed in **Table T2** and the MWQCs.
Well Gauging	Monitoring wells should be gauged using a calibrated water level probe. The probe should be decontaminated between each measurement. Water levels should be gauged from the surveyed point on the casing. Details of the gauging dates and depths recorded are to be provided as part of reporting requirements.
Well Surveying	A licensed surveyor will be engaged to survey the location and elevation of the groundwater monitoring network to Australian Height Datum (m AHD).
Well Purging and Sampling Process	All groundwater monitoring wells should be purged using low flow (such as Micropurge) pumping prior to sampling, using new disposable low-density polyethylene (LDPE) bladders, in conjunction with flow cells as necessary and dedicated LDPE tubing. The GMP will detail the length of screen to be installed within monitoring wells and the depth of the sampling inlet tubing in each well to standardise validation conditions. The LDPE tubing will be disposed of appropriately after each sampling event. Measurement of field water parameters should be conducted continuously and purging continued until groundwater field quality parameters have stabilised. An appropriately experienced environmental consultant should be engaged to carry out these activities.
Decontamination Procedure	Monitoring and sampling equipment should be decontaminated according to the following procedure: - Wash with Decon 90 or similar decontaminant / water solution and rinse. - Triple wash with laboratory supplied clean deionised water.
Sample Method and Preservation	Following stabilisation of field parameters, samples should be placed into laboratory-supplied bottles containing appropriate preservatives for the selected analytical testing. Samples should be immediately chilled and stored at a temperature of 4°C or less prior to transit to the laboratory.
Disposal of Purged Groundwater	If required, purged groundwater should be disposed of at the on-site water treatment plant or off-site to a licensed waste receiving facility. Purged groundwater may be placed in drums for characterisation and disposed in accordance with the DECCW (2009) *Waste Classification Guidelines* or any subsequent revision. If required, a licensed contractor should be engaged to dispose of the water to an appropriately licensed facility.
Analytical Laboratories	Both a primary laboratory and secondary (QC) laboratory should be used. Both laboratories should be accredited by NATA for the analyses undertaken.
Quality Assurance / Quality Control (QA/QC)	QA/QC samples collected for quality control purposes during each round of groundwater sampling will be consistent with the requirements of **Section 19.7.3** and **19.7.4**. Discussion of the laboratory and field quality assurance/quality control and analytical data validation should be included in the reporting requirements.
Sample Nomenclature	Sample nomenclature will be consistent between sampling events.

19.11 Validation Data Quality Objectives

The Data Quality Objectives (DQO) process is a systematic, seven-step process that defines the criteria that an investigation should satisfy. DQOs for the validation works have been developed based on the iterative DQO

process developed by the USEPA (2000) *Guidance for the Data Quality Objectives Process* – EPA QA/G-4 and adopted by DEC (2006a). The guidelines incorporate field quality control and laboratory analysis, methods and information on laboratory quality control data and have been used to validate the field and analytical data for the validation works.

The DQO approach follows the general guidance provided in Appendix IV of DEC (2006a) with respect to setting the DQOs and assessing their achievement by reference to the Data Quality Indicators (DQIs) set out in Appendix V of DEC (2006a). The approach has been modified to focus on setting appropriate objectives and ensuring the reliability of data from both field and laboratory procedures. The approach puts more emphasis on Step 5 (Developing the analytical approach to assessing data), which assesses the reliability of both the field and laboratory data and on demonstrating achievement of the objectives of the validation works. The approach assesses achievement of Step 6 (performance or acceptance criteria that data need to achieve) by reference to DQIs for both field and laboratory procedures.

The DQOs are detailed in the following Sections.

19.11.1 Step 1 – State the problem

Parts of the Site have been impacted by the historic gas works located across most of the Site (refer to **Section 3.2**). The reclamation of the Site with fill materials (refer to **Section 3.2**) is also likely to have impacted soil and groundwater quality. The discussed activities' has caused metals, BTEX, PAH, phenols and TPH contamination in the soils and groundwater in some areas of the Site.

The *VMP HHERA* (AECOM, 2012c) and *Declaration Site HHERA* (AECOM, 2011a) has concluded that some chemicals are present in the Site soils and groundwater at concentrations which may pose a risk to human health or the environment. Consequently, remediation or management of soils and groundwater in some areas of the Site is required.

A validation program is required to demonstrate that the remedial works required to mitigate the risks to human health and the environment have achieved the objectives of this RAP.

19.11.2 Step 2 – Identify the decisions

The decisions to be made relate to whether the validation program has demonstrated that the remedial works have achieved the objectives of this RAP:

- Is the remediated Declaration Area protective of human health in the context of the Site's current land use in its current form?
- Is the remediated Block 4 protective of human health in the context of the proposed Block 4 Development Works?
- Has the remediated Declaration Area been remediated to a standard that will be protective of the environment (specifically groundwater down hydraulic gradient of the Declaration Area and ultimately Darling Harbour)?
- Do the completed remediation works comply with applicable legislative requirements including the appropriate requirements of the NSW DoPI and NSW EPA?
- Has the remediated Declaration Area been remediated to a standard which enables the NSW EPA's declaration of the Site as a Remediation Site (Declaration Number 21122; Area Number 3221) to be revoked (to be determined by the NSW EPA)?

19.11.3 Step 3 - Identify the decision inputs

Inputs to the decision that need to be made with respect to whether the proposed remediation works at the Site have achieved the stated objectives are:

- The results of previous investigations (refer to **Section 5.0**);
- The use of appropriate remediation criteria (refer to **Section 7.0**) as described in the *VMP HHERA* (AECOM, 2012c), *VMP Remediation Extent* report (AECOM, 2013c) and *Declaration Site HHERA* (AECOM, 2011a);
- The development and implementation of remedial options;
- The data to be obtained during soil sampling during the validation testing discussed in **Section 19.4** and **19.5**;

- The data to be obtained during groundwater sampling during the monitoring discussed in **Section 17.4.1** and **19.8**;
- The use of appropriate validation field methods, including sampling and preservation of soil and groundwater samples;
- The use of NATA registered methods for all analysis; and
- Confirmation that the DQIs have been achieved.

19.11.4 Step 4 – Definition of the boundaries of the remedial works

This is clearly defined by reference to the Site address and surveyed site areas (including the Declaration Area, refer to **Section 3.1** and **Figure F2** in **Appendix B**).

19.11.5 Step 5 – Develop decision rules

The quality of data from field and laboratory procedures will be achieved by assessing data with reference to DQIs. The criteria will be as follows:

Table 17 Field and Laboratory Data Quality Indicators

Data	Data Quality Indicators
Field	
Field Personnel	Use appropriately trained field personnel.
Field data collection	Site conditions and sample locations properly described. All soil sample and groundwater monitoring well locations will be surveyed. Information to be recorded in field notes. Field notes are appropriately completed.
Sample handling (storage and transport)	Soil and water samples will be collected will be collected in accordance with **Section 19.7** and **19.10**.
Field duplicates	As per the requirements of **Section 19.7.3**.
Field blanks	As per the requirements of **Section 19.7.3**.
Calibration of Field Equipment	On-site screening of samples for volatile organic compounds (VOCs) in the field will be undertaken using a portable photoionisation detector (PID). The PID will be calibrated at least once daily (at the start of each sampling day) with a known concentration of isobutylene. Water quality meters will be calibrated prior to the commencement of field activities with relevant solutions. The calibration will be in accordance with manufacturer's instructions or NATA publications *General Requirements for Registration: Supplementary Requirement: Chemical Testing (NATA 1993) and Technical Note N0. 19* (NATA 1994). Where satisfactory calibration cannot be achieved, the equipment will not be used. Calibration details will be recorded on field sheets, which will be included in the final report.
Laboratory	
Sample Analysis	All sample analyses to be conducted using National Association of Testing Authorities (NATA) certified laboratory using *NEPM* (1999) procedures. Use NATA certified check laboratory.
Holding times	Maximum acceptable sample holding time will be as follows: - BTEX - 14 days; - TPH C_6-C_9 - 14 days; - TPH C_{10}-C_{36} - extract within 7 days, analyse within 40 days; - PAHs - extract within 7 days, analyse within 40 days; - Phenols - extract within 7 days, analyse within 40 days; and - Ammonia - 28 days.
QA/QC samples	As per the requirements of **Section 19.7.4**.
Practical Quantitation Limits (PQLs)	All PQLs to be less than the remediation criteria.

Data	Data Quality Indicators
Laboratory Relative Percentage Difference (RPD)	The RPDs of replicates will be determined and compared to the following criteria (from tender brief) for acceptability: - Less than 20 percent for laboratory duplicates where the detection is greater than 20 times the PQL; - Less than 50 percent for laboratory duplicates where the detection is greater than 10 times the PQL and less than 20 times the PQL; and - No limit where concentration less than 10 times PQL
Control Spike Duplicate RPDs	RPDs for Control Spike Duplicates will be compared to an acceptable limit of 20% and undertaken at 1 in 20 samples or a minimum of 1 per batch.
Matrix Spike Duplicates RPD	RPDs for Matrix Spike Duplicates will be compared to an acceptable limit of 20% and undertaken at a minimum of 1 in 20 samples.
Control Spike and Matrix Spike Recoveries	Percent recoveries of control spikes and matrix spikes will be compared to an acceptable range of 75–130 % and/or the laboratories internal DQI limits.

Corrective Actions

Analytical data that fails to meet the predetermined DQIs listed in **Table 17** above will be managed using the following corrective actions on a case-by-case basis:

- Inspect samples to determine heterogeneity;
- Reanalyse suspect samples;
- Evaluate and amend sampling and/or analytical procedures;
- Re-sampling and re-analysis;
- Accept the data with an acknowledged level of bias and imprecision; and
- Discard the data.

In the event that data of questionable reliability are used, then it is essential that any restrictions and limitations associated with the use of such data are clearly identified. Failure to meet the DQIs will be reported and the implications to data quality will be assessed.

If the DQIs are considered to have been achieved satisfactorily then it will be concluded that the data is suitable for use for validation purposes. If the DQIs are not achieved, the significance of possible errors will be assessed to decide whether the data is useable.

19.11.6 Step 6 – Specification of the acceptable limits on decision errors

Specification of the acceptable limits on decision errors will be achieved by reference to the DQIs outlined below:

Precision

Precision measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques will be assessed by calculating the Relative Percent Difference (RPD) of duplicate (laboratory and field) samples. The criteria to be used for the assessment of RPD will be based on guidelines given in AS4482.1 1997. These criteria listed in **Table 18** below.

Table 18 RPD Assessment Criteria

Sample Type	Typical Acceptable RPD [a]
Intra-Laboratory Duplicate	30-50% [b]
Inter-Laboratory Duplicate	30-50% [b]

Notes: a) The significance of RPDs of results should be evaluated on the basis of sampling technique, sample variability, absolute concentration relative to criteria and laboratory performance.

b) This variation can be expected to be higher for organic analysis than for inorganics and for low concentrations of analytes which are close to the laboratory LOR.

If duplicate results are not within the acceptable RPD range, investigation into the cause will be initiated. The results of the investigations will be written up and filed, and followed up with the laboratories to achieve resolution. Thus the precision of the laboratory will be assessed by the acceptability of the RPD of laboratory duplicate samples, which should be within the acceptable RPD limits as established for intra-laboratory and inter-laboratory duplicates.

Accuracy

Accuracy measures the bias in measurement. Accuracy can be impacted by factors such as field contamination of samples, poor preservation of samples, poor sample preparation techniques and poor selection of analysis techniques by the analysing laboratory and improper analyses.

The accuracy of the laboratory data that will be generated during the project is a measure of the closeness of the analytical results obtained by a method to the 'true' value. For reference laboratory methods (e.g. USEPA methods), the following levels of accuracy should generally be achievable within ± 15 % of:

- the expected value of a certified reference material of similar matrix; or
- the value obtained by a separately validated and recognised quantitative method for the sample matrix.

Accuracy will be assessed by:

- reference to the analytical results of laboratory control samples;
- use of trip, equipment and field blanks to check the accuracy of sampling techniques; and
- evaluating the results of laboratory spikes and analyses against reference standards.

Analytical results of these should be sufficient to establish that accuracy has been achieved in the work of the sampling team.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population or an environmental condition. Representativeness will be achieved by collecting samples on a grid basis from an adequate number of sample locations, to validate the subject area to the required accuracy and ensuring that an appropriate number of reliable analyses have been reported for each population or environmental condition, and that the concentrations of CoPC have been maintained in the samples during and after their collection. Consistent techniques and methods using written procedures will be utilised throughout the sampling program.

Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being a sufficient amount of valid data generated during the validation works. If there are insufficient valid data, as determined by the other DQIs, then additional data will be required to be collected.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. This will be achieved through maintaining a level of consistency in techniques used to collect samples, and ensuring the selected laboratories use consistent analytical techniques and reporting methods. Reporting of results will be done in consistent units and nomenclatures, and comparability will be achieved by ensuring that precision and accuracy objectives are met.

19.11.7 Step 7 – Optimisation of the design of the collection of data

This will be achieved by meeting the DQOs detailed in Steps 1 to 6 to confirm that the data generated from the remedial works is from appropriate locations, that analytical testing is undertaken for the identified CoPC, in appropriate quantities and of acceptable quality to confirm that the objectives of the remedial works have been achieved.

19.12 Validation Reporting

Following completion of the remediation and validation works, validation reports will be prepared. Depending on the final staging of the remediation works (as discussed in **Section 1.8**), it is anticipated that separate validation reports will be required for each of the Site areas as follows:

- Block 4;
- Block 5 (within the Declaration Area); and
- Hickson Road (within the Declaration Area).

The reporting requirements for the different areas will be confirmed with the various stakeholders including, but not limited to the Lend Lease, the NSW EPA Accredited Site Auditor, NSW EPA and the Authority.

Due to the potential staging of the remediation works in the above Site areas, separate Validation reports may also be prepared for the Declaration Area to enable the NSW EPA's Declaration to be progressively revoked (as required).

It is anticipated that the validation reporting will be undertaken in a manner which enables the NSW EPA Accredited Site Auditor to prepare Site Audit Statements confirming whether:

- the Declaration Area (or parts thereof) has been remediated to a standard to enable the NSW EPA Declaration to be revoked (i.e. the VMP Remediation Works); and/or
- Block 4 has been remediated to a standard suitable for the proposed post development land uses (i.e. the Block 4 Development Remediation Works).

The validation reports will be prepared in accordance with the requirements of the NSW EPA (2011) *Guidelines for Consultants Reporting on Contaminated Sites* and will include the following information:

- An overview of the remediation works carried out for each validation area;
- A summary of the site history and basis for the remediation approach for the validation areas;
- Surveyed figures outlining the extent of the remediation works;
- The location of validation and characterisation samples;
- Descriptions of sampled materials (including visual and olfactory observations);
- Field Equipment calibration certificates/records;
- Photographic documentation of the bedrock validation works;
- Details of imported material used at the Site;
- Waste classification certificates and landfill waste disposal information;
- Summary tables for soil and groundwater analytical results;
- Confirmation that the project DQO's and DQIs have been appropriately met;
- NATA registered laboratory analytical certificates;
- Summary of the tracking and fate of materials including materials excavated for on-site treatment, reuse on-site or off-site disposal;
- Landfill weighbridge dockets (if required);
- Conclusions as to the suitability of the Site, specifically:
    - for the VMP Remediation Works, that the remediated Declaration Area is appropriate to enable the NSW EPA's declaration of the Declaration Area as a Remediation Site to be revoked; and
    - for the Block 4 Development Remediation Works, that Block 4 is remediated to a standard suitable for the proposed development in Block 4.
- Recommendations (if required) for further works.

20.0 Environment Management Plan – During Remediation

20.1 General

This section of the RAP describes the minimum standards to be adopted to protect the environment during the remediation works. The Remediation Contractor will develop and implement a suitable Environmental Management System in compliance with legislative and regulatory requirements. A site-specific Environmental Management Plan (EMP) will be developed prior to commencement of the works. The EMP will detail the appropriate information and mitigation measures necessary to conduct the remediation works in a manner that will minimise the risk to the environment.

20.2 Water Management

The Environment Management Plan for the works will include procedures for the management of surface and groundwater during the works as outlined in **Section 17.0**.

20.3 Air Quality Management

An Air Quality Impact Assessment will be prepared in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2005) to assess potential air and odour issues generated during the remediation works. This assessment will make reference to the following guidance documents:

- *Assessment and Management of Odour from Stationary Sources in NSW: Technical Framework* (DEC 2006c); and
- *Management of Odour from Stationary Sources in NSW: Technical Notes* (DEC 2006d).

20.3.1 Odours

Odour management is recognised as a critical aspect of site environmental management and will need to be given high priority in the planning of all excavation and stockpiling of contaminated soil at the Site. Odours are expected during the soil excavation, and consequently, management procedures will need to be developed within the EMP to address odour issues during all remediation works involving excavation.

Primarily, odours at the Site will be associated with the excavation of hydrocarbon impacted materials. Odour generation at the Site will be influenced by weather conditions, the extent of open excavations stockpiles, and the quality of material exposed.

A detailed odour management system will be developed as part of the EMP incorporate the use of various management options as deemed appropriate for particular areas. The odour management system will include the following options:

- investigation as to the source of odours including odour monitoring;
- minimisation of the quantity or surface area of exposed odorous materials;
- implementation of odour management response procedures (as specified in the EMP);
- implementation of progressive contingency measures (as specified in the EMP);
- excavation within an EE (odorous soils), where practical;
- stockpiling in the RE (odorous soils);
- covering of exposed odorous materials progressively or at the completion of each work period;
- minimising exposed/excavation areas;
- apply odour suppressant sprays or foams to excavation surfaces; and
- undertake activities during favourable weather conditions.

The management of odours is recognised as a critical aspect of the environmental management of the proposed remediation works. Selection of the appropriate management and mitigation measures, including those summarised above, will be based on consideration of:

- the quantity of odorous materials that require remediation;

- the duration of the required remediation works and associated management of odorous materials;
- the proximity of the proposed remediation works to sensitive receptors;
- the prevailing and forecast weather conditions; and/or
- other activities being undertaken at the Site in parallel with the remediation work.

20.3.2 Dust

Care should be taken to manage wind-blown dust at the Site during excavation and earthworks activities. Dust can be generated through a range of means and activities:

- Wind action:
  - Exposed soil surfaces will generate dust during winds;
- Agitation and movement:
  - Excavation, mixing and placement of soil will generate dust;
  - Transfer of soil in uncovered trucks may result in dust generation;
- Vehicle Movements:
  - Vehicles' wheels on exposed soil surfaces (such as unsealed roadways) will generate dust.

Appropriate management of dust is required to ensure that it is minimised and/or prevented. Dust management will include the following:

- Excavation in the excavation enclosure for the contaminated areas;
- Covering surfaces;
- Minimising exposed/excavation areas;
- Wetting down; and
- Dust monitoring.

20.4 Noise and Vibration Management

An assessment of noise and vibration impacts potentially generated during the remediation works will be prepared in consultation with the NSW EPA. The assessment will be prepared in accordance with the *Interim Construction Noise Guideline* DECC (2009)*, Industrial Noise Policy* (NSW EPA 2000) and *Application Notes, Environmental Criteria for Road Traffic Noise* (NSW EPA 1999) *and Assessing Vibration: A Technical Guide* (DEC 2006b).

The potential for noise and vibration impacts from the remediation works will result from:

- Works associated with preparation of the Site;
- Movement of construction vehicles around the Site;
- Operation of plant and activities on the Site; and
- Operation of the proposed ECS associated with the EE and RE (which will necessarily operate 24 hours per day, 7 days per week).

20.5 Long Term Environmental Management Plan

It is anticipated that a Site Management Plan may be required to describe contingency management methods which may need to be applied by future land owners if they wish to re-develop the Site for any other land use different to its current site condition or as per the proposed Block 4 Development Works (refer to **Section 4.0**).

The Site Management Plan will be prepared as an outcome of the Soil Validation Program and in consultation with the NSW EPA Accredited Site Auditor.

On the basis that both the key assumptions and requirements of this RAP and the *VMP HHERA* (AECOM, 2012c) and *Declaration Site HHERA* (AECOM, 2011a) are successfully delivered and implemented during the execution

of the works, and validated accordingly upon completion, no other form of Long Term Management Plan is envisaged as a requirement of this RAP.

21.0 Occupational Health and Safety – During Remediation

21.1 General

This section of the RAP describes the minimum standards to be adopted to protect the health and safety of all persons involved in the remediation works. The Remediation Contractor will develop and implement a suitable Health and Safety Management System in compliance with legislative and regulatory requirements. A site-specific Occupational Health and Safety Plan (OHSP) will be developed prior to commencement of the works. The OHSP will detail the appropriate health and safety information necessary to conduct the remediation works in a safe manner. The OHSP will be endorsed by a suitably qualified occupational hygienist.

21.2 Occupational Health & Safety Plan

The purpose of the site-specific OHSP is to present all relevant health and safety information for the works. The information presented in the OHSP will include:

- Assignment of responsibilities for management personnel and workers;
- An outline of the existing Site conditions;
- Details of all work to be conducted;
- An evaluation of hazards and risks;
- Details of the proposed measures to be implemented to manage the identified hazards and risks;
- Establishment of personnel protection standards and mandatory safe work procedures;
- Establishment of OHS monitoring protocols;
- Training requirements for emergency team members;
- Communication protocols and training procedures;
- Evacuation procedures, emergency contacts and emergency drills to be implemented; and
- Provision for contingencies and changes in work practices.

21.2.1 Responsibilities

The responsibilities and duties of the Remediation Contractor in relation to OHS will include:

- Ensuring all work undertaken is performed in accordance with relevant legislation and regulations, and directions issued by regulatory authorities;
- Developing and documenting safe working practices for all employees and subcontractors;
- Ensuring workers are adequately trained to undertake their work tasks using the adopted work practices;
- Ensuring that work is performed in strict adherence to the adopted work practices;
- Appointing a suitably qualified and experienced Site Safety Officer (SSO) to supervise and control safety matters;
- Supplying and maintaining first aid kits, first aid facilities and ensuring first aid attendants are present in accordance with statutory requirements;
- Ensuring that all workers are inducted prior to their commencement of work. This will include site-specific training in regard to the site conditions, works procedures, emergency and evacuation procedures, first aid procedures, decontamination procedures and other relevant matters detailed in the OHSP;
- Ensuring that copies of the OHSP are readily available;
- Establishment and maintenance of a record of all hazardous substances on the Site including provision of Material Safety Data Sheets (MSDSs);
- Ensuring that all personnel who work with contaminated materials undergo a medical examination prior to and at the completion of their work on-site;

- Reporting all site incidents and accidents to the WorkCover Authority;
- Ensuring that the SSO is on-site during all site works to monitor compliance with the OHSP;
- Ensuring that regular documented OHS inspections are conducted, including the use of a documented follow-up system to monitor improvements and measures introduced to rectify any observations made;
- Supplying and maintaining the required personal protective equipment (PPE);
- Ensuring all workers are trained in the use of the PPE and correctly use PPE; and
- Ensuring that all electrical equipment, plant and tools comply with appropriate statutory requirements and are maintained in a good, serviceable and safe condition.

21.2.2 OH&S Legislation, Regulations and Standards

The remediation works will be conducted in compliance with applicable OH&S legislation, regulations and standards. In addition, the remediation works will comply with relevant industry codes of practice, guidelines and other publications that have been developed by the WorkCover Authority. These may include:

- *The Work Health and Safety Act* 2011 and *Regulation* 2011;
- *The Dangerous Good Act* 1975 and *General Regulation* 1999;
- *Guide for Riggers* (November 1995);
- *Electrical Practices for Construction Work* (February 1992); and
- *Exposure Standards for Atmospheric Contaminants in the Occupational Environment* (May 1995);

A number of Australian Standards have been identified relating to OH&S issues for the works proposed at the Site. These standards include:

- AS 1319 -1994 Safety Signs for the Occupational Environment;
- AS 1336 -1997 Recommended Practices for Occupational Eye Protection;
- AS 1470 -1986 Health and Safety at Work - Principles and Practices;
- AS 1715 -1994 Selection, Use and Maintenance of Respiratory Protective Devices;
- AS 1716 -2003 Respiratory Protective Devices;
- AS 1801 -1997 Occupational Protective Helmets;
- AS 1885.1 -1990 Measurements of Occupational Health and Safety Performance - Describing and Reporting Occupational Injuries and Disease (known as the National Standard for Workplace Injury and Disease Recording);
- AS 2161 - 2000 Occupational Protective Gloves;
- AS 2210 - 2000 Occupational Protective Footwear;
- AS 2436 -1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites;
- AS 2601 -2001 The Demolition of Structures;
- AS/NZS 2865-2001 Safe Working in a Confined Space;
- AS 2986 -1987 Workplace Atmospheres - Organic vapours - Sampling by Solid Adsorption Techniques;
- AS/NZS 3012 -1995 Electrical Installations – Construction and Demolition Sites;
- AS 3640 -1989 Workplace Atmospheres - Method for Sampling and Gravimetric Determination of Inspirable Dust; and
- AS/NZS 4576 -1995 Guidelines for Scaffolding.

21.3 Risk Assessment

A hazard analysis should be conducted prior to site establishment to identify the OHS hazards expected during the course of the remediation works. A Risk Management Plan will be developed to identify hazards associated with the proposed remediation works, evaluate the associated risks and determine the necessary measures to reduce or mitigate those risks. This section of the RAP outlines some of the hazards expected over the course of the project. Hazard identification and risk assessment will be conducted and documented on an ongoing basis as the project works proceed.

21.3.1 Chemical Hazards

Based on the information provided in previous investigations at the Site, the presence of asbestos, metals, BTEX, phenols, TPH and PAHs has been confirmed within the Sites soils and groundwater. The hazard posed by these materials will be evaluated and the associated risks assessed in the Risk Management Plan.

21.3.2 Atmospheric Exposure Limits and Recognition Qualities

The exposure limits and recognition qualities of the chemicals likely to be encountered in the remediation works will be taken from the following guidelines (listed in order of precedence) and detailed in the OHSP:

- NOHSC, Exposure Standards for Atmospheric Contaminants in the Occupational Environment, 1995. The most up-to-date Australian exposure standards are located on the Safe Work Australia Hazardous Substances Information System (http://hsis.ascc.gov.au/SearchHS.aspx); and
- National Institute for Occupational Safety and Health (NIOSH) 2007, Pocket Guide to Chemical Hazards. Also refer to http://www.cdc.gov/niosh/npg/.

21.3.3 Additional Hazards and Risks

The OHSP will identify and describe a range of other hazards anticipated during the remediation works. These hazards will include:

- Heat stress;
- Explosive atmospheres in areas dealing with contaminated materials;
- Oxygen deficient atmospheres and confined spaces (as defined under AS/NZS 2865 - 2001 Safe Working in a Confined Space);
- Underground utilities;
- Underground pipelines, pits, and other obstructions;
- Above ground electrical and utility hazards;
- Traffic hazards (particularly noting that Hickson Road will remain operational during the remedial works);
- Instability of excavation batters and stockpiled material;
- Hazards associated with the construction and decontamination of the EE, RE and ECS;
- Hazards associated with operation of the treatment works;
- Hazards associated with the airlock and decontamination operations in the EE and RE; and
- Physical hazards such as trip hazards and mobile plant.

Specific minimum standards for these hazards will be outlined within the Risk Management Plan.

21.4 Work Zones

The Site will be divided into a number of work zones, as follows:

- Exclusion Zones – the RE (as detailed in **Section 15.1**);
- Decontamination Zones – decontamination stations located in the Remediation Area; and
- Support Zones – the site office and site facilities areas within the Remediation Area.

Movement of personnel and equipment between these zones will be minimised and restricted to specific access control points and decontamination stations to prevent cross contamination to clean areas.

21.4.1 Decontamination Stations

The decontamination stations will be the only entry and exit points to Exclusion Zones. The stations will be located to minimise the transportation of contaminants between the various areas of the Site, and to ensure that the Support Zone does not become contaminated or affected by other site hazards.

As discussed in **Section 13.3.1**, clean and dirty zones will be established at all decontamination stations. All workers will be required to pass through the Decontamination Stations when entering and exiting the Exclusion Zones.

These stations will also house the PPE stock rooms and change rooms, so that when entering the Exclusion Zones workers are able to apply the necessary PPE.

21.4.2 Support Zone

The Support Zone refers to the site office and other support facilities involved in administering the remediation works. Site personnel may wear normal work clothes within this zone, leaving any potentially contaminated clothing, equipment and materials in the decontamination station until decontaminated or appropriately disposed of.

In the event of an emergency, support zone personnel are responsible for alerting the correct authorities. All emergency telephone numbers, evacuation route maps, vehicle keys and site safety information would be held within the Support Zone.

22.0 Community Engagement

Community engagement is critical to the success of remediation at Barangaroo. Over the past two years, Lend Lease, in conjunction with the Authority, have embarked on an extensive program of community engagement on the remediation activities associated with Barangaroo South and the NSW EPA Declaration Area. This engagement has been aimed at educating the community and key stakeholders about the historic nature of the contamination at the Site and the importance of remediation works, the type of works proposed and to provide a forum for community feedback. Consultation activities have also specifically addressed in detail the proposed Pilot Trials which are proposed to be undertaken prior to full scale remediation activities.

A number of consultation avenues have been utilised during this engagement program including:

- presentations to interested stakeholders;
- face to face meetings with key community groups and stakeholders to provide one-on-one briefings about the remediation;
- holding large scale community information sessions jointly between Lend Lease and the Authority;
- issue of Fact Sheets on remediation to relevant stakeholders and included on the Authority website - www.barangaroo.com; and
- newsletter updates and letterbox notifications.

All of these communications tools provided an opportunity to present factual information about the nature of the contamination and remediation works, along with ensuring the community could raise any issues of concern.

Lend Leases community engagement program for the project has also included establishing a Business Construction Liaison Group (BCLG) and a Community Construction Liaison Group (CCLG), in conjunction with the Authority. The purpose of these groups is to brief key representatives from both the local commercial and residential communities on key aspects of the project, relating to construction, as early as possible in the planning process. To date, both of these forums have received extensive briefings on the proposed remediation activities at Barangaroo and remain keenly interested in further progress updates in the future. Representatives of these groups then assist in actively disseminating information back to their respective networks on the status of the project. It is intended that further presentations will be given to these two groups as the plans for remediation activities progress.

All consultation has been carried out in line with the principals and methodologies outlined in the Lend Lease Community & Stakeholder Engagement Strategy (May 2012). Prior to undertaking full scale remediation works, Lend Lease will develop a Remediation Community Engagement Sub Plan, which will summarise ongoing engagement to be undertaken with the community. Engagement will continue, both prior to and during remediation activities, to ensure the community are fully informed of the remediation activities at the Site, and have an opportunity to provide feedback.

Table 10 below provides a summary of the Lend Lease communication strategy adopted for the community to date:

Table 19 Summary of Lend Lease Communication Strategy

Communication Channel	Purpose
1300 Community Enquiry Line	A key channel for the community to raise issues, ask questions and speak directly to a member of the Community Relations team. A 24 hour after hours service will also be provided to ensure any issues occurring outside of business hours are addressed in a timely manner.
Barangaroo South Website (www.barangaroo.com)	This is the central portal for all information about the project. It is the one-stop-shop for everything the community and stakeholders will need to know about the remediation works including electronic copies of all newsletters, notifications, press releases and links to the Department of Planning website and submissions.
Barangaroo South Blog (link on website)	An opportunity for open communication between the community, stakeholders and general public about the project.

Communication Channel	Purpose
Newsletters	To provide ongoing updates about the planning process and progress of works on site. This will be a key means of ensuring information transparently flows to the community and stakeholders about the remediation work.
Community Information Sessions	Used to convey key messages to the local stakeholders and proactively work to address specific concerns.
Stakeholder one-on-one briefings	To discuss concerns raised by key stakeholders face-to face and provide more detailed information and assurances about the project.
Public displays	To effectively raise greater awareness of the project and the progress, particularly during the design phase.
Notifications	To ensure all residents and businesses potentially impacted by Site works are informed in advance of key work commencing. Notifications will be used to inform the community of key issues such as the timing of noisy work, out of hours construction and traffic impacts.
Door knocking	To personally discuss concerns raised by the local business community (particularly the businesses along King Street Wharf and local cafes in the high rise commercial buildings) face-to-face on a one-on-one basis, proactively address any issues and provide assurances about the work.
Signage	To inform the community about who is responsible for the Site activities and the contact details for further information about the work.
Advertising	To provide regular updates to a large audience and direct them to the website for further information. To raise greater awareness about the project in the wider community.
Commercial Property Notice Boards	When appropriate, general information about the overall project will be included on the notice boards in commercial properties. This will also contain the contact details of the Lend Lease Barangaroo South Community Relations team should they require any further information about the work.
Hoardings	Hoardings will be used as a strategic communication tool to ensure the community and public are up to date with information regarding the construction and key marketing elements of the project (such as leasing enquiries). The relevant contact numbers (including the 24 hours Community Information Line) will be displayed on the hoarding at all times.

23.0 Contingency Planning

23.1 Approach

The purpose of this contingency plan is to outline procedures for the identification and management of unexpected issues or events that may occur during the works. The contingency plan will detail the following information:

- The assignment of responsibilities to nominated key personnel;
- The assessment of hazards associated with such situations, and the potential off-site impacts;
- Contingency responses; and
- Procedures for reporting relevant issues to regulatory authorities.

23.2 Potential Unexpected Events

The following table summarises the unexpected events which have the potential to occur during the remediation works, the likelihood of such an event occurring and the associated control measure which will mitigate such an event:

Table 20 Potential Unexpected Events and Related Control Measure

Potential Unexpected Event	Likelihood	Contingency Measure
Identification of greater volumes of SPGWT / CIM than presently anticipated	Medium	**Section 23.3**
Potential change in the approved land use(s) for the Site	Low	**Section 23.4**
Identification of SPGWT / CIM at depths greater than presently anticipated	Medium	**Section 23.5**
Variation of contaminant characteristics or identification of unanticipated contaminants and materials	Low	**Section 23.6**
Failure of the preferred treatment approach (i.e. either *in situ* or ex situ) to achieve the soil SSTCs (if required) or treatment standard required for off-site disposal of excavated material	Low	**Section 23.7**
Insufficient storage capacity to stockpile all required materials (*ex situ* remediation works)	Low	**Section 23.8**
The groundwater monitoring program detailed in **Section 17.4** may report an increase in CoPC concentrations in the Site's groundwater rather than a decreasing trend	Low	**Section 23.9**
An alternative remediation option may be required for practical and commercial reasons	Low	**Section 23.10**
SPGWT and/or surface water sheens are encountered during visual validation of exposed rock surfaces	Medium	**Section 23.11**
Further development of the basement and groundwater retention wall system designs	Medium	**Section 23.12**
S-ISCO® operational contingencies including potential impact: - to an Aquatic Ecosystem (Darling Harbour) - S-ISCO® Chemistry; - to an Aquatic Ecosystem (Darling Harbour) - Mobilisation of Metals; - to Subsurface Infrastructure; - to Buildings; - of Soil Vapours on Humans; and - due to Day-lighting.	 Low Low Medium Low Low Low	**Section 23.13**

Potential Unexpected Event	Likelihood	Contingency Measure
Operational issues during the remediation works including but not limited to:		**Section 20.14**
- Flooding of the Site;	Low	
- Generation of unacceptable levels of dust during excavation and reinstatement works;	Medium	
- Release of unacceptable levels of fugitive emissions during the excavation works;	Medium	
- Generation of unacceptable odours from the excavation works;	Medium	
- Generation of unacceptable noise levels during site works;	Low	
- Generation of unacceptable vibration levels during excavation and reinstatement works; and	Low	
- Spills and leaks of hazardous materials.	Low	

Contingency mitigations for the above items are described in the following sections.

23.3 Increased Volumes of Contaminated Material

The remediation strategy is to undertake remediation works to the extent practicable such that the Site is suitable for its current use with no change in site conditions. Soil SSTCs have been used to define CIM and to identify the extent of remediation required to accomplish the remediation objectives (refer to **Section 1.1**).

The environmental site investigations have been conducted to adequately characterise material within the Site and therefore minimise the risk of increased volumes of SPGWT or CIM requirement management during the remediation works.

Excavated and reused materials will be managed on-site using the Materials Tracking System described in **Section 14.7.2**. The quantities of materials excavated will be regularly compared to the estimated quantities.

In addition to unanticipated increased volumes of SPGWT or CIM, increased volumes of foreign materials in the form of steel reinforcement, scrap steel and pipe work may have the potential to adversely impact on the project. Depending on the magnitude of the changes of anticipated volumes of excavated materials, and the extent of contamination, changes to the depth of excavation and to the final reinstatement levels may be made during the project.

These changes may require revision of the *VMP HHERA* (AECOM, 2012c). Changes to the *VMP HHERA* (if required) will be issued to the NSW EPA Accredited Site Auditor and the NSW EPA, unless otherwise advised, for review and approval.

23.4 Changes to the Approved Land Uses(s)

The approved land use(s) for the Site envisaged in this RAP may change as a consequence of the planning approvals associated with the Barangaroo South and Barangaroo central development processes. If this occurs, the land use(s) that would require consideration for removal of the NSW EPA Declaration would also change.

If required, an Addendum to this RAP would be and submitted to the NSW EPA Accredited Site Auditor for approval to reflect the change in land use(s) and any changes in the extent of remediation that may be required to ensure Site suitability.

23.5 Variation of Contaminant Depth

Should SPGWT or CIM be identified at greater depths than can be practicably excavated, the following approach will be adopted:

- Review the identified SPGWT or CIM in accordance with the process described by **Section 8.4** and **Section 8.3**) to assess whether the subject material represents an unacceptable risk and thus requires remediation;
- Consider *in situ* remediation techniques;

- Consider the principles of CUTEP and ESD to assess whether the material can be practically removed in the light of: for example, its depth below both ground surface and the water table; and proximity to existing infrastructure and the Harbour;
- Additional or modified groundwater monitoring to assess potential impacts to the environment (as discussed in **Section 17.4**); and
- Review of the *VMP HHERA* (AECOM, 2012c) to assess whether the identified CIM represents an unacceptable risk to human health or the environment.

23.6 Variation of Contaminant Characteristics

The range of contaminants analysed in the environmental site investigations is considered to be appropriate for development of the soil SSTCs and determination of the extent of remediation. However, there is the potential for occurrence of as-yet unidentified contaminants, and for variation in the concentrations or distribution of known contaminants.

Should any significant changes to the nature or types of contaminants be identified during the works a variation to the *VMP HHERA* (AECOM, 2012c) and this RAP and the soil SSTCs may be required. Variations will be issued to the NSW EPA Accredited Site Auditor for review and approval. If the variation to the *VMP HHERA* (AECOM, 2012c) relates to VMP Remediation Works, the document would also be submitted to the NSW EPA for approval.

It is noted that Lend Lease is familiar with potential site conditions based on its experience on areas adjacent to the Site, which at the time of this RAP included:

- Excavation and remediation of the adjacent Bond site; and
- Constructed the basement groundwater perimeter retention wall and a number of piled foundations within the adjacent ORWS Area.

Notwithstanding this, it is considered that any different materials encountered can be adequately addressed by AECOM and Lend Lease following assessment and refinement of any required remediation design.

23.7 Failure of the preferred treatment approach(es)

23.7.1 *In situ* Remediation

If remediation of the treatment areas using S-ISCO® cannot be completed to a standard which achieves the Remediation Goals (refer to **Section 7.1** with respect to VMP Remediation Works and **Section 7.2** with respect to Block 4 Development Remediation Works), the following will be undertaken:

- The residual impacts will be assessed to determine whether they represent a significant risk to human health or the environment (i.e. is the residual material considered to be a CIM which warrants further remediation);
- If required, a detailed area- and CoPC-specific human health risk assessment may be undertaken to assess the significance of specific exceedances of the soil and groundwater SSTC or MWQCs (as required); and
- If, following the above risk assessment, the CIM is considered to represent an unacceptable risk to human health and/or the environment, another remediation strategy and/or engineering mitigation measure will be considered in consultation with the NSW EPA Accredited Site Auditor.

23.7.2 Ex situ Remediation

Two preferred ex situ treatment approaches have been identified by this RAP and selection of the preferred treatment approach will be based on consideration of:

- The ability to obtain an Immobilisation Approval for the stabilisation of material require disposal to an off-site licensed landfill; and
- Consideration of treatment rates, stockpile and curing requirement, programming of the remediation works and commercial efficacy.

Should the eventually selected treatment approach prove to be unsuccessful in achieving the Remediation Goals (refer to **Section 7.1** with respect to VMP Remediation Works and **Section 7.2** with respect to Block 4 Development Remediation Works):

- Consideration will be given to refinement of the treatment approach including use of different quantities of additives or different additives; and/or
- Implementation of the alternative ex situ treatment will be considered.

23.8 Insufficient Storage Capacity for Stockpiles (ex situ remediation)

The proposed ex situ remediation strategy is to minimise the requirement for on-site stockpiling by direct transfer of material either for reuse or for off-site disposal. Further, the site investigation works conducted to date have generally been conducted to adequately characterise material within the Site and therefore minimise the requirement for interim stockpiling. Notwithstanding, variations in quantities or contaminant characteristics or delays in establishment of treatment infrastructure may result in the requirement for additional stockpiling.

If there is insufficient storage capacity for the stockpiling of material in designated areas within Barangaroo, the following options will be assessed:

- Consider collection of additional *in situ* samples to facilitate characterisation of material (where contaminant quantities or contaminant characteristics may be different from those expected) for either reuse or off-site disposal before it is excavated;
- Explore options for temporary stockpiling of material outside of Barangaroo South; and
- Off-site disposal of materials classified as VENM for reuse on other sites outside Barangaroo. It is likely that VENM will be produced during the excavation of sandstone as required for the bulk excavation works.

23.9 Groundwater Quality

In the event that the groundwater monitoring program detailed in **Section 17.4** indicates that groundwater CoPC concentrations are not: a) achieving the groundwater SSTCs across the Site; and b) statistically/significantly[13] decreasing towards the MWQCs at the down hydraulic gradient Site boundary for the identified CoPCs for the duration of the monitoring, contingency measures will be assessed to reduce impacts to the groundwater system. The following contingency actions will be considered:

- The relevant GMP (refer to **Section 17.4.1**) may be modified to include more detailed, extended and/or more frequent groundwater monitoring. Additional groundwater monitoring wells may be installed if more detailed groundwater assessment is considered to be warranted. If required, the GMP would be modified in consultation with the NSW EPA Accredited Site Auditor. If modifications to the GMP relate to VMP Remediation Works, the document would also be submitted to the NSW EPA for approval;
- A detailed area- and CoPC-specific human health risk assessment may be undertaken to assess the significance of specific exceedances of the groundwater SSTCs;
- An quantitative ecological risk assessment may be undertaken to assess the significance of specific exceedances of the relevant groundwater MWQCs; and
- Active groundwater remediation works would be considered as an option.

23.10 Changes to the Development Strategy

The development strategy for Barangaroo may develop during the course of the planning approval process associated with Barangaroo South and Barangaroo Central. If changes resulting from this process affect the preferred remediation option identified by the RAP, the remediation strategy may require amendment.

Any change to the remediation strategy required may be based on consideration of:

[13] Significance will be determined estimating confidence intervals for each of the CoPC using the existing dataset for the Site. Concentrations falling outside of the confidence interval by greater than 3x will be considered significant.

- The requirement for, or changes to, development plans;
- Practical and commercial considerations; and
- Staging and sequencing of the remediation and development works in other Barangaroo site areas as part of the broader development works.

If required, an Addendum to this RAP would be issued to reflect any change to the remediation strategy. The Addendum would be issued to the NSW EPA Accredited Site Auditor for approval.

23.11 Failure of Visual Validation (SPGWT)

If SPGWT is encountered in rock exposed as part of ex situ remediation excavation works (refer to **Section 19.5.1**), the following contingency measures will be considered:

- Engineering mitigation measures to prevent the ingress of SPGWT to the excavation, potentially including:
  - Local over-excavation of bedrock to remove SPGWT ;
  - Grouting of the rock defect to seal the SPGWT within the rock matrix; or
  - Shotcreting (200 mm thick) of the rock surface to seal the SPGWT within the rock matrix.

If SPGWT is encountered in fill material/marine sediments exposed as part of ex situ remediation excavation works, the overexcavation works described following will be undertaken:

- In the case of VMP Remediation Works, as described by **Section 19.5.1**; and
- In the case of Block 4 Development Works Remediation, as described by **Section 19.5.3**.

23.12 Further Development of the Basement and Groundwater Retention Wall System Designs – Block 4 Development Remediation Works

As discussed previously, the Block 4 basement and retention wall system are subject to ongoing refinement and development as part of the Lend Lease design process. Consequently, changes to the depth of Block 4 basement and/or the final alignment of the basement groundwater retention wall system may be required. If the design is changed such that it affects the assumptions in the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d), an Addendum to this RAP will be issued, as required, and submitted to the NSW EPA Accredited Site Auditor for approval.

It is noted that the contingency measures described by this Section are specific to the Block 4 Development Remediation Works only. As such, they will not impact on the VMP Remediation Works, which are not dependant on construction of either the basement or the basement groundwater retention wall system.

For each of the contingency measures described following, the Auditor would be consulted to confirm agreement with the strategy to be adopted prior to implementation of the proposed measures.

23.12.1 Increase in basement depth

The Block 4 basement may be subject to further design development which may increase the basement depths below those detailed in **Section 4.2** and **Section 4.3**.

The additional bulk excavation works that would be required to facilitate construction of basements to greater depths is not considered to affect the preferred remediation strategy. This is because the depth of identified SPGWT/CIM requiring remediation in the Block 4 area (typically present at depths shallower than 8 m bgl) is already less than the proposed basement depth. Further in areas where the depth of remediation required is greater than the proposed basement depth, remediation below the depth of the proposed basement will be locally required to achieve the required extent of remediation (refer to **Section 9.2.2.3**). Therefore, the extent of remediation and the remediation strategy proposed by this RAP will not be impacted by increasing the depth of the basement.

It should be noted that bulk excavation works associated with a basement with an increased depth may generate contaminated material that, while not considered by this RAP to require remediation, may still require additional management to mitigate risks to human health or the environment. Such materials will require management in accordance with the environmental control measures detailed in **Section 14.0** and **Section 20.3**.

23.12.2 Reduction in basement depth

As above, the Block 4 basement may be subject to further design development which may reduce the basement depths to less than those detailed in **Section 4.2**.

As described by **Section 9.2.2.3**, the depth of the proposed Block 4 basement is already less than the proposed remediation extent in some areas within Block 4. In these areas, remediation to a depth extending below the proposed basement depth will be required to achieve the requisite Remediation Extent. If the depth of the Block 4 basement is reduced further, the extent of remediation required below the proposed basement depth would increase further, as necessary to facilitate removal of identified SPGWT and CIM to the extent practicals described by the required lateral and vertical Remediation Extent (refer to **Figure F12** in **Appendix B**). In addition, the data set for the additional material that would remain below the revised basement would be reassessed to confirm:

- whether the sampling density from previous investigations suitably characterises the additional material that will remain below the revised basement; and
- whether the additional material that will remain below the revised basement represents CIM or SPGWT that requires remediation.

If the additional material that will remain below the revised basement has not been adequately characterised, additional sampling will be conducted in consultation with the NSW EPA Accredited Site Auditor. If the additional material that will remain below the revised basement requires remediation, the depth of the excavation will be locally increased to include removal of the identified CIM or SPGWT. In considering whether the material requires remediation, consideration will be given to the extent and significance of the contamination in the context of other material to remain below the car park basement. This assessment will be conducted in consultation with the NSW EPA Accredited Site Auditor.

It is noted that the validation of fill or residual soils/bedrock below the proposed Block 4 basement will be based on the validation requirements detailed in **Section 19.5.3**.

23.12.3 Changes to the Lateral Alignment of the Basement Groundwater Retention Wall System

As for the Block 4 basement depth, the alignment of the basement groundwater retention wall system may be subject to further design development.

Realignment of the Western Block 4 Retention Wall to the West

- If the alignment of the western Block 4 retention wall system moves to the west by greater than 10m, the additional material that would be included as part of Block 4 (i.e. present within the footprint of the basement groundwater retention wall) would be assessed to determine:
    - whether the sampling density from previous investigations suitably characterises the additional material that will now be within Block 4; and
    - whether the additional material that will now be within the Site represents CIM or SPGWT that requires remediation.
- If the additional material that will now be included in Block 4 has not been adequately characterised, additional sampling will be conducted in consultation with the NSW EPA Accredited Site Auditor.
- If the additional material that will now be included in Block 4 requires remediation, the extent of remediation required will be increased to include remediation / removal of the identified CIM or SPGWT. This assessment will be conducted in consultation with the NSW EPA Accredited Site Auditor.

It should be noted that bulk excavation works within the expanded Block 4 basement may generate contaminated material that, while not considered by this RAP to require remediation, may still require additional management to mitigate risks to human health or the environment. Such materials will require management in accordance with the environmental control measures detailed in **Section 14.0** and **Section 20.3**.

Realignment of the Western Block 4 Retention Wall to the East

- If the alignment of the western Block 4 retention wall system moves to the east but remains outside or coincides with the Declaration Area boundary, there would be no impact to the preferred remediation strategy for the area remaining within the Block 4 groundwater retention wall system. With respect to the

residual Block 4 area between the current and amended retention wall alignments, the following mitigation measures would be required:

- The area would be subject to remediation and validation in accordance with the RAP to be developed for the ORWN Area; or
- Additional remediation criteria will be developed that are protective of the environment to ensure that soil and groundwater remaining within Block 4 outside the groundwater retention wall system is protective of the environment. Development of the additional remediation criteria would be undertaken in consultation with the NSW EPA Accredited Site Auditor; and
- Material within Block 4 outside the groundwater retention wall system, will be assessed against these additional remediation criteria to determine whether it represents CIM that requires remediation. This assessment would be conducted in consultation with the NSW EPA Accredited Site Auditor. If remediation is required it would be conducted in accordance with this RAP.

- If the alignment of the western Block 4 retention wall system moves to the east such that it is within the Declaration Area boundary, the following mitigation measures would be required:
  - Additional remediation criteria will be developed that are protective of the environment to ensure that soil and groundwater remaining within Block 4 (that is within the Declaration Area) but outside the groundwater retention wall system is protective of the environment. Development of the additional remediation criteria would be undertaken in consultation with the NSW EPA Accredited Site Auditor; and
  - Material remaining within Block 4, but outside the groundwater retention wall system, will be assessed against these additional remediation criteria to determine whether it represents CIM that requires remediation. This assessment would be conducted in consultation with the NSW EPA Accredited Site Auditor.

23.12.4 Changes to the Alignment of the Basement Groundwater Retention Wall between Block 4 and Block 5 (Northern Block 4 Wall)

It is possible that the alignment of the northern Block 4 basement groundwater perimeter retention wall system may be revised as part of the final design development. This could be due to changes in basement design and/or to accommodate a future roadway constructed at grade in that area, as discussed in **Section 4.2**. Design finalisation could result in the Block 4 northern retention wall being moved south of the Block 4 / Block 5 boundary (e.g. by 10-15m).

If the location of the northern Block 4 retention wall is moved to the south (i.e. such that a future basement does not extend to the current Block 4 boundary), the following measures would be undertaken to address soil and groundwater that would remain outside the northern retention wall:

- Additional remediation criteria will be developed to ensure that soil and groundwater remaining within Block 4, but outside the groundwater retention wall system, is protective of human health (for the proposed future land use in the area) and the environment. Development of the additional remediation criteria would be undertaken in consultation with the NSW EPA Accredited Site Auditor. Development of the additional remediation criteria would consider:
  - The remediation criteria for the VMP Remediation Works (refer to **Section 7.1**);
  - Noting that the remediation criteria for the VMP Remediation Works only addresses those CoPCs that are prescribed by the NSW EPA Declaration and current land uses, whether:
    - the remediation criteria for the VMP Remediation Works are also protective of the proposed future land use; and
    - the concentrations of other contaminants reported in the soil and groundwater remaining within Block 4, but outside the groundwater retention wall system, are protective of the environment (noting that the material will be outside the groundwater retention wall system and therefore have the potential to impact on the environment).
- Material remaining within Block 4, but outside the groundwater retention wall system, will be assessed against these additional remediation criteria to determine whether it represents CIM that requires

remediation. This assessment would be conducted in consultation with the NSW EPA Accredited Site Auditor;

- CIM that requires remediation would be remediated appropriately in accordance with this RAP using either S-ISCO® or an ex situ methodology; and
- As a guide, the extent of remediation would be expected to be similar to that described by **Figure F10** and **Figure F11** in **Appendix B** of this RAP.

23.12.5 Construction of a new Basement Groundwater Retention Wall between Block 4 and Block 3 (Southern Block 4 Wall)

It is possible that an additional groundwater retention wall will be required to be installed to form the southern boundary of the Block 4 basement. This retention wall would either be installed directly adjacent to the existing northern ORWS retention wall (such that there is no gap between the two walls), or it could be off-set from the existing retention wall (i.e. constructed to the north of the current alignment, within Block 4).

If the new southern Block 4 wall is:

- constructed immediately adjacent to the existing northern ORWS retention wall, there would be no impact to the preferred remediation strategy; and
- off-set from the existing ORWS northern retention wall (i.e. such that a future basement does not extend to the current Block 4 / Block 3 boundary), the measures described by **Section 23.12.4** in relation to changes to the alignment of the northern Block 4 Wall would be undertaken.

23.13 S-ISCO® Operational Contingencies

The following sub sections describe the *in situ* remediation risks as well as the mitigation measures that will be implemented to prevent these adverse impacts and contingency measures that will be enacted in the unlikely event that impacts are observed. A more detailed assessment of potential risks and description of specific mitigation measures including action levels for implementation of the mitigation measures based on observations from the performance monitoring program will be set out in the S-ISCO® and SEPR™ Detailed Work Plan (refer to **Section 13.1.3**).

23.13.1 Impact to an Aquatic Ecosystem (Darling Harbour) - S-ISCO® Chemistry

Darling Harbour is the nearest receptor for groundwater and surface water migrating from the Site.

No material, treated or otherwise, will enter Darling Harbour and impact either water quality or sediment as a result of the S-ISCO® and/or SEPR™ works. During the course of S-ISCO® and SEPR™ injections, the progression and extent of the S-ISCO® treatment front will be followed closely through *in situ* and ex situ monitoring and laboratory analysis of groundwater from monitoring wells on the Site (as part of the Performance Monitoring Program), specifically those installed in the area between the treatment area and the Harbour.

In addition, the rate of reactions between the S-ISCO® chemistry and subsurface contaminants will be closely monitored to track that the injected reagents are being consumed. In the event that monitoring results indicate that the treatment front becomes too close to the Harbour, a program of extraction will be initiated from monitoring wells that will be monitored as part of the monitoring plan. The contents of the injected front will be extracted from the subsurface using groundwater extraction pumps, the un-reacted S-ISCO® chemicals will be intercepted and adverse impacts on the Harbour will be minimised.

23.13.2 Impact to an Aquatic Ecosystem (Darling Harbour) – Mobilisation of Metals

In one of the column tests (Column 4) undertaken as part of the laboratory treatability study (refer to **Section 10.4**) in which hydrogen peroxide, VeruSOL-3® and Fe-TAML were used, the pH of the effluent reduced to as low as pH 1. This result raised questions about the potential for S-ISCO® treatment with the same chemistry, peroxide, VeruSOL-3® and Fe-TAML, to produce a low-pH environment in the treatment area, and, as a consequence, mobilise metals present in the subsurface that could eventually discharge into Darling Harbour. The following section describes how such low pH conditions will not occur, as well as the specific mitigation and contingency plans that will be in place to monitor pH and metals mobilisation.

The application of peroxide, VeruSOL-3® and Fe-TAML in the field will take place within a significantly larger mass and volume of soil (when compared to that of the laboratory treatability study), providing a largely expanded buffering capacity over what was furnished by soil in the laboratory treatability study. The chemistry will have a

greatly increased duration of contact with both the soil as well as contaminants, enabling more complete reactions. In addition, the chemistry used in the field will be altered to specifically maintain more alkaline conditions. Through groundwater monitoring, pH conditions will be closely monitoring and the pH will be adjusted with the injection of sodium hydroxide. In contrast to the imprecise metering pumps used during the column tests that cannot easily be modified in response to conditions measured in the effluent, that is, at only one point, the injection pumps used in the field can be easily adjusted to respond to conditions measured in the field at multiple sampling locations. During S-ISCO® with peroxide, the pH will be maintained between 8.5 and 9 in order to optimize the performance of the Fe-TAML activator. In addition, where persulfate is used as the oxidant, sodium hydroxide will also be used to create the alkaline conditions required to activate sodium persulfate.

Finally, the full scale implementation will include continuous monitoring of pH which will facilitate adjustment of pH (if needed) to: (a) demonstrate that low pH conditions do not develop away from the immediate vicinity of the injection wells; and (b) help both the hydrogen peroxide and sodium persulfate S-ISCO® reactions to occur optimally.

23.13.3 Impact to Subsurface Infrastructure

There is a possibility that subsurface infrastructure in the vicinity of the treatment areas, particularly within Hickson Road, may be subject to physical impacts, from well drilling, soil sampling and trenching, for example, and/or chemical impacts, from the injection and subsequent movement of the injected treatment chemistry, for example.

Subsurface assets in Hickson Road are composed of polyethylene, polyvinyl chloride, concrete, asbestos, reinforced concrete pipe, cast iron, and cast iron concrete-lined. Technical guidelines for trenched pipelines[14] indicate that the following materials can also be used in the construction of trenched pipelines, and may be present in the subsurface: ductile-iron cement lined, steel concrete-lined, PVC-lined concrete, vitrified clay, glass-reinforced plastic, polypropylene, fibre-reinforced concrete or high-density polyethylene.

Peroxide Compatibility

Hydrogen peroxide is a short-lived (on the scale of hours) oxidant. The short life of peroxide, along with the fact that it will typically be injected between 3 and 5 m bgl, a depth below identified assets, will mitigate the risk of it contacting subsurface assets. Water levels in the vicinity of subsurface assets will be closely controlled through extraction, thereby further reducing the risk of contact of the oxidant with subsurface assets. Finally, the majority of the known materials of which these assets are composed are not incompatible with peroxide, especially at the low (<8%) concentrations that will be used and in the presence of VeruSOL-3®, a surfactant that is known to mitigate corrosive impacts of oxidants.

Alkaline-Activated Persulfate Compatibility

Data indicates that alkaline-activated sodium persulfate (activated using sodium hydroxide) does not have corrosive effects on plastics, concrete or metallic materials including cast iron and carbon steel.

Physical Impacts

With respect to physical impacts to assets as a result of drilling, boring and trenching, the following measures will be taken to mitigate any potential impacts:

- All underground assets will be identified prior to intrusive work;
- Well drilling and placement will be modified as needed to avoid drilling near identified assets;
- After machine-drilling the surface concrete and pavement, hand-augering and/or air-knifing will be used in the vicinity of shallow services to a depth of 1.2 m bgl (or to the depth of hand auger/air knife refusal); and
- Coordinating the layout of the treatment with asset access and emergency access routes.

Finally, with respect to trenching, the trench will be shallow, approximately 200 mm deep, and therefore above the depth of known assets. Nevertheless, before any trenching begins, all assets in the vicinity of intrusive activities will be identified.

Other Chemicals

With respect to the other chemicals that will be injected, including VeruSOL-3®, water, sodium hydroxide and Fe-TAML, none of these materials are known to have corrosive impacts.

23.13.4 Impacts to Buildings

There is a potential risk of adverse impacts to the buildings at 30 and 38 Hickson Road. Adverse impacts to the basement groundwater treatment system at 38 Hickson Road will be monitored and mitigated. Any impact will be detected by monitoring wells before it reaches the basement. In the unlikely event that peroxide reaches the basement, peroxide will not impact but rather likely improve the water treatment process.

During the SEPR™ phase of the treatment, all injected fluid will subsequently be extracted. During S-ISCO®, liquid levels will be closely monitored to track their confinement within historic infrastructure – where appropriate. Subject to the results of the performance monitoring program, groundwater monitoring wells will also function as emergency recovery wells from which groundwater can be extracted to establish hydraulic control.

23.13.5 Impact of Soil Vapours on Humans

There is the risk of impacts from soil vapours to the following:

- the users and inhabitants of the Bond Building at 30 Hickson Road and the basement water treatment system at 38 Hickson Road;
- workers conducting construction, road or other sub-surface works in the vicinity of the Site, particularly in Sydney Water assets, EA assets, cable pits, utility pits, service access points and monitoring well heads;
- workers at the adjacent sewage pumping station SP1129 (to be retained for the future land use); and
- pedestrian, bicycle and vehicular users of Hickson Road and its footpaths.

Users of the Bond and 38 Hickson Road

To prevent the possibility that vapours generated by the SEPR™ or S-ISCO® enter the adjacent buildings or the sub-surface parking garages, soil vapour monitoring points will be installed: immediately adjacent to the basements of the building; and, between the treatment area and the buildings. These points will be connected to the SVE system that will be operated throughout the duration of the remediation. The SVE system will capture and treat gases displaced by peroxide decomposition and will be carefully monitored.

Construction and Maintenance Workers

There is the potential for workers conducting subsurface intrusive work in the vicinity of the treatment areas, including utility workers who must access below ground assets, to be exposed to soil vapours generated by S-ISCO® and/or SEPR™ injections. This includes service utility personnel who must access their assets in Hickson Road. In addition, there is the potential for users of Hickson Road in the vicinity of the treatment area to also be exposed to vapours generated by the remediation works. To mitigate this risk soil vapour extraction points will be installed in publically accessible areas in the vicinity of the Site. These points will be connected to the SVE system to intercept vapours and will be monitored regularly.

In addition, vapours will be monitored daily with a Photoionization Detector (PID) in utility pits, service access points and monitoring well heads, that is, areas with the potential for preferential migration of vapours. In the event that unsafe vapours are detected, additional soil vapour extraction may be implemented.

Pedestrian, Bicycle and Vehicular Users of Hickson Road and its Footpaths

To prevent the possibility that vapours generated by the SEPR™ or S-ISCO® are present in the footpath of Hickson Road that is accessed by pedestrians and cyclists, soil vapour monitoring points will be installed. All points will be connected to the SVE system which will extract continuously from them to mitigate any potential soil vapour exposure. In addition they will be monitored daily with a PID and weekly at a NATA-certified laboratory to confirm that the SVE system is adequately extracting and whether the system needs to be expanded.

23.13.6 Impact due to Day-lighting

Over the course of injections there exists the possibility that injected chemicals may leak upwards, on the outside of a well's casing or appear at the ground surface, an occurrence referred to as "day-lighting". Day-lighting has the potential to pose a hazard to the environment, and to the health and safety of site workers and other persons

in the vicinity of the injection area. Day-lighting events will be treated as a spill and managed according to the EMP (refer to **Section 1.7**).

In addition, day-lighting will trigger a temporary suspension of system operation in the area in which it occurs. This will enable the Site Manager to determine the cause of the day-lighting and alter operational parameters, such as injection rate and chemical concentration, to prevent it from recurring. When operations resume, injections will be begin slowly and gradually increase to the desired levels, accompanied by diligent monitoring.

As a preventative measure, all injection wells will be inspected daily for evidence of day-lighting so that this occurrence can be dealt with immediately to prevent risks to human health or the environment. Evidence of day-lighting includes liquid emerging from the ground in the vicinity of an injection well. The liquid may bubble, if hydrogen peroxide is being used, and a faint citrus odour may be noticeable (due to the VeruSOL-3®).

23.14 Other Operational Contingencies

23.14.1 Flooding of the Site

The EMP for the remediation works will be developed to control the impact of site works in order to minimise and mitigate against any impacts to off-site waters (Darling Harbour). As outlined in **Section 17.0**, the implementation and maintenance of a variety of environmental control measures will be undertaken during the project to manage water encountered during the works. Measures such as the installation of drains to divert clean water from up gradient areas to on-site stormwater drains, recycling of water and off-site water treatment will be conducted to manage and control water.

In extreme situations such as flooding or heavy rainfall, the discharge of treated water may be permitted to the sewer system in accordance with the conditions of a Sydney Water licence. All water intended for discharge will be stored on-site and tested prior to discharge to confirm compliance.

Records of all discharges will be kept describing the estimated volume of water discharged, the time period over which the discharge occurred, and the water quality results of water samples collected prior to discharge.

These control measures will be monitored during significant rainfall events to confirm their integrity and suitability.

23.14.2 Control of Dust

Should unacceptable levels of dust be detected during the remediation works, an investigation will be conducted to determine the source of the dust, and evaluate the appropriate measures to be implemented.

These measures may include the following:

- Increased use of a water cart or water sprays to suppress dust in open areas;
- Installation of temporary sheeting to cover localised exposed areas and stockpiles;
- Installation of dust screens around the Remediation Area;
- Covering stockpiles of contaminated soil which will remain on the Site for more than 24 hours (where practical);
- Alteration of the works program to minimise the extent of disturbed open areas;
- Consolidation of material stockpiles;
- Use of chemical dust-suppressants provided the chemicals do not pose a contamination or OHS hazard;
- Use of alternative coverings such as hydro-mulch to stabilise the surface of open disturbed areas;
- Use of additional dust suppression features on items of dust generating plant and equipment;
- Securely covering all loads entering or exiting the Site; and
- Use of alternate work practices such as modified equipment to minimise dust generation.

23.14.3 Fugitive Emissions and Odours

Should unacceptable levels of fugitive emissions be detected at the Site boundaries or in the surrounding area during the project, an investigation will be conducted to determine the source of the emissions, and to evaluate the appropriate measures to be implemented.

These measures may include the following:

- Alteration in the works program to minimise in the extent of disturbed open areas;
- Prompt removal and treatment of heavily contaminated materials that have been exposed and are identified to have caused the emissions;
- Use of fine mist sprays around the Remediation Area;
- Conducting the work in more favourable weather conditions;
- Use of alternate work practices to minimise the period of impact of the emissions;
- Use of additional features to control emissions from plant and equipment;
- Use of alternate work practices such as using modified equipment;
- Relocation of offending plant and equipment to less sensitive on-site areas;
- Reducing the number of plant and equipment items on-site; and
- Use of a deodorant within water sprays at locations on-site and at Site boundaries provided the chemicals do not pose a contamination or OHS hazard.

23.14.4 Noise and Vibration

Should unacceptable noise and/or vibration levels be detected during the remediation works the following measures may be implemented:

- Modify the works program to minimise the impact of noisy or vibratory operations, including:
  - Modify the timing of the works to appropriate times of the day; and
  - Accelerate the works program to complete the works quickly and minimise the period of disturbance;
- Install additional noise suppression features on plant and equipment;
- Construct additional noise attenuation measures such as stockpile barriers, works area enclosures; and
- Use of different items of plant and equipment that generate less noise or vibration.

23.14.5 Spills and Leaks

A spill response plan will be developed and implemented as part of the Emergency Response Plan (ERP) detailing the procedures for responding to spills and leaks. The procedures outlined in the plan will be aimed at minimising the impact of any contaminant releases that may occur during the works.

The following actions will be taken in preparation for spills or leaks:

- Training of site personnel in appropriate spill response techniques;
- Allocation of spill response materials and equipment on-site (such as oil absorbent pads, booms and bio-dispersants);
- Containment of all storage tanks and drums inside bunded areas with a capacity of 110% of the largest container, or 25% of the total volume of all containers, whichever is greater;
- Initial assessment of the spill;
- Notification of the appropriate authorities if necessary;
- Following a spill or leak, an investigation to determine the root cause of the incident will be undertaken; and
- Corrective and preventative actions implemented to prevent future incidents.

23.14.6 Emergency Response Plan

An ERP will be prepared prior to the commencement of the site remediation works. The plan will outline the process for identifying possible emergency situations and detailing the procedures necessary to ensure the safety of both on-site and off-site personnel in the event of an emergency.

The plan should include the following general information:

- Assignment of responsibilities to nominated key personnel;
- Assessment of the potential on and off-site impacts of hazards;
- Emergency reporting procedures including on-site reporting and reporting to the appropriate authorities;
- Emergency response procedures including, but not limited to, the following:
    - On-site fires or explosions;
    - Chemical spills;
    - Rupture of buried services;
    - Hazardous gas releases and emissions;
    - Confined spaces situations;
    - Traffic accidents both involving the transportation of "Dangerous Goods";
    - First aid for injured personnel;
    - Evacuation of on-site personnel; and
    - Managing unknown/uncertain situations.
- Incident investigation procedures to determine the root cause of the incident, and to identify the appropriate corrective and preventative actions to prevent future incidents.

24.0 Key Personnel

The contractual framework of delivery of the remediation works has not yet been determined by Lend Lease. Potential contractual structures include:

- Turnkey deliver of the remediation works by a remediation contractor;
- Supervision of the remediation works by a superintendent and validation team engaged separately for the remediation contractor; and
- A variation on the above.

Notwithstanding the contractual framework initially adopted by Lend Lease, the key roles and responsibilities associated with the remediation works are as discussed following. Depending on the contract structure the various roles and responsibilities may be discharged by one or more entities.

24.1 Project Director

The Project Director is responsible for ensuring that the remedial works undertaken on-site are in accordance with this RAP, the EMP, the OHSP and other relevant documentation, and that the objectives stated within the RAP are ultimately met. The Project Director will generally also be responsible for ensuring that the project occurs within the timeframe nominated and within the financial budget allocated, and is completed safely. The Project Director assumes ultimate responsibility for the project.

24.2 Project Manager

The Project Manager is responsible for daily operations and directs the site operations to ensure effective planning, verification, documentation and management of operational and environmental and safety issues in accordance with this RAP. This includes maintaining a liaison with regulatory authorities to ensure that the necessary work is undertaken to satisfy the NSW EPA and NSW EPA Accredited Site Auditor that the remediation achieves the objectives of this RAP.

The Project Manager is responsible for the implementation of all Project Plans including the RAP, EMP, OHSP Plan, Quality Plan and other relevant contractual documents associated with the remediation works. This includes responsibility for:

- any design that may be required during the work;
- implementation and scheduling of the remedial works in accordance with the abovementioned documents; and
- ensuring compliance with relevant legislation and regulations.

The Project Manager is also responsible for ensuring that human health and the environment are protected at all times, including the provision of training and site inductions to all appropriate subcontractors and workers.

The Project Manager will be a primary community contact and the first point of contact for sub-contractor issues.

24.3 Validation Team

A suitably qualified consultant will undertake the supervision and validation of the remedial works under the direction of a Validation Project Director (VPD). The VPD is responsible for ensuring that all required validation systems are fully functional, and that staff are trained in the requirements of the validation requirements as detailed in **Section 19.0** of this RAP.

Daily validation management will be from an on-site project office. A site-based administrative system will be established to ensure that the project is fully documented. A daily fieldwork summary will be prepared and filed. All job-related incoming and outgoing communications will be logged in a register.

Decisions related to validation will be made in accordance with relevant guidelines endorsed by the NSW EPA and NSW EPA Accredited Site Auditor. Copies of relevant guidelines will be kept in the Site office. All fieldwork will be undertaken by qualified environmental engineer(s)/scientist(s) with experience working on contaminated sites.

A member of the Consultant's field team will be the Site Validation Manager (SVM) responsible for making all validation decisions and directing all routine site fieldwork. Prior to commencement of the project, the SVM will prepare a project manual containing all required procedures and forms. The manual will be updated, in conformance with the VP, on an as needed basis. It is the responsibility of the SVM to ensure that the validation requirements detailed in **Section 19.0** are followed.

Site meetings will be convened, as required, to discuss fieldwork procedures. At least one meeting per week will be held with the SVM and the Project Manager to plan work for the following week and to resolve outstanding issues.

Where, because of an unforseen circumstance, the SVM considers that a departure from the validation requirements is required, this must be discussed with the VPD and NSW EPA Accredited Site Auditor before any other related action is taken. If the departure is approved it will be documented in site files. If urgent action is required, the VPD will be responsible for deciding the particular issue. The NSW EPA Accredited Site Auditor will be sent written confirmation as soon as practicable, but in any case within 5 working days of the reasons for making the changes to the validation procedures detailed in **Section 19.0** and feedback and endorsement of the changes will be requested in writing from the NSW EPA Accredited Site Auditor.

24.4 Site Foreman

The Site Foreman implements day-to-day operations as directed by the Project Manager.

24.5 Safety/Quality Officer and Environment

The Safety / Quality Officer is responsible for implementation of the quality and safety management systems. This person assists the Project Manager with day-to-day tasks that arise, reports activities undertaken, directs the subcontractors, maintains accurate records of works such as safety checklists, and maintains a photographic record of works undertaken. This will include review and update of the OH&S Plan and EMP plus health and safety manuals, rules and procedures.

The Safety / Quality Officer ensures personnel and visitors to the site are inducted and has responsibility for emergency response and training in accordance with the Emergency Plan. The Safety / Quality Officer has the authority and independence to require reasonable steps to be taken to avoid or minimise unintended or adverse work safety impacts, and can direct relevant actions to be ceased should any adverse impact on worker safety be likely to occur.

The Safety / Quality Officer ensures all H&S monitoring devices are operating in accordance with the RAP, EMP and OHSP and also keeps the incident and accident register up to date with notification given to Work Cover NSW as necessary.

The Safety / Quality Officer will provide advice and recommendations, when appropriate, with regards to:

- legal requirements;
- changes in legislation;
- dealings with Work Cover New South Wales;
- prevention of injury or damage;
- accident and injury investigations and reports;
- work methods, equipment, or materials which could reduce risk; and
- selection, suitability and application of safety equipment.

The Safety/Quality Officer will be responsible for holding regular 'toolbox' safety meetings with all site personnel and will ensure meeting minutes are appropriately documented.

24.6 Subcontractors

All work, irrespective of whom it is completed by will be undertaken, as specified by the Project Manager, and per the requirements stated within this RAP and the EMP, the OHSP and relevant management plans.

Subcontractors will be advised of required work procedures through induction, training, and meetings provided by the Contractor. Maintenance of subcontractor equipment will be the responsibility of the subcontractors.

The Subcontractor is responsible for ensuring that all works executed by the subcontractor complies with relevant WorkCover NSW as necessary.

24.6.1 S-ISCO® Personnel

In addition to the key roles described previously, key personnel required for implementing the S-ISCO® and SEPR™ soil remediation program are listed below. The actual staffing plan for these works will depend on conditions encountered in the field and are subject to the outcomes of the proposed S-ISCO® Pilot Trial.

- Site Manager;
- Plant Operator;
- Plant Support / Assistant Operator;
- Field Technician; and
- Laboratory Technician.

25.0 Conclusions

Based on the information detailed in this RAP the following conclusions can be made.

Remediation Extent - VMP Remediation Works

The Remediation Goals developed by the *VMP Remediation Extent* report (AECOM, 2013c) for the protection of human health and the environment based on the recommendations of the *VMP HHERA* (AECOM, 2012c) were derived to enable the enable the NSW EPA Declaration to be revoked. The Remediation Goals are:

- As a primary goal, removal / remediation of SPGWT to the extent practicable as required by the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*; and
- As a secondary goal, removal / remediation of soil, to the extent practicable:
    - That is representative of CIM, which is defined as:
        - Unsaturated soil concentrations exceeding the soil SSTC; and/or
        - Unsaturated or saturated soil concentrations that are considered to be the source of groundwater concentrations exceeding the groundwater SSTCs in fill material.
    - Such that groundwater quality within fill material leaving the Declaration Area (measured at the down hydraulic gradient Declaration Area boundary) approaches the MWQC.

The standard of remediation (as developed by the *VMP Remediation Extent* report [AECOM, 2013c]) to be achieved within the proposed Remediation Extent should equal the higher of:

- Removal of SPGWT to the extent practicable, for the protection of human health and the environment;
- Removal/remediation of soil and groundwater concentrations present within fill material exceeding the relevant $SSTC^{VMP}$, to the extent practicable; and
- Removal/remediation of contaminated fill materials such that the contaminant mass within the Remediation Extent fill material is reduced, on average, by 90%, to the extent practicable (calculated based on the estimated mass of naphthalene and TPH C_{10} - C_{14}).

If the standard of remediation can not be practicably achieved, the Contingency measures detailed in **Section 23.7** of this RAP will be considered.

The lateral extent of remediation required in the unsaturated and saturated zones for the protection of human health and the environment as recommended by the *VMP Remediation Extent* report (AECOM, 2013c) is presented on **Figure F10** and **Figure F11** in **Appendix B**, respectively. As detailed in the *VMP Remediation Extent* report (AECOM, 2013c), remediation to the extent practicable has been determined based on consideration of:

- The presence of historic gasworks infrastructure, the distribution of SPGWT and CIM within the respective Site areas; and
- The extent of remediation that can be practicably accomplished for the protection of the environment based on:
    - The standard of remediation that can be practically achieved by the remediation technologies that are most likely to be implemented;
    - Regulatory policy requirements including: source removal, removal of NAPL to the extent practicable, and clean-up to the extent practicable as contemplated by the NSW DEC (2007) *Guidelines for the Assessment and Management of Groundwater Contamination*; the principles of ESD as required by Section 9 of the *CLM Act* (1997); and, the principles of the *Waste Avoidance and Resource Recovery Act* (2001)..

The vertical extent of remediation has been broadly defined as remediation to the depth of the underlying natural bedrock to a maximum depth of 10 m below ground level (bgl). The vertical extent of remediation is based on consideration of:

- locations where SPGWT has been reported;
- locations where exceedances of the groundwater SSTC and unsaturated soil SSTC have been reported;

- the footprint of historical gasworks structures and infrastructure; and
- the depth to bedrock (noting that the depth to bedrock steadily increases to the west beyond the 10 m bgl rock contour).

It is noted that SPGWT and CIM have been reported in the natural marine sediments both within the Site and in some hydraulically down gradient areas to the west of the Site. However, the negligible contaminant flux from these natural materials is not considered to pose a significant risk to human health or the environment. As such, the proposed extent of remediation works includes remediation of fill material and marine sediments to 10 m bgl (unless bedrock is encountered at shallower depths) and will generally exclude remediation of natural marine sediments which are present below a depth of 10 m bgl.

Remediation Extent - Block 4 Development Remediation Works

The Block 4 Development Works remediation criteria (as developed by the *Declaration Site HHERA* (AECOM, 2011a) and *Declaration Site HHERA Letter* (AECOM, 2012d), to be achieved within the Block 4 basement area requires that remediation should be undertaken as follows:

- As a primary goal, removal/remediation of SPGWT to the extent practicable, for the protection of human heath; and
- As a secondary goal, removal/remediation of identified CIM, to the extent practicable based on remediation of soil contamination that is considered to be the source of groundwater concentrations exceeding the groundwater $SSTC^{DEV}$.

The extent of remediation required to facilitate the Block 4 Development Works as recommended by the *Declaration Site HHERA* (AECOM, 2011a) is presented in **Figure F12** in **Appendix B**.

It is noted that the proposed design for the Block 4 Development includes construction of a basement groundwater retention wall system around the perimeter of Block 4 that will extend to and be keyed into bedrock. In consideration of this, the development of remediation criteria for Block 4 (within the retention wall system) for ecological protection is therefore not required for the Block 4Development Remediation Works.

Preferred Remediation Option

The preferred remediation option for each of Block 4, Block 5 and Hickson Road (as appropriate) is summarised as follows:

- Block 4 VMP Remediation Works - excavation of contaminated materials as required to facilitate removal of the NSW EPA Declaration from Block 4, followed by on-site treatment (where required) and off-site landfill disposal;
- Block 4 Development Remediation Works - excavation of contaminated materials as required to make the site suitable for the proposed future land use including construction of the basement groundwater retention wall system;
- Block 5 and Hickson Road (within the Declaration Area) VMP Remediation Works:
    - Completion of a S-ISCO® and SEPR™ Proving Phase and Pilot Trial to demonstrate the effectiveness of the treatment processes and enable optimisation of the full scale treatment process; and
    - If the Proving Phase and Pilot Trial are successful - Option 1:
        - Full scale S-ISCO® and SEPR™ treatment of the SPGWT and CIM in accordance with the Remediation objectives; or
    - If the Proving Phase and/or the Pilot Trial are unsuccessful - Option 2:
        - Excavation of required contaminated materials, followed by on-site treatment (where required) and off-site landfill disposal.

    It is possible that, depending on the outcome of the S-ISCO® and SEPR™ Proving Phase and/or the Pilot Trial and project requirements, the preferred remediation option adopted for the Block 5 and Hickson Road VMP Remediation Works will be a combination of Option 1 (full scale S-ISCO® and SEPR™ treatment) and Option 2 (excavation and onsite treatment). Selection of the preferred remediation option that will be adopted in each part of Block 5 and Hickson Road will be undertaken in consultation with the NSW EPA Accredited Site Auditor.

It is noted that, any remediation of SPGWT and/or CIM undertaken as part of the bulk excavation and Block 4 Development Works is considered VMP Remediation Works to the extent that it would have been required in any event to remove the NSW EPA Declaration.

Closure

This RAP has generally been prepared to meet the requirements of the DUAP and NSW EPA (1998) *Managing Land Contamination - Planning Guidelines SEPP 55 - Remediation of Land* and relevant NSW EPA endorsed guidelines including the NSW EPA (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*.

It is concluded that the preferred remediation strategy described by this RAP, upon successful implementation will:

- enable the NSW EPA's declaration of the Declaration Area as a Remediation Site to be revoked; and
- if the Block 4 Development Works proceed, ensure that Block 4 is remediated to a standard suitable for the proposed development (i.e. suitable for the proposed land uses including a mixture of commercial, retail and high density residential and public open space).

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Appendix A

Tables

Appendix A Tables

Table T1: Soil Remediation Criteria

Table T2: Groundwater Remediation Criteria

Table T3: Site wide Soil Analytical Results (Declaration Area) - Unsaturated

Table T4: Site wide Soil Analytical Results (Declaration Area) – Saturated

Table T5: Block 4 and 5 Soil Analytical Results (Declaration Area) - Unsaturated

Table T6: Block 4 and 5 Soil Analytical Results (Declaration Area) - Saturated

Table T7: Block 4 and 5 Asbestos Analytical Results (Declaration Area)

Table T8: Hickson Road Soil Analytical Results - Unsaturated

Table T9: Hickson Road Soil Analytical Results - Saturated

Table T10: Block 4 and 5 Groundwater Analytical Results (Declaration Area, 2010-11)

Table T11: Block 4 and 5 Historic Groundwater Analytical Results (Declaration Area)

Table T12: Declaration Area Site Boundary Groundwater Analytical Results

Table T13: Hickson Road Groundwater Analytical Results (2008-10)

Table T14: Offsite - Soil Analytical Results – Unsaturated

Table T15: Offsite - Soil Analytical Results – Saturated

Table T16: Offsite - Groundwater Analytical Results (west of Block 5 & ORWN)

Table T17: Block 4 Soil Analytical Results – Unsaturated & Saturated

Table T18: Block 4 Groundwater Analytical Results (2010-11)

Table T19: Preliminary Technology Screening Matrix

TABLE T1

SOIL REMEDIATION CRITERIA

VMP/BLOCK 4 REMEDIAL ACTION PLAN

BARANGAROO, NSW

	SOIL REMEDIATION CRITERIA	
CoPC	**SRC**	**Land Use Scenario**
Relevant Site Area	**VMP Area - Unsaturated Soil**	
Relevant Land Use Scenarios	**mg/kg**	**Scenarios 1 and 2**
Benzene	380	SSTC (Scenario 2)
TPH C_{10}-C_{14} aliphatic	54,000	SSTC (Scenario 2)
TPH C_{10}-C_{14} aromatic		
TPH C15-C28 aliphatic	72,000	SSTC (Scenario 2)
TPH C15-C28 aromatic		
TPH C29-C36 aliphatic	21,000	SSTC (Scenario 2)
TPH C29-C36 aromatic		
CPAH**	67	SSTC (Scenario 2)

Notes:
All soil criteria in mg/kg
SSTC - Site Specific Target Criteria
TPH - Total Petroleum Hydrocarbons
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-c,d)pyrene)

Land Use Scenarios:
Scenario 1: Paved Recreation
Scenario 2: Intrusive Maintenance Worker

TABLE T2

GROUNDWATER REMEDIATION CRITERIA

VMP/BLOCK 4 REMEDIAL ACTION PLAN

BARANGAROO, NSW

	GROUNDWATER REMEDIATION CRITERIA			
CoPC	**GRC**	**VMP Remediation Works**	**GRC**	**Block 4 Development Works**
Relevant Site Area(s)	**VMP Area**		**Block 4**	
Relevant Land Use Scenarios	**mg/L**	**VMP Scenarios 1 and 2**	**mg/L**	**Development Scenarios 1 and 2**
Acenaphthylene	47	$SSTC^{VMP}$ (Scenario 2)	80	$SSTC^{DEV}$ (Scenario 1)
Aniline			180000	$SSTC^{DEV}$ (Scenario 1)
Benzene	2.1	$SSTC^{VMP}$ (Scenario 2)	7.7	$SSTC^{DEV}$ (Scenario 1)
Ethylbenzene			750	$SSTC^{DEV}$ (Scenario 1)
Fluorene			13	$SSTC^{DEV}$ (Scenario 1)
2-methylnapthalene			4.5	$SSTC^{DEV}$ (Scenario 1)
3&4-methylphenol			130	$SSTC^{DEV}$ (Scenario 1)
Naphthalene	1.3	$SSTC^{VMP}$ (Scenario 2)	0.24	$SSTC^{DEV}$ (Scenario 1)
Phenanthrene			5.8	$SSTC^{DEV}$ (Scenario 1)
Styrene			840	$SSTC^{DEV}$ (Scenario 1)
Toluene			4,000	$SSTC^{DEV}$ (Scenario 1)
Ammonia	150	$SSTC^{VMP}$ (Scenario 2)	630	$SSTC^{DEV}$ (Scenario 1)
TPH C_6-C_9 aliphatic			7,300	$SSTC^{DEV}$ (Scenario 1)
TPH C_{10}-C_{14} aliphatic	17	$SSTC^{VMP}$ (Scenario 2)	1.8	$SSTC^{DEV}$ (Scenario 1)
TPH C_{10}-C_{14} aromatic				
TPH C_{15}-C_{28} aliphatic	220	$SSTC^{VMP}$ (Scenario 2)		
TPH C_{15}-C_{28} aromatic				
TPH C_{29}-C_{36} aliphatic	250	$SSTC^{VMP}$ (Scenario 2)		
TPH C_{29}-C_{36} aromatic				
1,2,4-trimethylbenzene			22	$SSTC^{DEV}$ (Scenario 1)
Xylenes (total)			176	$SSTC^{DEV}$ (Scenario 1)
CPAH**	1	$SSTC^{VMP}$ (Scenario 2)		

Notes:
All groundwater criteria in mg/L
SSTC - Site Specific Target Criteria
TPH - Total Petroleum Hydrocarbons
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-c,d)pyrene)

VMP Land Use Scenarios:
$SSTC^{VMP}$ Scenario 1: Public area with concrete/hardstand paving
$SSTC^{VMP}$ Scenario 2: Short term intrusive maintenance worker

Development Scenarios:
$SSTC^{DEV}$ Scenario 1: Lower Basement
$SSTC^{DEV}$ Scenario 2: Upper Basement

						PAHs																				
						CPAH (TEF)	PAH (Total)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SSTC [VMP]						67																				
Tar Containing Material (TCM) Criteria							**2000**								**150**											
Location	**Sample Depth**	**Field ID**	**Sample Date**	**Matrix**	**Area**																					
BH001	1	BH001	1/05/06	Fill	VMP & PDA - Block 5	67.03	699.1				1.1	14.4	19.2	65.9	33.4		98.6	25.5	29.6	70.5	10.4	104	3.6	28.6	11.5	84.4	98.4
BH019	1.5-1.95	BH019 1.5-1.95	8/05/06	Fill	VMP & PDA - Block 4	<1.21	38.2				<0.5	<0.5	1	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	1.3	1.4	<0.5	29.3	4.1	1.1
BH020	0.3-0.5	BH020 0.3-0.5	9/05/06	Fill	VMP & PDA - Block 4	9.621	80.3				0.6	1.6	2.5	6.2	6.8		7.7	3.7	2.3	5.4	0.8	14.6	1.2	3.1	0.8	7.8	15.2
BH020	1.5-2.1	BH020 1.5-2.1	9/05/06	Fill	VMP & PDA - Block 4	6.351	50				<0.5	1.3	1.6	3.9	4.4		5	2.5	1.9	3.6	0.6	8.5	0.7	2.1	0.5	4.7	8.7
BH021	0.3-0.5	BH021 0.3-0.5	9/05/06	Fill	VMP & PDA - Block 4	3.06	27.3				<0.5	0.9	0.9	2.2	2.3		2.8	1.2	1.1	1.8	<0.5	4.5	<0.5	1.2	0.8	2.8	4.8
BH028	0.3-0.5	BH028_0.3-0.5	12/05/06	Fill	VMP & PDA - Block 5																						
BH058	1.5-1.95	BH058-1.5-1.95	31/05/06	Fill	VMP & PDA - Block 5	39.542	368.6				1.2	8.4	11.1	29	25.3		37.9	19.3	11.8	26.9	4.3	65.3	5.1	16.1	5.7	39.5	61.7
BH059	1.5-1.95	BH059-1.5-1.95	31/05/06	Fill	VMP & PDA - Block 5	5.742	52.6				<0.5	2.1	2.1	4.3	3.9		4.6	2.5	1.9	3.7	0.5	8.5	0.6	2	1	6.4	8.5
BH060	1.7-2	BH060-1.7-2.0	31/05/06	Fill	VMP & PDA - Block 5	6.082	44				<0.5	1.2	1.3	3.6	3.6		6.3	3.5	2.3	3.7	0.9	5.4	<0.5	2.9	0.6	3.2	5.5
BH062	1.5-1.95	BH062-1.5-1.95	31/05/06	Fill	VMP & PDA - Block 5	30.902	228.3				<0.5	6.6	5.1	17.1	19.9		29.7	14.4	10.1	16.8	3.6	38.2	1.1	14	4	17.1	30.6
BH065	0.3-0.5	BH065-0.3-0.5	1/06/06	Fill	VMP & PDA - Block 4	4.098	35.4				<0.5	1.1	1.2	3	3.1		3.6	2.1	1.3	2.7	<0.5	5.9	<0.5	1.6	<0.5	3.6	6.2
BH065	1.5-1.95	BH065-1.5-1.95	1/06/06	Fill	VMP & PDA - Block 4	1.134	11.7				<0.5	<0.5	0.6	1.1	0.9		1.1	0.6	<0.5	0.8	<0.5	2.4	<0.5	<0.5	<0.5	1.9	2.3
BH067	1.5-1.95	BH067-1.5-1.95	1/06/06	Fill	VMP & PDA - Block 5	1.711	18.6				<0.5	<0.5	0.8	1.2	1.3		1.4	0.9	0.6	1.2	<0.5	3.1	0.7	0.7	0.8	2.9	3
BH070	0.3-0.5	BH070_0.3-0.5	2/05/06	Fill	VMP & PDA - Block 4	1.828	17.7				<0.5	0.5	0.6	1.3	1.4		1.6	0.7	0.6	1.1	<0.5	3	<0.5	0.6	0.9	2.3	3.1
BH070	1.5-1.95	BH070_1.5-1.95	2/05/06	Fill	VMP & PDA - Block 4	3.349	30				<0.5	0.7	1.2	2.5	2.5		3.1	1.5	1.2	2.4	<0.5	4.9	<0.5	1.3	<0.5	3.7	5
BH071	1.5-1.95	BH071_1.5-1.95	2/05/06	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH072	0.3-0.5	BH072_0.3-0.5	2/05/06	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH073	1.5-1.95	BH073_1.5-1.95	2/05/06	Fill	VMP & PDA - Block 4	140.147	1451.6				20.6	87.8	77.3	107	100		99.3	44	33.5	88.7	10.7	252	56.5	41.4	14.8	190	228
BH074	1.5-1.95	BH074_1.5-1.95	2/05/06	Fill	VMP & PDA - Block 5	1.239	11.3				<0.5	0.6	0.5	1.2	1		1.1	<0.5	<0.5	0.9	<0.5	2.4	<0.5	<0.5	<0.5	1.4	2.2
BH075	0.3-0.5	BH075_0.3-0.5	6/06/06	Fill	VMP & PDA - Block 4	27.657	242.1				0.5	8.4	7.9	19.4	19		21.2	11.3	9.4	16.4	2.4	42.7	2.2	9.8	2.8	25.7	43
BH087	**1.5-1.95**	**BH087 1.5-1.95**	**8/06/06**	**Fill**	**VMP & PDA - Block 4**	114.535	**2982.2**				21.6	177	136	114	78.5		83.6	34	35.2	69.5	8.6	325	182	31.2	925	496	265
BH089	0.3-0.5	BH089 0.3-0.5	9/06/06	Fill	VMP & PDA - Block 4	<1.21	2.2				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	0.7	0.7
BH089	1.5-1.95	BH089 1.5-1.95	9/06/06	Fill	VMP & PDA - Block 4	4.367	57.4				<0.5	2.5	2.3	3.7	3.3		3.4	1.6	1.7	3.1	<0.5	7.7	2	1.4	9	8.3	7.4
BH090	1.5-1.95	BH090 1.5-1.95	9/06/06	Fill	VMP & PDA - Block 4	0.845	5.6				<0.5	<0.5	<0.5	0.6	0.7		0.8	<0.5	<0.5	0.5	<0.5	1.1	<0.5	<0.5	<0.5	0.8	1.1
BH109 0.3	0.3-0.5	BH109 0.3_0.5	27/06/06	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH113 1.5	1.5-1.95	BH113 1.5_1.95	27/06/06	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH114 0.3	0.3-0.5	BH114 0.3_0.5	28/06/06	Fill	VMP & PDA - Block 4	2.225	15				<0.5	<0.5	<0.5	1.2	1.7		2	1.3	0.9	1.2	<0.5	2.3	<0.5	0.9	<0.5	1	2.5
BH115 0.8	0.8-1	BH115 0.8_1.0	28/06/06	Fill	VMP & PDA - Block 4																						
BH115 1.5	1.5-1.95	BH115 1.5_1.95	28/06/06	Fill	VMP & PDA - Block 4	0.877	7.4				<0.5	<0.5	<0.5	0.8	0.7		0.9	<0.5	<0.5	0.7	<0.5	1.7	<0.5	<0.5	<0.5	1	1.6
BH119 1.6	1.6-2.05	BH119 1.6_2.05	30/06/06	Fill	VMP & PDA - Block 4	0.962	6				<0.5	<0.5	<0.5	0.6	0.8		0.9	0.6	<0.5	0.6	<0.5	1	<0.5	<0.5	<0.5	0.5	1
BH132	1.5-1.95	BH132_1.5-1.95	6/07/06	Fill	VMP & PDA - Block 4	25.386	189.2				0.9	3.5	5.4	19.5	17.1		21.9	8.8	9	14.8	2.3	29.5	2	7.1	3.8	16.1	27.5
BH133	0.3-0.5	BH133_0.3-0.5	6/07/06	Fill	VMP & PDA - Block 4	2.803	26				<0.5	1	0.9	2.2	2.1		2.6	1.4	0.9	1.9	<0.5	4	<0.5	1	1.3	2.7	4
BH133 1.5	1.5-1.95	BH133 1.5_1.95	6/07/06	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH135A	0.4-0.6	BH135A-0.4-0.6	11/07/06	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH141	1.5-1.95	BH141_1.5-1.95	7/07/06	Fill	VMP & PDA - Block 4	34.823	350.5				1.8	11.8	14.6	28.2	24.6		25.2	12.2	10.6	24.1	2.5	72.2	4.5	9.6	2.3	38.4	67.9
BH145	0.3-0.5	BH145-0.3-0.5	11/07/06	Fill	VMP & PDA - Block 5	109.996	849.7				1.5	22	24.1	81.4	72.4		91.3	45.6	36.4	72	11.9	130	5.6	36.1	8.8	61.6	149
BH146	1.5-1.95	BH146-1.5-1.95	11/07/06	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH156	0.4-0.5	BH156_0.4-0.5	14/08/06	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH156	0.9-1	BH156_0.9-1.0	14/08/06	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH160	0.3-0.4	BH160_0.3-0.4	14/08/06	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH161	0.3-0.4	BH161_0.3-0.4	14/08/06	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH197	0.4	BH197/0.4	3/03/08	Fill	VMP & PDA - Block 5	0.125	12.1				<0.5	<0.5	0.5	0.6	<0.5		0.6	0.5	<0.5	<0.5	<0.5	3.5	0.6	<0.5	<0.5	2.9	2.9
BH200	1	BH200/1.0	7/04/08	Fill	VMP & PDA - Block 4	166.044	1781.5				5.2	54.8	75.7	158	113		158	30.4	48.2	128	11.6	320	14.8	34.4	64.4	269	296
BH203	1.9	BH203/1.9	10/03/08	Fill	VMP & PDA - Block 4	7.675	57.4				<0.5	1.4	2.2	5	5.1		5.3	3.4	2.3	4.1	0.9	9.3	<0.5	3.4	<0.5	5.9	9.1
BH204S	**1**	**BH204/1.0**	**18/03/08**	**Fill**	**VMP & PDA - Block 4**	119.443	**3702.1**				45.2	194	187	128	78.6		68.8	39.8	59	83.5	9.9	373	295	41.3	1180	673	246
BH204D	**1.5**	**BH204D/1.5**	**7/04/08**	**Fill**	**VMP & PDA - Block 4**	921.56	**20,934**				222	605	1200	823	**652**		587	305	231	631	71.4	1550	1190	247	8410	2700	1510
BH206	0.5	BH206/0.5	7/03/08	Fill	VMP & PDA - Block 4	11.321	98.2				<0.5	4.2	3.9	8.4	7.8		7.7	3.6	3.6	7.5	1.1	15.6	0.9	3.4	1.9	11.8	16.8
BH206	1.8	BH206/1.8	17/04/08	Fill	VMP & PDA - Block 4	<1.21	0.5				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5
BH210	1.5	BH210/1.5	18/03/08	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH34	1.8-2.2	BH34_1.8-2.2	25/02/10	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH4	0.4-0.5	BH4_0.4-0.5	21/02/08	Fill	VMP & PDA - Hickson Road	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH42	1-1.1	BH42_1.0-1.1	23/02/10	Fill	VMP & PDA - Block 4	2.115	17.2				<0.5	<0.5	<0.5	2	1.5		2.3	0.8	1	1.7	<0.5	2.9	<0.5	0.6	<0.5	1.2	3.2
BH44	1.9-2	BH44_1.9-2.0	23/02/10	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH49	1.5-1.7	BH49_1.5-1.7	22/02/10	Fill	VMP & PDA - Block 4	36.552	428.1				1.1	11	18.1	35.8	22.7		37	13.2	11.8	32	3.8	76.7	4.5	11.4	9.7	61.4	77.9
BH5	0.4-0.5	BH5 0.4-0.5	23/02/08	Fill	VMP & PDA - Hickson Road	8.491	82.9	<0.5	<0.5	<0.5	<0.5	6.4	4.4	11.8	6.9	20		2.2		4.9	<0.5	15.9	<0.5	3.4	0.7	11.6	14.7
BH5	1.2-1.3	BH5 1.2-1.3	23/02/08	Natural Clayey Sand	VMP & PDA - Hickson Road	0.06	4.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<1		<0.5		<0.5	<0.5	0.8	<0.5	<0.5	1.6	0.7	0.9

						PAHs																				
						CPAH (TEF)	PAH (Total)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SSTC [VMP]						67																				
Tar Containing Material (TCM) Criteria							**2000**								**150**											
Location	**Sample Depth**	**Field ID**	**Sample Date**	**Matrix**	**Area**																					
BH50	1.3-1.5	BH50_1.3-1.5	26/02/10	Natural Sandstone	VMP & PDA - Block 4	0.06	1.1		<0.5		<0.5	<0.5	<0.5	0.6	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5
BH51	0.4-0.5	BH51_0.4-0.5	6/03/10	Fill	VMP & PDA - Hickson Road	1.256	10.6		<0.5		<0.5	<0.5	<0.5	1.3	0.9		1.4	0.5	0.7	1.1	<0.5	1.9	<0.5	<0.5	<0.5	0.8	2
BH52	1-1.2	BH52_1.0-1.2	22/02/10	Fill	VMP & PDA - Block 4																					
BH53	1.1-1.5	BH53_1.1-1.5	6/03/10	Fill	VMP & PDA - Hickson Road	56.149	668.3		<0.5		5.4	13	25.7	52.3	38.1		50.4	16.8	13.8	36.1	4.4	142	15.6	14.7	20.8	91.2	128
BH54	**1-1.4**	**BH54_1.0-1.4**	**23/02/10**	**Fill**	**VMP & PDA - Block 4**	842.57	**20,627**				273	1000	1070	912	**533**		824	248	324	549	72.5	2130	1290	231	6370	3130	1670
BH55	**1-1.2**	**BH55_1.0-1.2**	**25/02/10**	**Fill**	**VMP & PDA - Block 4**	372.05	**12,143**		<4		80.7	473	482	425	252		300	123	107	282	23.3	1280	460	95	4510	2030	1220
BH58	1-1.2	BH58_1.0-1.2	22/02/10	Fill	VMP & PDA - Block 4	19.668	205.8				0.6	8.2	8.5	16.2	12.7		19	9.8	6.9	14	1.8	36.1	1.5	7.2	2.3	23.4	37.6
BH59	1.9-2	BH59_1.9-2.0	22/02/10	Fill	VMP & PDA - Block 4	40.933	1264.5				10.3	58.8	60.3	45.9	26.5		35.8	13.1	14.3	32.2	3.2	121	68.3	11.8	453	206	104
BH61	0.3-0.4	BH61_0.3-0.4	6/03/10	Fill	VMP & PDA - Hickson Road																					
BH62	1-1.2	BH62_1.0-1.2	26/02/10	Fill	VMP & PDA - Block 5	0.1	4.4		<0.5		<0.5	<0.5	<0.5	0.5	<0.5		0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	0.7	0.9	0.9
BH64	1-1.2	BH64_1.0-1.2	1/03/10	Fill	VMP & PDA - Block 5	107.979	1463.6		1		7.5	51.9	70.8	95.5	69.8		104	37.2	29.4	79.7	10.8	246	31.1	33.2	76.7	261	259
BH67	0.4-0.43	BH67_0.4-0.43	6/03/10	Fill	VMP & PDA - Hickson Road	12.389	131.2		<0.5		<0.5	3.2	3.4	16.2	5.5		20.3	6.3	8.7	17.6	1.6	17.7	<0.5	5.3	0.9	7.9	16.6
BH8	0.26-0.4	BH8 0.26-0.4	19/02/08	Fill	VMP & PDA - Hickson Road	21.841	136.7	<0.5	<0.5	<0.5	<0.5	7.4	5.9	24	16.1	34		4.5		7.6	2.5	23	0.8	7.2	0.9	12.6	24.2
BH8	0.6-0.7	BH8 0.6-0.7	19/02/08	Fill	VMP & PDA - Hickson Road	37.753	274.5	<0.5	1.4	<0.5	<0.5	17.1	11.5	33.5	31.3	57		4.8		10.5	2	62	1.9	9.5	2.3	24.8	63.3
BH9	0.4-0.5	BH9 0.4-0.5	21/02/08	Fill	VMP & PDA - Hickson Road	0.06	1.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<1		<0.5		<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	0.6
BH9	0.9-1	BH9 0.9-1.0	21/02/08	Natural Sandstone	VMP & PDA - Hickson Road	1.546	14.1	<0.5	<0.5	<0.5	<0.5	0.6	0.5	2.6	1.2	2		0.6		1	<0.5	2.6	<0.5	0.7	<0.5	1.6	2.7
MW10	1.9-2	MW10 1.9-2.0	21/02/08	Fill	VMP & PDA - Hickson Road	12.023	87.2	<0.5	<0.5	<0.5	<0.5	1.6	2.4	21.1	8.6	14		1.2		7.1	1	16.8	<0.5	2.3	<0.5	7.6	17.5
MW15	0.4-0.5	MW15 0.4-0.5	10/04/08	Fill	VMP & PDA - Hickson Road	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW15	1.4-1.5	MW15 1.4-1.5	10/04/08	Fill	VMP & PDA - Hickson Road	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW3	0.4-0.5	MW3 0.4-0.5	23/02/08	Fill	VMP & PDA - Hickson Road	0.16	5.1	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	0.8	<0.5	1		1		<0.5	<0.5	0.7	<0.5	0.7	<0.5	0.5	0.8
MW3	0.9-1	MW3 0.9-1.0	23/02/08	Fill	VMP & PDA - Hickson Road	19.996	468.5	<0.5	<0.5	<0.5	1.7	42.5	13.8	44.6	11.7	62		4.2		23.4	2.7	91.1	8.5	8.6	2.5	120	93.2
MW6	0.8-0.9	MW6 0.8-0.9	20/02/08	Fill	VMP & PDA - Hickson Road	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW7	1.4-1.5	MW7 1.4-1.5	25/02/08	FILL	VMP & PDA - Hickson Road	38.745	218	<0.5	0.7	<0.5	0.7	7.7	9.6	41.2	32.1	49		1.4		16.1	1.7	36.6	2	6.5	1.6	24.9	35.9
SV09	0.2-0.4	SV09_0.2-0.4	26/02/10	Fill	VMP & PDA - Block 5	42.044	495.4		<0.5		1.4	9.9	18.5	45.3	25.4		43.7	14.5	18	33.9	4.2	97.5	3.4	12.6	5.8	69.1	92.2
TBH01	0.43-0.5	TBH01_0.43-0.5	5/02/11	Fill	VMP & PDA - Hickson Road	2.22	16.5				<0.5	<0.5	0.5	1.9	1.7		1.8	0.6	0.7	1.4	<0.5	3.1	<0.5	0.6	<0.5	1.2	3
TBH03	1.2-1.3	TBH03_1.2-1.3	5/02/11	Fill	VMP & PDA - Hickson Road	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TBH03	1.5-1.6	TBH03_1.5-1.6	5/02/11	Fill	VMP & PDA - Hickson Road	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TBH05	0.6-0.7	TBH05_0.6-0.7	12/02/11	Fill	VMP & PDA - Hickson Road	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TBH05	1.3-1.7	TBH05_1.3-1.7	12/02/11	Fill	VMP & PDA - Hickson Road	0.85	4.1				<0.5	<0.5	<0.5	0.7	0.7		0.8	<0.5	<0.5	<0.5	<0.5	1	<0.5	<0.5	<0.5	<0.5	0.9
TBH05	1.8-2	TBH05_1.8-2.0	12/02/11	Fill	VMP & PDA - Hickson Road	28.753	161.8				0.6	0.9	3.1	15.6	18.8		23.8	15.1	9.3	13.2	3.4	19.1	<0.5	14	0.6	8.3	16
TBH06	0.55-0.6	TBH06_0.55-0.6	5/02/11	Fill	VMP & PDA - Hickson Road	0.967	7.3				<0.5	<0.5	<0.5	0.9	0.8		0.7	<0.5	<0.5	0.7	<0.5	1.7	<0.5	<0.5	<0.5	0.6	1.9
TBH06	1.5-2	TBH06_1.5-2.0	12/02/11	Fill	VMP & PDA - Hickson Road	<1.21	<8				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TBH07	0.1-0.15	TBH07_0.1-0.15	4/02/11	Fill	VMP & PDA - Hickson Road	10.663	58.6				<0.5	1.4	1.4	4.7	7.8		8	6.5	2.7	4.8	0.8	6.4	<0.5	4.1	<0.5	1.4	8.6
TBH08	0.13-0.25	TBH08_0.13-0.25	4/02/11	Fill	VMP & PDA - Hickson Road	1.828	12.3				<0.5	<0.5	<0.5	1.3	1.5		1.3	0.7	0.5	1.1	<0.5	2.8	<0.5	<0.5	<0.5	<0.5	3.1

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC[VMP] - Site Specific Target Criteria for the VMP Area
shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds
(Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene;
Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene;
Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)

TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

						Phenols									TPH						BTEX					
						2,4-dimethylphenol	2,4-dinitrophenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	4-methylphenol	4-nitrophenol	Phenol	TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Total Xylene	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL						0.5		0.5	0.5	0.5	0.5	0.5		0.5		50	100	100	10	100	0.15	0.2	0.2	0.2	0.2	0.2
SSTC [VMP]																54000	72000	21,000				380				
Tar Containing Material (TCM) Criteria																										
Location	**Sample Depth**	**Field ID**	**Sample Date**	**Matrix**	**Area**																					
BH001	1	BH001	1/05/06	Fill	VMP & PDA - Block 5										4470	2360	3280	1190	3	6830	0.2	0.5	<0.2	0.4	0.2	<0.2
BH019	1.5-1.95	BH019 1.5-1.95	8/05/06	Fill	VMP & PDA - Block 4										<200	100	<100	<100	50	100						
BH020	0.3-0.5	BH020 0.3-0.5	9/05/06	Fill	VMP & PDA - Block 4										810	<50	460	350	<2	810						
BH020	1.5-2.1	BH020 1.5-2.1	9/05/06	Fill	VMP & PDA - Block 4										620	<50	280	340	<2	620						
BH021	0.3-0.5	BH021 0.3-0.5	9/05/06	Fill	VMP & PDA - Block 4										230	<50	130	100	<2	230						
BH028	0.3-0.5	BH028_0.3-0.5	12/05/06	Fill	VMP & PDA - Block 5										340	<50	200	140	<2	340	<0.01	<0.2	<0.2	<0.2	<0.2	<0.2
BH058	1.5-1.95	BH058-1.5-1.95	31/05/06	Fill	VMP & PDA - Block 5										3030	120	1960	1070	8	3150	<0.4	0.3	0.3	0.2	<0.2	<0.2
BH059	1.5-1.95	BH059-1.5-1.95	31/05/06	Fill	VMP & PDA - Block 5										550	<50	290	260	<2	550	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH060	1.7-2	BH060-1.7-2.0	31/05/06	Fill	VMP & PDA - Block 5										140	<50	<100	140	<2	140	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH062	1.5-1.95	BH062-1.5-1.95	31/05/06	Fill	VMP & PDA - Block 5										1120	100	610	510	8	1220	0.3	<0.2	<0.2	0.4	0.3	<0.2
BH065	0.3-0.5	BH065-0.3-0.5	1/06/06	Fill	VMP & PDA - Block 4										530	<50	180	350	<2	530	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH065	1.5-1.95	BH065-1.5-1.95	1/06/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH067	1.5-1.95	BH067-1.5-1.95	1/06/06	Fill	VMP & PDA - Block 5										1100	<50	480	620	<2	1100	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH070	0.3-0.5	BH070_0.3-0.5	2/05/06	Fill	VMP & PDA - Block 4										810	<50	600	210	<2	810	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH070	1.5-1.95	BH070_1.5-1.95	2/05/06	Fill	VMP & PDA - Block 4										570	<50	230	340	<2	570	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH071	1.5-1.95	BH071_1.5-1.95	2/05/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH072	0.3-0.5	BH072_0.3-0.5	2/05/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH073	1.5-1.95	BH073_1.5-1.95	2/05/06	Fill	VMP & PDA - Block 4										830	<50	560	270	<2	830	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH074	1.5-1.95	BH074_1.5-1.95	2/05/06	Fill	VMP & PDA - Block 5										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH075	0.3-0.5	BH075_0.3-0.5	6/06/06	Fill	VMP & PDA - Block 4										1010	<50	570	440	<2	1010	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH087	**1.5-1.95**	**BH087 1.5-1.95**	**8/06/06**	**Fill**	**VMP & PDA - Block 4**										7340	2230	5820	1520	20	9570	10.5	0.7	1.2	0.8	7.3	3.2
BH089	0.3-0.5	BH089 0.3-0.5	9/06/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH089	1.5-1.95	BH089 1.5-1.95	9/06/06	Fill	VMP & PDA - Block 4										610	70	440	170	<2	680	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH090	1.5-1.95	BH090 1.5-1.95	9/06/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH109 0.3	0.3-0.5	BH109 0.3_0.5	27/06/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH113 1.5	1.5-1.95	BH113 1.5_1.95	27/06/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH114 0.3	0.3-0.5	BH114 0.3_0.5	28/06/06	Fill	VMP & PDA - Block 4										340	<50	130	210	<2	340	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH115 0.8	0.8-1	BH115 0.8_1.0	28/06/06	Fill	VMP & PDA - Block 4										900	<50	560	340	<2	900	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH115 1.5	1.5-1.95	BH115 1.5_1.95	28/06/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH119 1.6	1.6-2.05	BH119 1.6_2.05	30/06/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH132	1.5-1.95	BH132_1.5-1.95	6/07/06	Fill	VMP & PDA - Block 4										890	<50	500	390	<2	890	<0.4	0.5	<0.2	<0.2	<0.2	<0.2
BH133	0.3-0.5	BH133_0.3-0.5	6/07/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH133 1.5	1.5-1.95	BH133 1.5_1.95	6/07/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH135A	0.4-0.6	BH135A-0.4-0.6	11/07/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH141	1.5-1.95	BH141_1.5-1.95	7/07/06	Fill	VMP & PDA - Block 4										2190	70	1600	590	<2	2260	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH145	0.3-0.5	BH145-0.3-0.5	11/07/06	Fill	VMP & PDA - Block 5										3390	80	2120	1270	4	3470	0.3	0.2	<0.2	0.4	0.3	<0.2
BH146	1.5-1.95	BH146-1.5-1.95	11/07/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH156	0.4-0.5	BH156_0.4-0.5	14/08/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH156	0.9-1	BH156_0.9-1.0	14/08/06	Fill	VMP & PDA - Block 4	<0.5		<0.5	<0.5	<1	<0.5			<0.5	<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH160	0.3-0.4	BH160_0.3-0.4	14/08/06	Fill	VMP & PDA - Block 4	<0.5		<0.5	<0.5	<1	<0.5			<0.5	<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH161	0.3-0.4	BH161_0.3-0.4	14/08/06	Fill	VMP & PDA - Block 4										<200	<50	<100	<100	<2	<250	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH197	0.4	BH197/0.4	3/03/08	Fill	VMP & PDA - Block 5	<0.5		<0.5	<0.5	<1	<0.5			<0.5	600	<50	150	450	<10	600	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH200	1	BH200/1.0	7/04/08	Fill	VMP & PDA - Block 4	<0.5		3.8	<0.5	8.5	<0.5			6.7	14,930	520	10,200	4730	<10	15,450	2.8	1.6	<0.5	2.2	2	0.8
BH203	1.9	BH203/1.9	10/03/08	Fill	VMP & PDA - Block 4	<0.5		<0.5	<0.5	<1	<0.5			<0.5	690	<50	330	360	<10	690	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH204S	**1**	**BH204/1.0**	**18/03/08**	**Fill**	**VMP & PDA - Block 4**	1.5		<0.5	<0.5	<1	<0.5			<0.5	12,690	2890	9620	3070	20	15,580	8.6	0.6	3.5	1.4	4.2	4.4
BH204D	**1.5**	**BH204D/1.5**	**7/04/08**	**Fill**	**VMP & PDA - Block 4**	754		1160	<8	2290	<8			1720	93,000	54,200	72,400	20,600	226	147,200	94.1	61	7	69.2	67.2	26.9
BH206	0.5	BH206/0.5	7/03/08	Fill	VMP & PDA - Block 4	<0.5		<0.5	<0.5	<1	<0.5			<0.5	490	<50	310	180	<10	490	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH206	1.8	BH206/1.8	17/04/08	Fill	VMP & PDA - Block 4	<0.5		<0.5	<0.5	<1	<0.5			<0.5	530	<50	190	340	<10	530	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH210	1.5	BH210/1.5	18/03/08	Fill	VMP & PDA - Block 4	<0.5		<0.5	<0.5	<1	<0.5			<0.5	<200	<50	<100	<100	<10	<250	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH34	1.8-2.2	BH34_1.8-2.2	25/02/10	Fill	VMP & PDA - Block 4	<0.5		<0.5	<0.5	<1	<0.5			<0.5	<200	<50	<100	<100	<10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH4	0.4-0.5	BH4_0.4-0.5	21/02/08	Fill	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	<0.5	<0.5			<0.5	<200	<50	<100	<100	<10	<250	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH42	1-1.1	BH42_1.0-1.1	23/02/10	Fill	VMP & PDA - Block 4	<0.5		<0.5	<0.5	<1	<0.5			<0.5	110	<50	110	<100	<10	110	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH44	1.9-2	BH44_1.9-2.0	23/02/10	Fill	VMP & PDA - Block 4	<0.5		<0.5	<0.5	<1	<0.5			<0.5	<200	<50	<100	<100	10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH49	1.5-1.7	BH49_1.5-1.7	22/02/10	Fill	VMP & PDA - Block 4	0.8		0.8	<0.5	2.1	<0.5			1.9	2250	80	1460	790	11	2330	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH5	0.4-0.5	BH5 0.4-0.5	23/02/08	Fill	VMP & PDA - Hickson Road	0.8		0.5	<0.5	1.9	<0.5			0.7	1700	<50	1060	640	<10	1700	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH5	1.2-1.3	BH5 1.2-1.3	23/02/08	Natural Clayey Sand	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	<0.5	<0.5			<0.5	<200	<50	<100	<100	<10	<250	0.8	2	<0.5	0.7	0.8	<0.5

						Phenols									TPH						BTEX					
						2,4-dimethylphenol	2,4-dinitrophenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	4-methylphenol	4-nitrophenol	Phenol	TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Total Xylene	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL						0.5		0.5	0.5	0.5	0.5	0.5		0.5		50	100	100	10	100	0.15	0.2	0.2	0.2	0.2	0.2
SSTC [VMP]																54000	72000	21,000				380				
Tar Containing Material (TCM) Criteria																										
Location	**Sample Depth**	**Field ID**	**Sample Date**	**Matrix**	**Area**																					
BH50	1.3-1.5	BH50_1.3-1.5	26/02/10	Natural Sandstone	VMP & PDA - Block 4	<0.5		<0.5	<0.5	<1	<0.5			<0.5	<200	<50	<100	<100	<10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH51	0.4-0.5	BH51_0.4-0.5	6/03/10	Fill	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	<1	<0.5			<0.5	<200	<50	<100	<100	<10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH52	1-1.2	BH52_1.0-1.2	22/02/10	Fill	VMP & PDA - Block 4										950	<50	580	370	78	950	28.9	0.2	2.7	3.9	20.2	8.7
BH53	1.1-1.5	BH53_1.1-1.5	6/03/10	Fill	VMP & PDA - Hickson Road	0.7		0.8	<0.5	1.6	<0.5			1.2	3250	<50	1920	1330	<10	3250	<1	0.4	<0.5	<0.5	<0.5	<0.5
BH54	**1-1.4**	**BH54_1.0-1.4**	**23/02/10**	**Fill**	**VMP & PDA - Block 4**	22.8		7	<4	<8	<4			5	15,260	4380	11,700	3560	72	19,600 - 19,640	35.5	2.5	3.5	7.3	25	10.5
BH55	**1-1.2**	**BH55_1.0-1.2**	**25/02/10**	**Fill**	**VMP & PDA - Block 4**	41.3		28.3	<4	33.2	<4			23.5	24,950	11,300	19,400	5550	109	36,200 - 36,250	34.9	7.8	2.8	14	24.1	10.8
BH58	1-1.2	BH58_1.0-1.2	22/02/10	Fill	VMP & PDA - Block 4	<0.5		<0.5	<0.5	<1	<0.5			<0.5	1010	<50	550	460	<10	1010	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH59	1.9-2	BH59_1.9-2.0	22/02/10	Fill	VMP & PDA - Block 4	<0.5		<0.5	<0.5	<1	<0.5			<0.5	3150	980	2290	860	<10	4130	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH61	0.3-0.4	BH61_0.3-0.4	6/03/10	Fill	VMP & PDA - Hickson Road										<200	<50	<100	<100	<10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH62	1-1.2	BH62_1.0-1.2	26/02/10	Fill	VMP & PDA - Block 5	<0.5		<0.5	<0.5	<1	<0.5			<0.5	<200	<50	<100	<100	<10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH64	1-1.2	BH64_1.0-1.2	1/03/10	Fill	VMP & PDA - Block 5	2.4		1.9	<0.5	5.3	<0.5			3.8	2970	260	1970	1000	<10	3230	<1	0.2	<0.5	<0.5	<0.5	<0.5
BH67	0.4-0.43	BH67_0.4-0.43	6/03/10	Fill	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	<1	<0.5			<0.5	1270	<50	700	570	<10	1270	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH8	0.26-0.4	BH8 0.26-0.4	19/02/08	Fill	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	0.5	<0.5			<0.5	510	<50	310	200	<10	510	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH8	0.6-0.7	BH8 0.6-0.7	19/02/08	Fill	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	1.7	<0.5			0.7	2370	<50	1380	990	<10	2370	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH9	0.4-0.5	BH9 0.4-0.5	21/02/08	Fill	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	<0.5	<0.5			<0.5	<200	<50	<100	<100	<10	<250	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH9	0.9-1	BH9 0.9-1.0	21/02/08	Natural Sandstone	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	<0.5	<0.5			<0.5	<200	<50	<100	<100	<10	<250	<1	<0.2	<0.5	<0.5	<0.5	<0.5
MW10	1.9-2	MW10 1.9-2.0	21/02/08	Fill	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	<0.5	<0.5			<0.5	830	<50	370	460	<10	830	<1	<0.2	<0.5	<0.5	<0.5	<0.5
MW15	0.4-0.5	MW15_0.4-0.5	10/04/08	Fill	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	<0.5	<0.5			<0.5	<200	<50	<100	<100	<10	<250	<1	<0.2	<0.5	<0.5	<0.5	<0.5
MW15	1.4-1.5	MW15_1.4-1.5	10/04/08	Fill	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	<0.5	<0.5			<0.5	<200	<50	<100	<100	<10	<250	<1	<0.2	<0.5	<0.5	<0.5	<0.5
MW3	0.4-0.5	MW3 0.4-0.5	23/02/08	Fill	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	<0.5	<0.5			<0.5	<200	<50	<100	<100	<10	<250	<1	<0.2	<0.5	<0.5	<0.5	<0.5
MW3	0.9-1	MW3 0.9-1.0	23/02/08	Fill	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	2.2	<0.5			<0.5	3270	1010	2510	760	<10	4280	<1	<0.2	<0.5	<0.5	<0.5	<0.5
MW6	0.8-0.9	MW6 0.8-0.9	20/02/08	Fill	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	<0.5	<0.5			<0.5	<200	<50	<100	<100	<10	<250	<1	<0.2	<0.5	<0.5	<0.5	<0.5
MW7	1.4-1.5	MW7 1.4-1.5	25/02/08	FILL	VMP & PDA - Hickson Road	<0.5		<0.5	<0.5	1.4	<0.5			0.9	2660	<50	1400	1260	<10	2660	<1	0.2	<0.5	<0.5	<0.5	<0.5
SV09	0.2-0.4	SV09_0.2-0.4	26/02/10	Fill	VMP & PDA - Block 5	<0.5		<0.5	<0.5	1.4	<0.5			<0.5	3160	120	1920	1240	<10	3280	<1	0.5	<0.5	<0.5	<0.5	<0.5
TBH01	0.43-0.5	TBH01_0.43-0.5	5/02/11	Fill	VMP & PDA - Hickson Road										<200	<50	<100	<100	<10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
TBH03	1.2-1.3	TBH03_1.2-1.3	5/02/11	Fill	VMP & PDA - Hickson Road										<200	<50	<100	<100	<10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
TBH03	1.5-1.6	TBH03_1.5-1.6	5/02/11	Fill	VMP & PDA - Hickson Road										<200	<50	<100	<100	<10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
TBH05	0.6-0.7	TBH05_0.6-0.7	12/02/11	Fill	VMP & PDA - Hickson Road										<200	<50	<100	<100	<10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
TBH05	1.3-1.7	TBH05_1.3-1.7	12/02/11	Fill	VMP & PDA - Hickson Road										<200	<50	<100	<100	<10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
TBH05	1.8-2	TBH05_1.8-2.0	12/02/11	Fill	VMP & PDA - Hickson Road										1210	<50	600	610	<10	1210	<1	<0.2	<0.5	<0.5	<0.5	<0.5
TBH06	0.55-0.6	TBH06_0.55-0.6	5/02/11	Fill	VMP & PDA - Hickson Road										<200	<50	<100	<100	<10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
TBH06	1.5-2	TBH06_1.5-2.0	12/02/11	Fill	VMP & PDA - Hickson Road										<200	<50	<100	<100	<10	<50	<1	<0.2	<0.5	<0.5	<0.5	<0.5
TBH07	0.1-0.15	TBH07_0.1-0.15	4/02/11	Fill	VMP & PDA - Hickson Road										700	<50	280	420	<10	700	<1	<0.2	<0.5	<0.5	<0.5	<0.5
TBH08	0.13-0.25	TBH08_0.13-0.25	4/02/11	Fill	VMP & PDA - Hickson Road										370	<50	110	260	<10	370	<1	<0.2	<0.5	<0.5	<0.5	<0.5

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC[VMP] - Site Specific Target Criteria for the VMP Area
shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds
(Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene;
Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene;
Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)

TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

						PAHs																							
						CPAH (TEF)	PAH (Total)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SSTC[VMP]						67																							
Tar Containing Material (TCM) Criteria							**2000**									**150**													
Location	**Sample Depth**	**Consultant**	**Sample Date**	**Matrix**	**Area**																								
BH001	4	ERM	2/05/2006	Fill	VMP & PDA - Block 5	3.531	30.7				<0.5	0.5		0.8	3.3	2.6		3.3	1	1.3	3.1	<0.5	5	<0.5	1	1.3		2.4	5.1
BH019	2.5-3	ERM	8/05/2006	Fill	VMP & PDA - Block 4	82.897	1994.2				24.3	82		79.3	70.3	58.2		56.9	22.6	25.5	54.1	6.4	208	110	22.6	700		295	179
BH019	**3-3.45**	ERM	**8/05/2006**	**Fill**	**VMP & PDA - Block 4**	122.038	**2733.9**				31.6	120		114	103	86.3		85.3	32.2	37.2	77.6	8.8	295	157	32.9	891		407	255
BH020	1.5-2.1	ERM	9/05/2006	Fill	VMP & PDA - Block 4	6.351	50				<0.5	1.3		1.6	3.9	4.4		5	2.5	1.9	3.6	0.6	8.5	0.7	2.1	0.5		4.7	8.7
BH028	13-13.5	ERM	12/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	12.142	470.5				6.7	38.6		20.4	13.2	8.4		9	3.1	3.2	11.1	0.8	28.2	32.3	2.6	183		76	33.9
BH058	6-6.5	ERM	31/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	2.618	154.1				2.7	15.6		6.9	3.6	2		1.6	0.6	0.6	3.2	<0.5	6.6	12.3	<0.5	59.5		28.9	10
BH059	3-3.45	ERM	31/05/2006	Fill	VMP & PDA - Block 5	3.224	27.9				<0.5	0.7		1	2.5	2.4		3	1.4	1.2	2	<0.5	4.4	0.5	1.2	<0.5		2.6	5
BH059	8.5-9	ERM	31/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	<1.21	10.9				<0.5	1.4		0.6	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	0.8	1.2	<0.5	2.7		3	1.2
BH060	9.5-10	ERM	31/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	<1.21	1.4				<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		0.9	0.5
BH062	3-3.45	ERM	31/05/2006	Fill	VMP & PDA - Block 5	6.023	47.4				<0.5	1		1.8	3.5	4.2		5	3	1.8	3.3	0.5	7.4	0.6	2.3	<0.5		4.9	8.1
BH065	3-3.45	ERM	1/06/2006	Fill	VMP & PDA - Block 4	11.332	176.3				7	1.4		9.7	9.5	7.7		9.4	4.5	3.5	8.7	0.9	28.3	7.8	3.6	13.9		34.6	25.8
BH067	3-3.45	ERM	1/06/2006	Fill	VMP & PDA - Block 5	6.064	63.1				<0.5	1.1		1.8	5.1	4.5		5.7	2.1	2.4	4.3	<0.5	12.5	0.9	1.8	1.5		7.5	11.9
BH071	3-3.45	ERM	2/05/2006	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH072	3-3.45	ERM	2/05/2006	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH072	9.5-10	ERM	2/05/2006	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH073	2-2.4	ERM	2/05/2006	Fill	VMP & PDA - Block 4	21.659	383.1				4.4	24.4		18.7	19	15.3		15.6	6.3	6.2	14.6	1.5	48.8	20.8	5.7	80.5		58.3	43
BH074	3-3.45	ERM	2/05/2006	Fill	VMP & PDA - Block 5	3.729	45.5				<0.5	1.5		2.6	3.7	2.8		3	1.1	1.2	2.8	<0.5	8.2	1.3	1	<0.5		8.6	7.7
BH074	9.5-10	ERM	2/05/2006	Natural Sandy Clay	VMP & PDA - Block 5	45.766	1222.9				10.5	80.5		60	41.3	32.7		30.6	11.5	12.9	30.1	3.1	112	71.6	10.7	435		184	96.4
BH075	3-3.45	ERM	6/06/2006	Fill	VMP & PDA - Block 4	1.063	9.3				<0.5	<0.5		<0.5	0.9	0.8		1.1	0.6	0.5	0.7	<0.5	1.8	<0.5	<0.5	<0.5		1	1.9
BH087	**3-3.45**	ERM	**8/06/2006**	**Fill**	**VMP & PDA - Block 4**	113.187	**2895.7**				24.4	158		120	97.4	79.6		79.6	34	31.9	70.7	8.6	285	160	30.5	1030		439	247
BH087	**7-7.5**	ERM	**8/06/2006**	**Fill**	**VMP & PDA - Block 4**	69.75	**2418.5**				23.7	135		104	64.5	49		45.7	20	19.9	50	5.3	163	125	17.4	1090		333	173
BH089	3-3.45	ERM	9/06/2006	Fill	VMP & PDA - Block 4	7.99	76.8				<0.5	2.3		3.4	6.2	5.6		5.9	2.6	2.7	5.4	0.6	13.5	1.1	2.3	0.7		11.5	13
BH090	3-3.45	ERM	9/06/2006	Fill	VMP & PDA - Block 4	4.337	41.6				<0.5	1		2	3.5	3.3		3.3	1.6	1.7	3.1	<0.5	7.1	<0.5	1.4	<0.5		6.3	7.3
BH109	3-3.45	ERM	27/06/2006	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH109	9.5-10	ERM	27/06/2006	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH113	3-3.45	ERM	27/06/2006	Fill	VMP & PDA - Block 4	0.878	9.2				<0.5	<0.5		0.6	0.9	0.7		0.8	<0.5	<0.5	0.8	<0.5	1.8	<0.5	<0.5	<0.5		1.8	1.8
BH114	3-3.45	ERM	28/06/2006	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH115	3-3.45	ERM	28/06/2006	Fill	VMP & PDA - Block 4	0.756	6.5				<0.5	<0.5		<0.5	0.7	0.6		0.8	<0.5	<0.5	0.6	<0.5	1.6	<0.5	<0.5	<0.5		0.8	1.4
BH119	1.6-2.05	ERM	30/06/2006	Fill	VMP & PDA - Block 4	0.962	6				<0.5	<0.5		<0.5	0.6	0.8		0.9	0.6	<0.5	0.6	<0.5	1	<0.5	<0.5	<0.5		0.5	1
BH119	**7.5-8**	ERM	**30/06/2006**	**Fill**	**VMP & PDA - Block 4**	217.559	**5173.3**				53.5	273		236	152	149		113	59.9	71.3	121	27.4	550	313	57.2	1620		880	497
BH119	**9.5-10**	ERM	**30/06/2006**	**Fill**	**VMP & PDA - Block 4**	111.363	**3325.3**				39.7	240		163	88.9	80		55.5	23.5	43.5	69.8	9	289	239	26.4	1210		504	244
BH132	8-8.5	ERM	6/07/2006	Natural Clayey Sand	VMP & PDA - Block 4	40.715	1700.3				18.4	148		57	45	28		27.4	11	11.6	37.5	3	77.6	76.9	8.3	825		228	97.6
BH135	3-3.45	ERM	11/07/2006	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH141	**3-3.45**	ERM	**7/07/2006**	**Fill**	**VMP & PDA - Block 4**	489.37	**13659**				127	600		499	429	**344**		359	149	140	328	35.4	1160	725	124	5840		1820	980
BH145	3-3.45	ERM	11/07/2006	Fill	VMP & PDA - Block 5	<1.21	1.4				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5		<0.5	0.7
BH146	3-3.33	ERM	11/07/2006	Fill	VMP & PDA - Block 4	99.1	951.4				8.8	58.8		35.4	89.7	67.3		72.8	33	28.9	69	8.5	184	10.9	31.4	28.3		26.6	198
BH146	4.1-4.6	ERM	11/07/2006	Fill	VMP & PDA - Block 4	48.479	1274.6				16	78.8		58.6	43.5	32.9		37.2	16.2	14.8	34.7	4.1	107	71.6	14.2	454		186	105
BH159		ERM	14/08/2006	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH197	11.5	ERM	9/04/2008	Natural Clayey Sand	VMP & PDA - Block 5	1.587	91.3				1.7	9.9		3.6	2.7	1.2		1	<0.5	<0.5	1.7	<0.5	3.8	9.2	<0.5	31.1		19.3	6.1
BH197	15.9	ERM	10/04/2008	Natural Sandstone	VMP & PDA - Block 5	0.06	10.5				<0.5	1		0.7	0.6	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	1.3	1	<0.5	2		2.7	1.2
BH197	18.6	ERM	10/04/2008	Natural Sandstone	VMP & PDA - Block 5	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH197	5	ERM	9/04/2008	Fill	VMP & PDA - Block 5	49.087	546.8				5.1	27		19.2	57.7	34.2		31.4	9.2	15.7	36.5	3	86.6	10.1	9.5	83		23.6	95
BH197	6.5	ERM	9/04/2008	Natural Sandy Clay	VMP & PDA - Block 5	0.05	10				<0.5	<0.5		0.5	0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	1	0.6	<0.5	4.8		1.6	1
BH198	3	ERM	6/03/2008	Fill	VMP & PDA - Block 5	37.064	274.8				3.4	16.3		12.7	13.3	26.3		26.5	12.7	10.5	12.7	4.3	26.6	4.7	11.8	17.2		21	54.8
BH198	4.5	ERM	6/03/2008	Natural Sandy Clay	VMP & PDA - Block 5	<1.21	1				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1		<0.5	<0.5
BH198	6.9	ERM	6/03/2008	Natural Clayey Sand	VMP & PDA - Block 5	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH199	2.7	ERM	11/03/2008	Fill	VMP & PDA - Block 5	20.52	217.2				2	11.6		9	20.3	14.4		14.6	5.4	6.5	14.6	1.3	42.7	3.8	4.8	1.5		25.3	39.4
BH199	3.7	ERM	11/03/2008	Natural Silty Clay	VMP & PDA - Block 5	39.473	1158.9				14.2	47.2		44.7	39.8	27.4		29.8	10.3	11.9	28	2.5	122	69	10.4	439		164	98.7
BH199	5.6	ERM	11/03/2008	Natural Clayey Sand	VMP & PDA - Block 5	1.454	25.2				<0.5	1.4		1.3	1.8	1.1		1	<0.5	0.6	1.4	<0.5	4.8	1	<0.5	3.5		2.9	4.4
BH199	6	ERM	17/03/2008	Natural Sandstone	VMP & PDA - Block 5	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH200	2.5	ERM	7/04/2008	Fill	VMP & PDA - Block 4	19.759	220.1				1	6.7		9.9	16.9	12.4		18.2	8.3	7.3	14.6	2.2	34.7	5.4	6.9	10.1		32.4	33.1
BH200	6.53	ERM	7/04/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH201	2.4	ERM	4/03/2008	Fill	VMP & PDA - Block 5	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH201	10.3	ERM	18/03/2008	Fill	VMP & PDA - Block 5	21.747	160.4				1.5	6.5		5.5	13.1	15.6		16.7	6.7	4.7	11	1.9	21.9	4.3	6.2	5		16.2	23.6
BH201	11	ERM	18/03/2008	Natural Clayey Sand	VMP & PDA - Block 5	0.72	4.4				<0.5	<0.5		<0.5	0.6	0.6		0.6	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	<0.5	<0.5		<0.5	1.5
BH202	2.3	ERM	10/03/2008	Fill	VMP & PDA - Block 4	9.474	66.6				<0.5	1		1.6	6.5	6.5		6.4	3.9	3	5.5	0.9	11.4	<0.5	3.9	1		3.4	11.6
BH202	4.7	ERM	10/03/2008	Fill	VMP & PDA - Block 4	4.748	47.6				1.1	0.8		2	4	3.6		3.5	1.7	1.8	3.1	<0.5	8.9	0.8	1.7	<0.5		4.8	9.8
BH202	6.8	ERM	10/03/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH203	7.3	ERM	10/03/2008	Fill	VMP & PDA - Block 4	3.394	31.5				<0.5	0.8		1.3	2.9	2.6		2.4	1.2	1.1	2.2	<0.5	5.5	0.6	1.2	0.7		3.4	5.6
BH204D	**3**	ERM	**7/04/2008**	**Fill**	**VMP & PDA - Block 4**	265.142	**6223.3**				85.6	234		283	255	**195**		210	38.2	40.4	184	13.3	655	384	40.8	1970		1090	545
BH204D	**4**	ERM	**7/04/2008**	**Fill**	**VMP & PDA - Block 4**	305.575	**7972.5**				73.4	336		338	299	**224**		239	42.5	41	212	16.3	777	462	48.3	2930		1290	644
BH205	7.8	ERM	27/03/2008	Natural Sandy Clay	VMP & PDA - Block 4	<1.21	1.2				<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	0.7		0.5	<0.5
BH205	9.3	ERM	27/03/2008	Natural Clayey Sand	VMP & PDA - Block 4	22.484	738.1				11	57.6		30.7	25.2	15.5		14.3	5.6	6.7	20.8	1.6	42.4	42.9	5	291		117	50.8
BH205	13	ERM	1/04/2008	Natural Sandstone	VMP & PDA - Block 4	2.566	81.5				1.2	3.8		3.9	2.9	1.9		2.1	0.6	0.8	2	<0.5	7.5	6	0.6	28.8		13.1	6.3
BH205	13.8	ERM	1/04/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH205	19.2	ERM	2/04/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	4				<0.5	0.7		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.7		1.4	0.7

						PAHs																					
						CPAH (TEF)	PAH (Total)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SSTC[VMP]						67																							
Tar Containing Material (TCM) Criteria							**2000**									**150**													
Location	**Sample Depth**	**Consultant**	**Sample Date**	**Matrix**	**Area**																								
BH205	22.2	ERM	2/04/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH206	4.6	ERM	17/04/2008	Fill	VMP & PDA - Block 4	1.658	18.7				<0.5	0.6		0.7	1.7	1.2		1.5	0.7	0.6	1.1	<0.5	4	<0.5	0.6	<0.5		2.4	3.6
BH206	7.1	ERM	17/04/2008	Natural Clayey Sand	VMP & PDA - Block 4	2.862	110.1				1.4	10		5.6	4.1	2.1		1.9	0.7	0.7	2.5	<0.5	6.7	8.3	0.6	39.8		16.9	8.8
BH207	7.45	ERM	3/04/2008	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH206	10.7	ERM	21/04/2008	Natural Sandstone	VMP & PDA - Block 4	0.909	21.7				<0.5	1.9		1.6	1.2	0.7		0.8	<0.5	<0.5	0.9	<0.5	2.1	1.4	<0.5	3.5		5.1	2.5
BH207	12	ERM	3/04/2008	Fill	VMP & PDA - Block 4	6.811	53.6				<0.5	2.2		1.9	4.4	4.8		5.2	2.5	1.7	3.6	0.6	8.8	0.7	2.2	1.2		4.3	9.5
BH207	13.1	ERM	3/04/2008	Fill	VMP & PDA - Block 4	1.525	33				<0.5	2.4		2	1.8	1.2		1.3	<0.5	<0.5	1.5	<0.5	3.5	2.4	<0.5	6.1		6.5	4.3
BH207	15	ERM	3/04/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	0.6				<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	0.6		<0.5	<0.5
BH208	2.25	ERM	4/04/2008	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH208	9.5	ERM	4/04/2008	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH208	13.5	ERM	4/04/2008	Natural Sandy Clay	VMP & PDA - Block 4	13.108	109.8				<0.5	1.8		3.2	9.4	9.3		11.4	4.9	3	8.9	0.9	20.5	0.7	3.9	0.7		8.4	22.8
BH209	2.3	ERM	22/04/2008	Fill	VMP & PDA - Block 4	23.217	168				0.7	7.5		4.8	10.8	16.5		19.8	7.7	6.4	8	2.2	20.1	1.9	6.6	2.6		7.6	44.8
BH209	4.5	ERM	22/04/2008	Natural Clay	VMP & PDA - Block 4	16.094	497				5.9	33.8		19.1	17.7	11.2		11.4	4.5	2.7	12.9	1.2	28.3	24.8	3.4	203		75.5	41.6
BH209	6.1	ERM	22/04/2008	Natural Sandstone	VMP & PDA - Block 4	12.992	814				6.8	54.9		22.3	15.4	9.1		7	3.2	2.9	11	1	24.6	27	2.2	498		86.5	42.1
BH209	9.4	ERM	23/04/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH210	15.9	ERM	27/03/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH211	14	ERM	26/03/2008	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH211	15.5	ERM	26/03/2008	Natural Clayey Sand	VMP & PDA - Block 4	0.086	17.7				<0.5	1.9		1.4	0.8	<0.5		<0.5	<0.5	<0.5	0.6	<0.5	1.2	1.2	<0.5	5.2		3.6	1.8
BH211	16.05-16.15	ERM	26/03/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH34	1.8-2.2	AECOM	25/02/2010	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH34	6-6.2	AECOM	25/02/2010	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH34	11-11.2	AECOM	25/02/2010	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH35	4.9-5	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH35	9.9-10	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH4	2.3-2.4	Coffey	21/02/2008	Fill	VMP & PDA - Hickson Road	17.265	139.5	<1.2	7.2	<1.2	<1.2	52.8		12.3	9.4	11.4	23		8.4		8.1	3.9	10.1	<1.2	8.6	4.6		5.3	4.6
BH4	4.2-4.3	Coffey	21/02/2008	Fill	VMP & PDA - Hickson Road	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<1		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH405	4-4.3	AECOM	10/02/2011	Fill	VMP & PDA - Block 4	7.736	58.5				<0.5	0.9		1.2	5	5.9		8	2.6	2.4	5	<0.5	6.8	<0.5	2.2	<0.5		1.4	17.1
BH405	7-7.3	AECOM	10/02/2011	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH405	13-13.2	AECOM	11/02/2011	Natural Sand	VMP & PDA - Block 4	31.691	750.2				11.2	45.2		40.9	30.2	21.6		25.7	7.5	14.3	23.6	2	72.9	46.5	7.6	208		130	63
BH405	**14-14.4**	AECOM	**11/02/2011**	**Natural Sandy Clay**	**VMP & PDA - Block 4**	129.201	**3296.3**				44.9	221		182	130	86.2		96.3	49.1	44.5	93	10.3	301	236	42	1040		470	250
BH408	2-2.4	AECOM	14/02/2011	Fill	VMP & PDA - Block 4	9.097	74.5				<0.5	2.2		3.5	6.2	6.3		7.1	4.5	3.1	5.2	0.7	12.6	<0.5	3.6	<0.5		6.6	12.9
BH408	8-8.3	AECOM	15/02/2011	Natural Sandy Clay	VMP & PDA - Block 4	1.695	62.2				1.8	6.1		6.2	2.6	1.3		1.1	0.6	<0.5	1.9	<0.5	4.3	7	<0.5	13		9.4	6.9
BH408	9-9.4	AECOM	15/02/2011	Natural Clayey Sand	VMP & PDA - Block 4	8.162	252.6				4.2	22.9		12.5	9.7	5.6		4.6	2.6	2.3	7.6	0.6	14.5	16.6	2	89.8		38.8	18.3
BH409	3.7-4	AECOM	14/02/2011	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH409	5-5.3	AECOM	14/02/2011	Natural Sand	VMP & PDA - Block 4	0.06	56.7				5.6	2.8		1.9	0.6	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	1.2	2.2	<0.5	33.8		6.8	1.8
BH409	6-6.4	AECOM	15/02/2011	Natural Sandy Clay	VMP & PDA - Block 4				<0.5																				
BH409	7-7.3	AECOM	15/02/2011	Natural Clayey Sand	VMP & PDA - Block 4	<1.21	5.2				<0.5	0.7		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.8		1.1	0.6
BH42	**3.2-3.3**	AECOM	**23/02/2010**	**Fill**	**VMP & PDA - Block 4**	140.429	**3497.6**	<1.2	431	<1.2	35	250	<1.2	217	157	113	136		22.9		122	7.9	369	243	23.8	926		660	351
BH42	3.5-3.6	AECOM	23/02/2010	Natural Sandstone	VMP & PDA - Block 4	<1.21	6.4				<0.5	0.8		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	0.8	0.6	<0.5	1		2.4	0.8
BH44	4.9-5	AECOM	23/02/2010	Natural Sandstone	VMP & PDA - Block 4	18.96	962.7	<1.2	204	<1.2	11.3	90	<1.2	41.9	27.6	15.6	18		3.2		22.8	<1.2	59.2	54.5	3.4	410		156	67.2
BH45	3.2-3.4	AECOM	23/02/2010	Fill	VMP & PDA - Block 4	<1.21	1				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5		0.5	<0.5
BH45	7.2-7.4	AECOM	23/02/2010	Fill	VMP & PDA - Block 4	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH49	4.2-4.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	29.264	374.2				4.1	23.8		16	23.2	19.2		27.6	9.2	13.4	16.2	2.6	38.8	12.5	7.9	64.7		41.7	53.3
BH49	6.2-6.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	2.91	50.1	<0.5	4	<0.5	0.8	2.3	<0.5	1.7	3.1	2.5	3		0.6		2.4	<0.5	4.4	2.7	0.7	19.5		5.7	3.7
BH49	8.2-8.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	25.723	946.5				11.2	55.1		43.6	30.9	16.4		21.4	6.7	12	22.6	2	83.3	62	6	373		130	70.3
BH49	10.2-10.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	17.52	813.1				5.3	32.6		25.8	23.1	11.4		14.8	4.7	6.5	15.3	1.1	54.6	33.4	3.8	343		191	46.7
BH49	12.2-12.4	AECOM	22/02/2010	Natural Clayey Sand	VMP & PDA - Block 4	45.485	1760.5	<1.2	211	<1.2	16.5	132	<1.2	59.1	48.4	35.8	45		8.7		37.8	3.4	161	125	9.8	703		283	137
BH45	13.2-13.4	AECOM	23/02/2010	Natural Sandstone	VMP & PDA - Block 4	<1.21	3.3				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	<0.5	<0.5		1.2	1
BH52	2.2-2.6	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	2.288	23.3				<0.5	1		1	2.4	1.6		2.4	0.9	1	1.9	<0.5	4.1	<0.5	0.8	<0.5		2.3	3.9
BH52	4.2-4.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	127.752	1994.9				36.1	85.7		115	140	82.2		93.8	43.2	52.9	109	11.6	306	123	37.6	55.8		412	291
BH53	2-2.4	AECOM	6/03/2010	Fill	VMP & PDA - Hickson Road	100.803	1510.3		<0.5		11.4	28.3		84.8	92.8	70.7		77.8	23.9	27.5	63.4	7.1	316	56.1	23.2	48.3	1510	302	277
BH53	**4-4.4**	AECOM	**6/03/2010**	**Fill**	**VMP & PDA - Hickson Road**	338.605	**9566.6**	<2.5	757	<2.5	108	657	<2.5	343	275	**291**	305		53.5		257	12.1	747	344	49	4330		1390	710
BH54	2.8-3	AECOM	23/02/2010	Natural Sand	VMP & PDA - Block 4	27.593	678.1	<1.2	41.8	<1.2	11.1	29.3	<1.2	32.6	27.5	21.7	28		5.8		22.5	2.2	66.1	40.2	6.6	227		131	54.5
BH55	**2.2-2.4**	AECOM	**25/02/2010**	**Fill**	**VMP & PDA - Block 4**	102.892	**3476.4**	<1.2	308	<1.2	25.3	149	<1.2	119	107	84	102		17.2		87	5.4	274	151	17.5	1740		463	237
BH55	**2.7-2.9**	AECOM	**25/02/2010**	**Fill**	**VMP & PDA - Block 4**	242.28	**10435**		<4		67.1	386		341	294	**160**		187	65	117	200	14.5	783	440	53.3	4810	10,400	1840	677
BH58	3.2-3.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	2.979	50.8				1.6	1.1		2.2	2.8	2.1		3.6	1.4	1	2.5	<0.5	6.6	1.3	1	10.9		5.9	6.8
BH58	5.2-5.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	3.688	45.6				1.2	0.9		2	3.3	2.6		3.8	1.7	1.9	3.1	<0.5	7.5	1.3	1.4	1.3		6.2	7.4
BH58	8.6-8.8	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	6.05	47.5	<0.5	<0.5	<0.5	<0.5	2.1	<0.5	2.2	5.6	5.3	7		1.4		4.6	<0.5	7.9	0.7	1.3	1.2		4.6	10.6
BH58	10.8-11.2	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	3.161	39.8				0.8	0.9		1.3	3.3	2.2		3.2	1.3	1.7	2.8	<0.5	7.3	0.7	1	1.2		3.6	8.5
BH59	**3.4-3.5**	AECOM	**22/02/2010**	**Fill**	**VMP & PDA - Block 4**	245.605	**8362.4**	<1.2	967	<1.2	104	404	<1.2	368	271	**189**	232		44.5		214	21.7	669	462	52.2	3560		1400	603
BH59	4.2-4.3	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	4.859	147.6				1.4	9.1		8.3	6.2	3.4		4.6	1.4	2	4.5	<0.5	14.2	8.8	1.2	46.4		23.5	12.6
BH61	**2-2.4**	AECOM	**7/03/2010**	**Fill**	**VMP & PDA - Hickson Road**	223.905	**2168.2**		2		4.8	47.6		91.6	217	**162**		182	41.5	28	164	13.2	423	23.8	39.5	51.2	2170	267	412
BH61	3-3.4	AECOM	7/03/2010	Natural Clayey Sand	VMP & PDA - Hickson Road	18.103	728.4	<1.2	81.2	<1.2	7.3	47.8	<1.2	30.1	18.9	14.3	17		4.7		14.6	1.3	60.1	38.4	4.2	318		113	55.7
BH62	3.4-3.8	AECOM	26/02/2010	Fill	VMP & PDA - Block 5	<1.21	<8		<0.5		<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH62	5.4-5.6	AECOM	26/02/2010	Fill	VMP & PDA - Block 5	4.247	52.5		<0.5		<0.5	0.6		2.2	5.1	2.9		4.3	1.7	2.2	4	<0.5	10.8	0.5	1.3	0.5	52.5	6.1	10.3
BH62	11.8-12	AECOM	26/02/2010	Fill	VMP & PDA - Block 5	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5

						PAHs																					
						CPAH (TEF)	PAH (Total)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SSTC[VMP]						67																							
Tar Containing Material (TCM) Criteria							**2000**									**150**													
Location	**Sample Depth**	**Consultant**	**Sample Date**	**Matrix**	**Area**																								
BH64	2.5-2.7	AECOM	1/03/2010	Fill	VMP & PDA - Block 5																								
BH64	5.5-5.7	AECOM	1/03/2010	Fill	VMP & PDA - Block 5																								
BH64	10-10.3	AECOM	1/03/2010	Natural Sandstone	VMP & PDA - Block 5																								
BH65	3.4-3.6	AECOM	24/02/2010	Fill	VMP & PDA - Block 5	41.546	532.8				5.2	13.8		28.1	40.6	27		32.3	17.4	17.2	30.2	3.7	82.9	29.1	13.6	10.1		98.8	82.8
BH65	8.2-8.6	AECOM	24/02/2010	Fill	VMP & PDA - Block 5	12.071	115				0.8	3		5	9.2	7.9		9.5	4.7	3.9	7.4	1.4	17.1	5	3.9	2.3		15.6	18.3
BH65	11.2-11.4	AECOM	24/02/2010	Natural Clayey Sand	VMP & PDA - Block 5	3.415	216.8	<0.5	57.6	<0.5	3.1	24.9	<0.5	11.7	4.7	2.9	3		<0.5		4.5	<0.5	10.8	20.8	<0.5	65		51.5	16.9
BH65	13.4-13.6	AECOM	24/02/2010	Natural Sandy Clay	VMP & PDA - Block 5	2.755	114.4				2.4	7.3		6.6	3.8	2.1		1.8	0.5	0.6	3	<0.5	6.4	10.8	<0.5	34.6		25.1	9.4
BH66	2.3-2.4	AECOM	24/02/2010	Fill	VMP & PDA - Block 5	16.292	105				0.8	1.5		3.5	8.8	10.9		11.9	7.3	4.2	6.9	2.2	12.4	1.5	5.6	5.3		9.2	13
BH66	3.2-3.6	AECOM	24/02/2010	Fill	VMP & PDA - Block 5	<1.21	<8				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH66	7-7.2	AECOM	24/02/2010	Natural Sandstone	VMP & PDA - Block 5	<1.21	1.4				<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5		<0.5	0.7
BH68	2.5-2.9	AECOM	2/03/2010	Fill	VMP & PDA - Block 5																								
BH68	4-4.3	AECOM	2/03/2010	Fill	VMP & PDA - Block 5	<1.21	<8		<0.5		<0.5	<0.5		<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH68	7-7.1	AECOM	2/03/2010	Natural Silty Sand	VMP & PDA - Block 5																								
MW3	2.9-3	Coffey	23/02/2008	Natural Clayey Sand	VMP & PDA - Hickson Road	14.51	312	<0.5	22.6	<0.5	3.2	20		25.3	15.8	10.9	26		4.4		10.6	1.3	35.8	20.9	5.8	55		65.8	37.2
MW6	2.5-2.6	Coffey	20/02/2008	Fill	VMP & PDA - Hickson Road	2.181	24.4	<0.5	<0.5	<0.5	<0.5	1.9		1.2	3.8	1.7	3		0.6		1.5	<0.5	5	<0.5	0.8	<0.5		2.7	5.2
MW6	4.4-4.5	Coffey	20/02/2008	Fill	VMP & PDA - Hickson Road	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<1		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
MW7	3.5-3.6	Coffey	25/02/2008	FILL	VMP & PDA - Hickson Road	71.045	696	<0.5	92.7	<0.5	33.7	48.7		28.7	86.7	59.7	70		2.9		8.6	1.7	62.3	39.6	8.6	150		116	48.8
MW7	**4.5-4.6**	Coffey	**25/02/2008**	**FILL**	**VMP & PDA - Hickson Road**	486.608	**21670**	<1.2	3680	<1.2	210	3060		800	863	**359**	608		59.8		341	22.9	1470	1160	144	7800		3350	2030
MW7	**5-5.1**	Coffey	**25/02/2008**	**FILL**	**VMP & PDA - Hickson Road**	884.497	**30782**	<1.2	5130	<1.2	282	4140		1200	1240	**677**	1170		87.7		582	57.2	2160	1980	196	10,200		4870	3110
MW10	**4.9-5**	Coffey	**21/02/2008**	**Fill**	**VMP & PDA - Hickson Road**	386.828	**7282.2**	<1.2	102	<1.2	212	652		523	934	**278**	698		21.8		61	9.4	966	662	52	224		1740	947
MW10	**8.6-8.7**	Coffey	**22/02/2008**	**Fill**	**VMP & PDA - Hickson Road**	590.52	**29653**	<1.2	7650	<1.2	511	1700		2150	1470	**412**	968		26		771	20.3	2440	2100	32.5	10,200		5180	2640

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC[VMP] - Site Specific Target Criteria for the VMP Area
Shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)

TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

Table T4
Site wide
Soil Analytical Results (Declaration Area) - Saturated

						TPH						BTEX						
						TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonia as N	Total Xylene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL							50	100	100	10	100	0.2	0.2	0.2	0.2	0.2	20	0.15
SSTC[VMP]							54000	72000	21,000			380						
Tar Containing Material (TCM) Criteria																		
Location	**Sample Depth**	**Consultant**	**Sample Date**	**Matrix**	**Area**													
BH001	4	ERM	2/05/2006	Fill	VMP & PDA - Block 5	160	<50	160	<100	<2	160	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH019	2.5-3	ERM	8/05/2006	Fill	VMP & PDA - Block 4	4900	2180	3840	1060	354	7080							
BH019	**3-3.45**	ERM	**8/05/2006**	**Fill**	**VMP & PDA - Block 4**	7320	3160	5450	1870	210	10,480							
BH020	1.5-2.1	ERM	9/05/2006	Fill	VMP & PDA - Block 4	620	<50	280	340	<2	620							
BH028	13-13.5	ERM	12/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	1620	780	1370	250	119	2400	8.2	2.7	14.8	15.4	6.9		22.3
BH058	6-6.5	ERM	31/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	510	220	510	<100	40	730	3.1	5.9	0.4	8.5	4.3		12.8
BH059	3-3.45	ERM	31/05/2006	Fill	VMP & PDA - Block 5	290	<50	170	120	<2	290	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH059	8.5-9	ERM	31/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH060	9.5-10	ERM	31/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH062	3-3.45	ERM	31/05/2006	Fill	VMP & PDA - Block 5	830	<50	420	410	<2	830	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH065	3-3.45	ERM	1/06/2006	Fill	VMP & PDA - Block 4	1760	90	1040	720	3	1850	<0.2	<0.2	<0.2	0.5	0.3		0.8
BH067	3-3.45	ERM	1/06/2006	Fill	VMP & PDA - Block 5	4510	<50	1490	3020	2	4510	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH071	3-3.45	ERM	2/05/2006	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH072	3-3.45	ERM	2/05/2006	Fill	VMP & PDA - Block 4	120	<50	120	<100	<2	120	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH072	9.5-10	ERM	2/05/2006	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH073	2-2.4	ERM	2/05/2006	Fill	VMP & PDA - Block 4	1600	260	1340	260	8	1860	<0.2	2.1	<0.2	3.4	2.1		5.5
BH074	3-3.45	ERM	2/05/2006	Fill	VMP & PDA - Block 5	260	<50	260	<100	3	260	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH074	9.5-10	ERM	2/05/2006	Natural Sandy Clay	VMP & PDA - Block 5	3350	1510	2480	870	122	4860	14.9	1.6	21.1	20.7	7.6		28.3
BH075	3-3.45	ERM	6/06/2006	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH087	**3-3.45**	ERM	**8/06/2006**	**Fill**	**VMP & PDA - Block 4**	8980	4560	7310	1670	271	13,540	15	47.5	24.9	79.9	38.6		118.5
BH087	**7-7.5**	ERM	**8/06/2006**	**Fill**	**VMP & PDA - Block 4**	8270	4360	6720	1550	442	12,630	82.7	24.3	149	116	57.1		173.1
BH089	3-3.45	ERM	9/06/2006	Fill	VMP & PDA - Block 4	170	<50	170	<100	<2	170	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH090	3-3.45	ERM	9/06/2006	Fill	VMP & PDA - Block 4	140	<50	140	<100	<2	140	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH109	3-3.45	ERM	27/06/2006	Fill	VMP & PDA - Block 4	130	<50	<100	130	<2	130	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH109	9.5-10	ERM	27/06/2006	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH113	3-3.45	ERM	27/06/2006	Fill	VMP & PDA - Block 4	1010	70	540	470	<2	1080	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH114	3-3.45	ERM	28/06/2006	Fill	VMP & PDA - Block 4	980	60	620	360	<2	1040	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH115	3-3.45	ERM	28/06/2006	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH119	1.6-2.05	ERM	30/06/2006	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH119	**7.5-8**	ERM	**30/06/2006**	**Fill**	**VMP & PDA - Block 4**	17,690	6750	13,000	4690	1140	24,440	82.4	63	118	182	69.8		251.8
BH119	**9.5-10**	ERM	**30/06/2006**	**Fill**	**VMP & PDA - Block 4**	10,050	5320	7940	2110	1060	15,370	97.8	14.7	124	152	53		205
BH132	8-8.5	ERM	6/07/2006	Natural Clayey Sand	VMP & PDA - Block 4	4230	1870	3040	1190	1050	6100	140	44.7	232	225	120		345
BH135	3-3.45	ERM	11/07/2006	Fill	VMP & PDA - Block 4													
BH141	**3-3.45**	ERM	**7/07/2006**	**Fill**	**VMP & PDA - Block 4**	5920	1800	4490	1430	325	7720	41.8	49.1	17.3	86.5	60.3		146.8
BH145	3-3.45	ERM	11/07/2006	Fill	VMP & PDA - Block 5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH146	3-3.33	ERM	11/07/2006	Fill	VMP & PDA - Block 4													
BH146	4.1-4.6	ERM	11/07/2006	Fill	VMP & PDA - Block 4	4610	3020	3750	860	222	7630	15.2	13.9	25.3	56	31		87
BH159		ERM	14/08/2006	Fill	VMP & PDA - Block 4	1230	<50	270	960	<2	1230	<0.2	<0.2	<0.2	0.3	<0.2		0.3
BH197	11.5	ERM	9/04/2008	Natural Clayey Sand	VMP & PDA - Block 5	400	160	400	<100	<10	560	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH197	15.9	ERM	10/04/2008	Natural Sandstone	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH197	18.6	ERM	10/04/2008	Natural Sandstone	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH197	5	ERM	9/04/2008	Fill	VMP & PDA - Block 5	5300	560	3820	1480	26	5860	4.8	1.9	8	4.2	1.9		6.1
BH197	6.5	ERM	9/04/2008	Natural Sandy Clay	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<250	0.5	<0.5	0.8	0.6	<0.5		0.6
BH198	3	ERM	6/03/2008	Fill	VMP & PDA - Block 5	8130	1360	6690	1440	<10	9490	<0.2	<0.5	<0.5	0.7	<0.5		0.7
BH198	4.5	ERM	6/03/2008	Natural Sandy Clay	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH198	6.9	ERM	6/03/2008	Natural Clayey Sand	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH199	2.7	ERM	11/03/2008	Fill	VMP & PDA - Block 5	1120	<50	740	380	<10	1120	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH199	3.7	ERM	11/03/2008	Natural Silty Clay	VMP & PDA - Block 5	3540	950	2620	920	96	4490	6.4	16.3	2.6	22.4	22.9		45.3
BH199	5.6	ERM	11/03/2008	Natural Clayey Sand	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH199	6	ERM	17/03/2008	Natural Sandstone	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH200	2.5	ERM	7/04/2008	Fill	VMP & PDA - Block 4	1560	110	1060	500	<10	1670	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH200	6.53	ERM	7/04/2008	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH201	2.4	ERM	4/03/2008	Fill	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH201	10.3	ERM	18/03/2008	Fill	VMP & PDA - Block 5	3280	<50	1930	1350	<10	3280	<0.2	0.7	<0.5	<0.5	<0.5		<1
BH201	11	ERM	18/03/2008	Natural Clayey Sand	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH202	2.3	ERM	10/03/2008	Fill	VMP & PDA - Block 4	510	<50	240	270	<10	510	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH202	4.7	ERM	10/03/2008	Fill	VMP & PDA - Block 4	620	<50	280	340	<10	620	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH202	6.8	ERM	10/03/2008	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH203	7.3	ERM	10/03/2008	Fill	VMP & PDA - Block 4	1010	<50	560	450	<10	1010	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH204D	**3**	ERM	**7/04/2008**	**Fill**	**VMP & PDA - Block 4**	25,740	11,600	19,400	6340	289	37,340	36.8	34.9	49.3	112	39.9		151.9
BH204D	**4**	ERM	**7/04/2008**	**Fill**	**VMP & PDA - Block 4**	29,420	12,600	22,400	7020	215	42,020	44.3	15.1	53	72.8	26.7		99.5
BH205	7.8	ERM	27/03/2008	Natural Sandy Clay	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	1.4	<0.5	0.7	<0.5	<0.5		<1
BH205	9.3	ERM	27/03/2008	Natural Clayey Sand	VMP & PDA - Block 4	3350	1500	2710	640	138	4850	7.5	5.4	34.7	42.4	21.9		64.3
BH205	13	ERM	1/04/2008	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	13	<250	2.5	<0.5	3.3	2.8	1.2		4
BH205	13.8	ERM	1/04/2008	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	0.7	<0.5	0.5	<0.5	<0.5		<1
BH205	19.2	ERM	2/04/2008	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	0.5	<0.5		0.5

Table T4
Site wide
Soil Analytical Results (Declaration Area) - Saturated

						TPH						BTEX						
						TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonia as N	Total Xylene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL							50	100	100	10	100	0.2	0.2	0.2	0.2	0.2	20	0.15
SSTC[VMP]							54000	72000	21,000			380						
Tar Containing Material (TCM) Criteria																		
Location	**Sample Depth**	**Consultant**	**Sample Date**	**Matrix**	**Area**													
BH205	22.2	ERM	2/04/2008	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH206	4.6	ERM	17/04/2008	Fill	VMP & PDA - Block 4	460	<50	230	230	<10	460	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH206	7.1	ERM	17/04/2008	Natural Clayey Sand	VMP & PDA - Block 4	350	200	350	<100	15	550	<0.2	1	<0.5	2.7	2.2		4.9
BH207	7.45	ERM	3/04/2008	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH206	10.7	ERM	21/04/2008	Natural Sandstone	VMP & PDA - Block 4	110	<50	110	<100	<10	110	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH207	12	ERM	3/04/2008	Fill	VMP & PDA - Block 4	770	<50	430	340	<10	770	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH207	13.1	ERM	3/04/2008	Fill	VMP & PDA - Block 4	140	<50	140	<100	<10	140	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH207	15	ERM	3/04/2008	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH208	2.25	ERM	4/04/2008	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH208	9.5	ERM	4/04/2008	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH208	13.5	ERM	4/04/2008	Natural Sandy Clay	VMP & PDA - Block 4	5840	80	3320	2520	<10	5920	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH209	2.3	ERM	22/04/2008	Fill	VMP & PDA - Block 4	1460	<50	880	580	<10	1460	<0.2	<0.5	0.5	<0.5	<0.5		<1
BH209	4.5	ERM	22/04/2008	Natural Clay	VMP & PDA - Block 4	2410	1190	1950	460	227	3600	15.5	37.2	4.3	36	50		86
BH209	6.1	ERM	22/04/2008	Natural Sandstone	VMP & PDA - Block 4	2780	2280	2350	430	929	5060	88.2	34.8	213	165	94.8		259.8
BH209	9.4	ERM	23/04/2008	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH210	15.9	ERM	27/03/2008	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH211	14	ERM	26/03/2008	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH211	15.5	ERM	26/03/2008	Natural Clayey Sand	VMP & PDA - Block 4	<200	<50	<100	<100	19	<250	3.4	0.6	5.5	3.3	1.8		5.1
BH211	16.05-16.15	ERM	26/03/2008	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH34	1.8-2.2	AECOM	25/02/2010	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH34	6-6.2	AECOM	25/02/2010	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH34	11-11.2	AECOM	25/02/2010	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH35	4.9-5	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH35	9.9-10	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH4	2.3-2.4	Coffey	21/02/2008	Fill	VMP & PDA - Hickson Road	8660	200	5700	2960	<10	8860	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH4	4.2-4.3	Coffey	21/02/2008	Fill	VMP & PDA - Hickson Road	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH405	4-4.3	AECOM	10/02/2011	Fill	VMP & PDA - Block 4	1020	<50	400	620	<10	1020	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH405	7-7.3	AECOM	10/02/2011	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH405	13-13.2	AECOM	11/02/2011	Natural Sand	VMP & PDA - Block 4	2320	510	1760	560	<10	2830	0.7	0.6	0.6	3	1.3		4.3
BH405	**14-14.4**	AECOM	**11/02/2011**	**Natural Sandy Clay**	**VMP & PDA - Block 4**	9030	3390	7020	2010	156	12,400 - 12,420	5.9	4	33	57.2	19.4		76.6
BH408	2-2.4	AECOM	14/02/2011	Fill	VMP & PDA - Block 4	450	<50	190	260	<10	450	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH408	8-8.3	AECOM	15/02/2011	Natural Sandy Clay	VMP & PDA - Block 4	350	100	350	<100	<10	450	0.6	0.7	<0.5	0.7	0.6		1.3
BH408	9-9.4	AECOM	15/02/2011	Natural Clayey Sand	VMP & PDA - Block 4	860	360	710	150	24	1220	2.1	4.6	<0.5	5.1	3.8		8.9
BH409	3.7-4	AECOM	14/02/2011	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH409	5-5.3	AECOM	14/02/2011	Natural Sand	VMP & PDA - Block 4	180	150	180	<100	12	330	1.8	3.5	<0.5	1.1	1.8		2.9
BH409	6-6.4	AECOM	15/02/2011	Natural Sandy Clay	VMP & PDA - Block 4		<50			<10	<50	0.3	<0.5	<0.5	<0.5	<0.5	<20	<1
BH409	7-7.3	AECOM	15/02/2011	Natural Clayey Sand	VMP & PDA - Block 4	<200	<50	<100	<100	106	<50	2.8	3.5	22.3	17.8	8.9		26.7
BH42	**3.2-3.3**	AECOM	**23/02/2010**	**Fill**	**VMP & PDA - Block 4**	17,350	4680	13,200	4150	234	22,000 - 22,030	1	40.8	1.5	39.9	83.6		123.5
BH42	3.5-3.6	AECOM	23/02/2010	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH44	4.9-5	AECOM	23/02/2010	Natural Sandstone	VMP & PDA - Block 4	3300	1040	2650	650	147	4340	2.1	18.1	5.4	25.7	20.9		46.6
BH45	3.2-3.4	AECOM	23/02/2010	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH45	7.2-7.4	AECOM	23/02/2010	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	12	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH49	4.2-4.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	2690	250	1610	1080	13	2940	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH49	6.2-6.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	600	160	450	150	<10	760	1.6	<0.5	1.8	2	0.8		2.8
BH49	8.2-8.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	3440	1160	2650	790	348	4600	49.7	5.2	74.6	61.5	22.6		84.1
BH49	10.2-10.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	1660	670	1240	420	56	2330	5.5	1.4	10.8	9.9	4.7		14.6
BH49	12.2-12.4	AECOM	22/02/2010	Natural Clayey Sand	VMP & PDA - Block 4							10.2	2	16.6	21.2	7.7		28.9
BH45	13.2-13.4	AECOM	23/02/2010	Natural Sandstone	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<50							
BH52	2.2-2.6	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH52	4.2-4.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	8970	<50	6600	2370	10	8970	1.7	1	1.1	1.4	0.7		2.1
BH53	2-2.4	AECOM	6/03/2010	Fill	VMP & PDA - Hickson Road	6970	260	4540	2430	<10	7230	2.7	<0.5	1.4	0.8	<0.5		0.8
BH53	**4-4.4**	AECOM	**6/03/2010**	**Fill**	**VMP & PDA - Hickson Road**	57,800	28,400	46,800	11,000	3000	86,200	678	50.7	670	470	197		667
BH54	2.8-3	AECOM	23/02/2010	Natural Sand	VMP & PDA - Block 4	3980	900	2980	1000	13	4880	<0.2	0.8	<0.5	3.2	1.6		4.8
BH55	**2.2-2.4**	AECOM	**25/02/2010**	**Fill**	**VMP & PDA - Block 4**	14,340	6420	10,600	3740	304	20,760 - 20,800	22.2	29.6	2.3	48.8	51.6		100.4
BH55	**2.7-2.9**	AECOM	**25/02/2010**	**Fill**	**VMP & PDA - Block 4**	19,550	9150	14,800	4750	104	28,700	9.4	8.9	2	19.8	21.1		40.9
BH58	3.2-3.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	830	80	450	380	<10	910	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH58	5.2-5.4	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	620	<50	320	300	<10	620	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH58	8.6-8.8	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	1150	<50	640	510	<10	1150	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH58	10.8-11.2	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	850	<50	420	430	<10	850	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH59	**3.4-3.5**	AECOM	**22/02/2010**	**Fill**	**VMP & PDA - Block 4**	25,340	9120	19,200	6140	459	34,460 - 34,500	82.4	88.3	32.5	103	51.2		154.2
BH59	4.2-4.3	AECOM	22/02/2010	Fill	VMP & PDA - Block 4	510	140	380	130	14	650	3.4	<0.5	2.9	2.4	0.9		3.3
BH61	**2-2.4**	AECOM	**7/03/2010**	**Fill**	**VMP & PDA - Hickson Road**	12,790	450	8130	4660	67	13,200 - 13,240	32.7	<0.5	9.5	5.4	1.4		6.8
BH61	3-3.4	AECOM	7/03/2010	Natural Clayey Sand	VMP & PDA - Hickson Road	1680	320	1220	460	75	2000	11.2	5.9	14.7	16.2	5.8		22
BH62	3.4-3.8	AECOM	26/02/2010	Fill	VMP & PDA - Block 5	380	<50	140	240	<10	380	<0.2	<0.5	<0.5	<0.5	<0.5	<20	<1
BH62	5.4-5.6	AECOM	26/02/2010	Fill	VMP & PDA - Block 5	720	<50	390	330	<10	720	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH62	11.8-12	AECOM	26/02/2010	Fill	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1

Table T4
Site wide
Soil Analytical Results (Declaration Area) - Saturated

						TPH						BTEX						
						TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonia as N	Total Xylene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL							50	100	100	10	100	0.2	0.2	0.2	0.2	0.2	20	0.15
SSTC[VMP]							54000	72000	21,000			380						
Tar Containing Material (TCM) Criteria																		
Location	**Sample Depth**	**Consultant**	**Sample Date**	**Matrix**	**Area**													
BH64	2.5-2.7	AECOM	1/03/2010	Fill	VMP & PDA - Block 5	1230	<50	640	590	<10	1230	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH64	5.5-5.7	AECOM	1/03/2010	Fill	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH64	10-10.3	AECOM	1/03/2010	Natural Sandstone	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH65	3.4-3.6	AECOM	24/02/2010	Fill	VMP & PDA - Block 5	13,260	710	7500	5760	<10	13,970 - 14,000	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH65	8.2-8.6	AECOM	24/02/2010	Fill	VMP & PDA - Block 5	1030	<50	560	470	<10	1030							
BH65	11.2-11.4	AECOM	24/02/2010	Natural Clayey Sand	VMP & PDA - Block 5	1330	450	1110	220	14	1780	<0.2	0.8	<0.5	3.5	2.3		5.8
BH65	13.4-13.6	AECOM	24/02/2010	Natural Sandy Clay	VMP & PDA - Block 5	380	100	380	<100	<10	480	<0.2	<0.5	<0.5	1.1	0.7		1.8
BH66	2.3-2.4	AECOM	24/02/2010	Fill	VMP & PDA - Block 5	810	<50	420	390	<10	810	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH66	3.2-3.6	AECOM	24/02/2010	Fill	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH66	7-7.2	AECOM	24/02/2010	Natural Sandstone	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<50							
BH68	2.5-2.9	AECOM	2/03/2010	Fill	VMP & PDA - Block 5	770	<50	320	450	<10	770							
BH68	4-4.3	AECOM	2/03/2010	Fill	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH68	7-7.1	AECOM	2/03/2010	Natural Silty Sand	VMP & PDA - Block 5	<200	<50	<100	<100	<10	<50							
MW3	2.9-3	Coffey	23/02/2008	Natural Clayey Sand	VMP & PDA - Hickson Road	8840	1100	6760	2080	<10	9940	0.4	0.9	<0.5	1.1	0.7		1.8
MW6	2.5-2.6	Coffey	20/02/2008	Fill	VMP & PDA - Hickson Road	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
MW6	4.4-4.5	Coffey	20/02/2008	Fill	VMP & PDA - Hickson Road	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
MW7	3.5-3.6	Coffey	25/02/2008	FILL	VMP & PDA - Hickson Road	7770	2140	5680	2090	227	9910	87.7	10.3	57.5	49.8	19		68.8
MW7	**4.5-4.6**	Coffey	**25/02/2008**	**FILL**	**VMP & PDA - Hickson Road**	74,600	31,500	61,000	13,600	7710	106,100	2080	147	1930	1210	502		1712
MW7	**5-5.1**	Coffey	**25/02/2008**	**FILL**	**VMP & PDA - Hickson Road**	80,400	45,900	65,200	15,200	7890	126,300	1980	154	1990	1300	563		1863
MW10	**4.9-5**	Coffey	**21/02/2008**	**Fill**	**VMP & PDA - Hickson Road**	55,600	4600	41,400	14,200	64	60,200	12.4	4.1	2.2	4.1	1.5		5.6
MW10	**8.6-8.7**	Coffey	**22/02/2008**	**Fill**	**VMP & PDA - Hickson Road**	112,400	69,400	93,200	19,200	7590	181,800	1510	261	2650	1830	746		2576

Notes

mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC[VMP] - Site Specific Target Criteria for the VMP Area
Shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)

TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

						PAHs																
						CPAH (TEF)	PAH (Total)	2-methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								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
SSTC[VMP]						67																
Tar Containing Material (TCM) Criteria							**2000**						**150**									
Location	**Sample Depth**	**Consultant**	**Sample Date**	**Matrix**	**Area**																	
BH001	1	ERM	1/05/06	Fill	VMP & PDA - Block 5	67.03	699.1		1.1	14.4	19.2	65.9	33.4	98.6	25.5	29.6	70.5	10.4	104	3.6	28.6	11.5
BH019	1.5-1.95	ERM	8/05/06	Fill	VMP & PDA - Block 4	<1.21	38.2		<0.5	<0.5	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	1.4	<0.5	29.3
BH020	0.3-0.5	ERM	9/05/06	Fill	VMP & PDA - Block 4	9.621	80.3		0.6	1.6	2.5	6.2	6.8	7.7	3.7	2.3	5.4	0.8	14.6	1.2	3.1	0.8
BH020	1.5-2.1	ERM	9/05/06	Fill	VMP & PDA - Block 4	6.351	50		<0.5	1.3	1.6	3.9	4.4	5	2.5	1.9	3.6	0.6	8.5	0.7	2.1	0.5
BH021	0.3-0.5	ERM	9/05/06	Fill	VMP & PDA - Block 4	3.06	27.3		<0.5	0.9	0.9	2.2	2.3	2.8	1.2	1.1	1.8	<0.5	4.5	<0.5	1.2	0.8
BH028	0.3-0.5	ERM	12/05/06	Fill	VMP & PDA - Block 5																	
BH058	1.5-1.95	ERM	31/05/06	Fill	VMP & PDA - Block 5	39.542	368.6		1.2	8.4	11.1	29	25.3	37.9	19.3	11.8	26.9	4.3	65.3	5.1	16.1	5.7
BH059	1.5-1.95	ERM	31/05/06	Fill	VMP & PDA - Block 5	5.742	52.6		<0.5	2.1	2.1	4.3	3.9	4.6	2.5	1.9	3.7	0.5	8.5	0.6	2	1
BH060	1.7-2	ERM	31/05/06	Fill	VMP & PDA - Block 5	6.082	44		<0.5	1.2	1.3	3.6	3.6	6.3	3.5	2.3	3.7	0.9	5.4	<0.5	2.9	0.6
BH062	1.5-1.95	ERM	31/05/06	Fill	VMP & PDA - Block 5	30.902	228.3		<0.5	6.6	5.1	17.1	19.9	29.7	14.4	10.1	16.8	3.6	38.2	1.1	14	4
BH065	0.3-0.5	ERM	1/06/06	Fill	VMP & PDA - Block 4	4.098	35.4		<0.5	1.1	1.2	3	3.1	3.6	2.1	1.3	2.7	<0.5	5.9	<0.5	1.6	<0.5
BH065	1.5-1.95	ERM	1/06/06	Fill	VMP & PDA - Block 4	1.134	11.7		<0.5	<0.5	0.6	1.1	0.9	1.1	0.6	<0.5	0.8	<0.5	2.4	<0.5	<0.5	<0.5
BH067	1.5-1.95	ERM	1/06/06	Fill	VMP & PDA - Block 5	1.711	18.6		<0.5	<0.5	0.8	1.2	1.3	1.4	0.9	0.6	1.2	<0.5	3.1	0.7	0.7	0.8
BH070	0.3-0.5	ERM	2/05/06	Fill	VMP & PDA - Block 4	1.828	17.7		<0.5	0.5	0.6	1.3	1.4	1.6	0.7	0.6	1.1	<0.5	3	<0.5	0.6	0.9
BH070	1.5-1.95	ERM	2/05/06	Fill	VMP & PDA - Block 4	3.349	30		<0.5	0.7	1.2	2.5	2.5	3.1	1.5	1.2	2.4	<0.5	4.9	<0.5	1.3	<0.5
BH071	1.5-1.95	ERM	2/05/06	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH072	0.3-0.5	ERM	2/05/06	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH073	1.5-1.95	ERM	2/05/06	Fill	VMP & PDA - Block 4	140.147	1451.6		20.6	87.8	77.3	107	100	99.3	44	33.5	88.7	10.7	252	56.5	41.4	14.8
BH074	1.5-1.95	ERM	2/05/06	Fill	VMP & PDA - Block 5	1.239	11.3		<0.5	0.6	0.5	1.2	1	1.1	<0.5	<0.5	0.9	<0.5	2.4	<0.5	<0.5	<0.5
BH075	0.3-0.5	ERM	6/06/06	Fill	VMP & PDA - Block 4	27.657	242.1		0.5	8.4	7.9	19.4	19	21.2	11.3	9.4	16.4	2.4	42.7	2.2	9.8	2.8
BH087	**1.5-1.95**	**ERM**	**8/06/06**	**Fill**	**VMP & PDA - Block 4**	114.535	**2982.2**		21.6	177	136	114	78.5	83.6	34	35.2	69.5	8.6	325	182	31.2	925
BH089	0.3-0.5	ERM	9/06/06	Fill	VMP & PDA - Block 4	<1.21	2.2		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5
BH089	1.5-1.95	ERM	9/06/06	Fill	VMP & PDA - Block 4	4.367	57.4		<0.5	2.5	2.3	3.7	3.3	3.4	1.6	1.7	3.1	<0.5	7.7	2	1.4	9
BH090	1.5-1.95	ERM	9/06/06	Fill	VMP & PDA - Block 4	0.845	5.6		<0.5	<0.5	<0.5	0.6	0.7	0.8	<0.5	<0.5	0.5	<0.5	1.1	<0.5	<0.5	<0.5
BH109	0.3-0.5	ERM	27/06/06	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH113	1.5-1.95	ERM	27/06/06	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH114	0.3-0.5	ERM	28/06/06	Fill	VMP & PDA - Block 4	2.225	15		<0.5	<0.5	<0.5	1.2	1.7	2	1.3	0.9	1.2	<0.5	2.3	<0.5	0.9	<0.5
BH115	0.8-1	ERM	28/06/06	Fill	VMP & PDA - Block 4																	
BH115	1.5-1.95	ERM	28/06/06	Fill	VMP & PDA - Block 4	0.877	7.4		<0.5	<0.5	<0.5	0.8	0.7	0.9	<0.5	<0.5	0.7	<0.5	1.7	<0.5	<0.5	<0.5
BH119	1.6-2.05	ERM	30/06/06	Fill	VMP & PDA - Block 4	0.962	6		<0.5	<0.5	<0.5	0.6	0.8	0.9	0.6	<0.5	0.6	<0.5	1	<0.5	<0.5	<0.5
BH132	1.5-1.95	ERM	6/07/06	Fill	VMP & PDA - Block 4	25.386	189.2		0.9	3.5	5.4	19.5	17.1	21.9	8.8	9	14.8	2.3	29.5	2	7.1	3.8
BH133	1.5-1.95	ERM	6/07/06	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH133	0.3-0.5	ERM	6/07/06	Fill	VMP & PDA - Block 4	2.803	26		<0.5	1	0.9	2.2	2.1	2.6	1.4	0.9	1.9	<0.5	4	<0.5	1	1.3
BH135A	0.4-0.6	ERM	11/07/06	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH141	1.5-1.95	ERM	7/07/06	Fill	VMP & PDA - Block 4	34.823	350.5		1.8	11.8	14.6	28.2	24.6	25.2	12.2	10.6	24.1	2.5	72.2	4.5	9.6	2.3
BH145	0.3-0.5	ERM	11/07/06	Fill	VMP & PDA - Block 5	109.996	849.7		1.5	22	24.1	81.4	72.4	91.3	45.6	36.4	72	11.9	130	5.6	36.1	8.8

						PAHs																
						CPAH (TEF)	PAH (Total)	2-methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								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
SSTC[VMP]						67																
Tar Containing Material (TCM) Criteria							**2000**						**150**									
Location	**Sample Depth**	**Consultant**	**Sample Date**	**Matrix**	**Area**																	
BH146	1.5-1.95	ERM	11/07/06	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH156	0.4-0.5	ERM	14/08/06	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH156	0.9-1	ERM	14/08/06	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH159		ERM	14/08/06	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH160	0.3-0.4	ERM	14/08/06	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH161	0.3-0.4	ERM	14/08/06	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH197	0.4	ERM	3/03/08	Fill	VMP & PDA - Block 5	0.125	12.1		<0.5	<0.5	0.5	0.6	<0.5	0.6	0.5	<0.5	<0.5	<0.5	3.5	0.6	<0.5	<0.5
BH200	1	ERM	7/04/08	Fill	VMP & PDA - Block 4	166.044	1781.5		5.2	54.8	75.7	158	113	158	30.4	48.2	128	11.6	320	14.8	34.4	64.4
BH203	1.9	ERM	10/03/08	Fill	VMP & PDA - Block 4	7.675	57.4		<0.5	1.4	2.2	5	5.1	5.3	3.4	2.3	4.1	0.9	9.3	<0.5	3.4	<0.5
BH204S	**1**	**ERM**	**18/03/08**	**Fill**	**VMP & PDA - Block 4**	119.443	**3702.1**		45.2	194	187	128	78.6	68.8	39.8	59	83.5	9.9	373	295	41.3	1180
BH204D	**1.5**	**ERM**	**7/04/08**	**Fill**	**VMP & PDA - Block 4**	921.56	**20,934**		222	605	1200	823	**652**	587	305	231	631	71.4	1550	1190	247	8410
BH206	0.5	ERM	7/03/08	Fill	VMP & PDA - Block 4	11.321	98.2		<0.5	4.2	3.9	8.4	7.8	7.7	3.6	3.6	7.5	1.1	15.6	0.9	3.4	1.9
BH206	1.8	ERM	17/04/08	Fill	VMP & PDA - Block 4	<1.21	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
BH210	1.5	ERM	18/03/08	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH34	1.8-2.2	AECOM	25/02/10	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH42	1-1.1	AECOM	23/02/10	Fill	VMP & PDA - Block 4	2.115	17.2		<0.5	<0.5	<0.5	2	1.5	2.3	0.8	1	1.7	<0.5	2.9	<0.5	0.6	<0.5
BH44	1.9-2	AECOM	23/02/10	Fill	VMP & PDA - Block 4	<1.21	<8		<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
BH49	1.5-1.7	AECOM	22/02/10	Fill	VMP & PDA - Block 4	36.552	428.1		1.1	11	18.1	35.8	22.7	37	13.2	11.8	32	3.8	76.7	4.5	11.4	9.7
BH50	1.3-1.5	AECOM	26/02/10	Natural Sandstone	VMP & PDA - Block 4	0.06	1.1	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH52	1-1.2	AECOM	22/02/10	Fill	VMP & PDA - Block 4																	
BH54	**1-1.4**	**AECOM**	**23/02/10**	**Fill**	**VMP & PDA - Block 4**	842.57	**20,627**		273	1000	1070	912	**533**	824	248	324	549	72.5	2130	1290	231	6370
BH55	**1-1.2**	**AECOM**	**25/02/10**	**Fill**	**VMP & PDA - Block 4**	372.05	**12,143**	<4	80.7	473	482	425	**252**	300	123	107	282	23.3	1280	460	95	4510
BH58	1-1.2	AECOM	22/02/10	Fill	VMP & PDA - Block 4	19.668	205.8		0.6	8.2	8.5	16.2	12.7	19	9.8	6.9	14	1.8	36.1	1.5	7.2	2.3
BH59	1.9-2	AECOM	22/02/10	Fill	VMP & PDA - Block 4	40.933	1264.5		10.3	58.8	60.3	45.9	26.5	35.8	13.1	14.3	32.2	3.2	121	68.3	11.8	453
BH62	1-1.2	AECOM	26/02/10	Fill	VMP & PDA - Block 5	0.1	4.4	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	0.7
BH64	1-1.2	AECOM	1/03/10	Fill	VMP & PDA - Block 5	107.979	1463.6	1	7.5	51.9	70.8	95.5	69.8	104	37.2	29.4	79.7	10.8	246	31.1	33.2	76.7
SV09	0.2-0.4	AECOM	26/02/10	Fill	VMP & PDA - Block 5	42.044	495.4	<0.5	1.4	9.9	18.5	45.3	25.4	43.7	14.5	18	33.9	4.2	97.5	3.4	12.6	5.8

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC[VMP] - Site Specific Target Criteria for the VMP Area
shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)

TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

					TPH								BTEX						
					Phenanthrene	Pyrene	TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonia as N	Total Xylene
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					0.5	0.5		50	100	100	10	50	0.2	0.2	0.2	0.2	0.2	20	
SSTC[VMP]								54000	72000	21,000			380						
Tar Containing Material (TCM) Criteria																			
Location	**Sample Depth**	**Consultant**	**Sample Date**	**Matrix**															
BH001	1	ERM	1/05/06	Fill	84.4	98.4	4470	2360	3280	1190	3	6830	0.5	<0.2	0.4	0.2	<0.2		0.2
BH019	1.5-1.95	ERM	8/05/06	Fill	4.1	1.1	<200	100	<100	<100	50	100							
BH020	0.3-0.5	ERM	9/05/06	Fill	7.8	15.2	810	<50	460	350	<2	810							
BH020	1.5-2.1	ERM	9/05/06	Fill	4.7	8.7	620	<50	280	340	<2	620							
BH021	0.3-0.5	ERM	9/05/06	Fill	2.8	4.8	230	<50	130	100	<2	230							
BH028	0.3-0.5	ERM	12/05/06	Fill			340	<50	200	140	<2	340	<0.2	<0.2	<0.2	<0.2	<0.2		<0.01
BH058	1.5-1.95	ERM	31/05/06	Fill	39.5	61.7	3030	120	1960	1070	8	3150	0.3	0.3	0.2	<0.2	<0.2		<0.4
BH059	1.5-1.95	ERM	31/05/06	Fill	6.4	8.5	550	<50	290	260	<2	550	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH060	1.7-2	ERM	31/05/06	Fill	3.2	5.5	140	<50	<100	140	<2	140	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH062	1.5-1.95	ERM	31/05/06	Fill	17.1	30.6	1120	100	610	510	8	1220	<0.2	<0.2	0.4	0.3	<0.2		0.3
BH065	0.3-0.5	ERM	1/06/06	Fill	3.6	6.2	530	<50	180	350	<2	530	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH065	1.5-1.95	ERM	1/06/06	Fill	1.9	2.3	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH067	1.5-1.95	ERM	1/06/06	Fill	2.9	3	1100	<50	480	620	<2	1100	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH070	0.3-0.5	ERM	2/05/06	Fill	2.3	3.1	810	<50	600	210	<2	810	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH070	1.5-1.95	ERM	2/05/06	Fill	3.7	5	570	<50	230	340	<2	570	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH071	1.5-1.95	ERM	2/05/06	Fill	<0.5	<0.5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH072	0.3-0.5	ERM	2/05/06	Fill	<0.5	<0.5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH073	1.5-1.95	ERM	2/05/06	Fill	190	228	830	<50	560	270	<2	830	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH074	1.5-1.95	ERM	2/05/06	Fill	1.4	2.2	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH075	0.3-0.5	ERM	6/06/06	Fill	25.7	43	1010	<50	570	440	<2	1010	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH087	**1.5-1.95**	**ERM**	**8/06/06**	**Fill**	496	265	7340	2230	5820	1520	20	9570	0.7	1.2	0.8	7.3	3.2		10.5
BH089	0.3-0.5	ERM	9/06/06	Fill	0.7	0.7	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH089	1.5-1.95	ERM	9/06/06	Fill	8.3	7.4	610	70	440	170	<2	680	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH090	1.5-1.95	ERM	9/06/06	Fill	0.8	1.1	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH109	0.3-0.5	ERM	27/06/06	Fill	<0.5	<0.5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH113	1.5-1.95	ERM	27/06/06	Fill	<0.5	<0.5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH114	0.3-0.5	ERM	28/06/06	Fill	1	2.5	340	<50	130	210	<2	340	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH115	0.8-1	ERM	28/06/06	Fill			900	<50	560	340	<2	900	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH115	1.5-1.95	ERM	28/06/06	Fill	1	1.6	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH119	1.6-2.05	ERM	30/06/06	Fill	0.5	1	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH132	1.5-1.95	ERM	6/07/06	Fill	16.1	27.5	890	<50	500	390	<2	890	0.5	<0.2	<0.2	<0.2	<0.2		<0.4
BH133	1.5-1.95	ERM	6/07/06	Fill	<0.5	<0.5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH133	0.3-0.5	ERM	6/07/06	Fill	2.7	4	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH135A	0.4-0.6	ERM	11/07/06	Fill	<0.5	<0.5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH141	1.5-1.95	ERM	7/07/06	Fill	38.4	67.9	2190	70	1600	590	<2	2260	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH145	0.3-0.5	ERM	11/07/06	Fill	61.6	149	3390	80	2120	1270	4	3470	0.2	<0.2	0.4	0.3	<0.2		0.3

					TPH								BTEX						
					Phenanthrene	Pyrene	TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonia as N	Total Xylene
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					0.5	0.5		50	100	100	10	50	0.2	0.2	0.2	0.2	0.2	20	
SSTC[VMP]								54000	72000	21,000			380						
Tar Containing Material (TCM) Criteria																			
Location	**Sample Depth**	**Consultant**	**Sample Date**	**Matrix**															
BH146	1.5-1.95	ERM	11/07/06	Fill	<0.5	<0.5	<200	<50	<100	<100	2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH156	0.4-0.5	ERM	14/08/06	Fill	<0.5	<0.5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH156	0.9-1	ERM	14/08/06	Fill	<0.5	<0.5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH159		ERM	14/08/06	Fill	<0.5	<0.5	1230	<50	270	960	<2	1230	<0.2	<0.2	<0.2	0.3	<0.2		0.3
BH160	0.3-0.4	ERM	14/08/06	Fill	<0.5	<0.5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH161	0.3-0.4	ERM	14/08/06	Fill	<0.5	<0.5	<200	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2		<0.4
BH197	0.4	ERM	3/03/08	Fill	2.9	2.9	600	<50	150	450	<10	600	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH200	1	ERM	7/04/08	Fill	269	296	14,930	520	10,200	4730	<10	15,450	1.6	<0.5	2.2	2	0.8		2.8
BH203	1.9	ERM	10/03/08	Fill	5.9	9.1	690	<50	330	360	<10	690	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH204S	**1**	**ERM**	**18/03/08**	**Fill**	673	246	12,690	2890	9620	3070	20	15,580	0.6	3.5	1.4	4.2	4.4		8.6
BH204D	**1.5**	**ERM**	**7/04/08**	**Fill**	2700	1510	93,000	54,200	72,400	20,600	226	147,200	61	7	69.2	67.2	26.9		94.1
BH206	0.5	ERM	7/03/08	Fill	11.8	16.8	490	<50	310	180	<10	490	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH206	1.8	ERM	17/04/08	Fill	<0.5	0.5	530	<50	190	340	<10	530	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH210	1.5	ERM	18/03/08	Fill	<0.5	<0.5	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH34	1.8-2.2	AECOM	25/02/10	Fill	<0.5	<0.5	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH42	1-1.1	AECOM	23/02/10	Fill	1.2	3.2	110	<50	110	<100	<10	110	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH44	1.9-2	AECOM	23/02/10	Fill	<0.5	<0.5	<200	<50	<100	<100	10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH49	1.5-1.7	AECOM	22/02/10	Fill	61.4	77.9	2250	80	1460	790	11	2330	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH50	1.3-1.5	AECOM	26/02/10	Natural Sandstone	<0.5	0.5	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH52	1-1.2	AECOM	22/02/10	Fill			950	<50	580	370	78	950	0.2	2.7	3.9	20.2	8.7		28.9
BH54	**1-1.4**	**AECOM**	**23/02/10**	**Fill**	3130	1670	15,260	4380	11,700	3560	72	19,600 - 19,640	2.5	3.5	7.3	25	10.5		35.5
BH55	**1-1.2**	**AECOM**	**25/02/10**	**Fill**	2030	1220	24,950	11,300	19,400	5550	109	36,200 - 36,250	7.8	2.8	14	24.1	10.8		34.9
BH58	1-1.2	AECOM	22/02/10	Fill	23.4	37.6	1010	<50	550	460	<10	1010	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH59	1.9-2	AECOM	22/02/10	Fill	206	104	3150	980	2290	860	<10	4130	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH62	1-1.2	AECOM	26/02/10	Fill	0.9	0.9	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5		<1
BH64	1-1.2	AECOM	1/03/10	Fill	261	259	2970	260	1970	1000	<10	3230	0.2	<0.5	<0.5	<0.5	<0.5		<1
SV09	0.2-0.4	AECOM	26/02/10	Fill	69.1	92.2	3160	120	1920	1240	<10	3280	0.5	<0.5	<0.5	<0.5	<0.5		<1

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC[VMP] - Site Specific Target Criteria for the VMP Area
shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) p
Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene an

TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(

					PAHs																							
					CPAH (TEF)	PAH (Total)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	TPH C15-C36
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL							0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
SSTC[VMP]					67																							
TCM Criteria						**2000**									**150**								-					
Location	**Sample Depth**	**Sample Date**	**Matrix Description**	**Area**																								
BH 199	6	17/03/2008	Natural Sandstone	VMP & PDA - Block 5	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH001	4	2/05/2006	Fill	VMP & PDA - Block 5	3.531	30.7	-	-	-	<0.5	0.5	-	0.8	3.3	2.6	-	3.3	1	1.3	3.1	<0.5	5	<0.5	1	1.3	2.4	5.1	160
BH019	2.5-3	8/05/2006	Fill	VMP & PDA - Block 4	82.897	1994.2	-	-	-	24.3	82	-	79.3	70.3	58.2	-	56.9	22.6	25.5	54.1	6.4	208	110	22.6	700	295	179	4900
BH019	**3-3.45**	**8/05/2006**	**Fill**	**VMP & PDA - Block 4**	122.038	**2733.9**	-	-	-	31.6	120	-	114	103	86.3	-	85.3	32.2	37.2	77.6	8.8	295	157	32.9	891	407	255	7320
BH028	13-13.5	12/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	12.142	470.5	-	-	-	6.7	38.6	-	20.4	13.2	8.4	-	9	3.1	3.2	11.1	0.8	28.2	32.3	2.6	183	76	33.9	1620
BH058	6-6.5	31/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	2.618	154.1	-	-	-	2.7	15.6	-	6.9	3.6	2	-	1.6	0.6	0.6	3.2	<0.5	6.6	12.3	<0.5	59.5	28.9	10	510
BH059	3-3.45	31/05/2006	Fill	VMP & PDA - Block 5	3.224	27.9	-	-	-	<0.5	0.7	-	1	2.5	2.4	-	3	1.4	1.2	2	<0.5	4.4	0.5	1.2	<0.5	2.6	5	290
BH059	8.5-9	31/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	<1.21	10.9	-	-	-	<0.5	1.4	-	0.6	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	1.2	<0.5	2.7	3	1.2	<200
BH060	9.5-10	31/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	<1.21	1.4	-	-	-	<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	0.9	0.5	<200
BH062	3-3.45	31/05/2006	Fill	VMP & PDA - Block 5	6.023	47.4	-	-	-	<0.5	1	-	1.8	3.5	4.2	-	5	3	1.8	3.3	0.5	7.4	0.6	2.3	<0.5	4.9	8.1	830
BH065	3-3.45	1/06/2006	Fill	VMP & PDA - Block 4	11.332	176.3	-	-	-	7	1.4	-	9.7	9.5	7.7	-	9.4	4.5	3.5	8.7	0.9	28.3	7.8	3.6	13.9	34.6	25.8	1760
BH067	3-3.45	1/06/2006	Fill	VMP & PDA - Block 5	6.064	63.1	-	-	-	<0.5	1.1	-	1.8	5.1	4.5	-	5.7	2.1	2.4	4.3	<0.5	12.5	0.9	1.8	1.5	7.5	11.9	4510
BH071	3-3.45	2/05/2006	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH072	3-3.45	2/05/2006	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	120
BH072	9.5-10	2/05/2006	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH073	2-2.4	2/05/2006	Fill	VMP & PDA - Block 4	21.659	383.1	-	-	-	4.4	24.4	-	18.7	19	15.3	-	15.6	6.3	6.2	14.6	1.5	48.8	20.8	5.7	80.5	58.3	43	1600
BH074	3-3.45	2/05/2006	Fill	VMP & PDA - Block 5	3.729	45.5	-	-	-	<0.5	1.5	-	2.6	3.7	2.8	-	3	1.1	1.2	2.8	<0.5	8.2	1.3	1	<0.5	8.6	7.7	260
BH074	9.5-10	2/05/2006	Natural Sandy Clay	VMP & PDA - Block 5	45.766	1222.9	-	-	-	10.5	80.5	-	60	41.3	32.7	-	30.6	11.5	12.9	30.1	3.1	112	71.6	10.7	435	184	96.4	3350
BH075	3-3.45	6/06/2006	Fill	VMP & PDA - Block 4	1.063	9.3	-	-	-	<0.5	<0.5	-	<0.5	0.9	0.8	-	1.1	0.6	0.5	0.7	<0.5	1.8	<0.5	<0.5	<0.5	1	1.9	<200
BH087	**3-3.45**	**8/06/2006**	**Fill**	**VMP & PDA - Block 4**	113.187	**2895.7**	-	-	-	24.4	158	-	120	97.4	79.6	-	79.6	34	31.9	70.7	8.6	285	160	30.5	1030	439	247	8980
BH087	**7-7.5**	**8/06/2006**	**Fill**	**VMP & PDA - Block 4**	69.75	**2418.5**	-	-	-	23.7	135	-	104	64.5	49	-	45.7	20	19.9	50	5.3	163	125	17.4	1090	333	173	8270
BH089	3-3.45	9/06/2006	Fill	VMP & PDA - Block 4	7.99	76.8	-	-	-	<0.5	2.3	-	3.4	6.2	5.6	-	5.9	2.6	2.7	5.4	0.6	13.5	1.1	2.3	0.7	11.5	13	170
BH090	3-3.45	9/06/2006	Fill	VMP & PDA - Block 4	4.337	41.6	-	-	-	<0.5	1	-	2	3.5	3.3	-	3.3	1.6	1.7	3.1	<0.5	7.1	<0.5	1.4	<0.5	6.3	7.3	140
BH109	3-3.45	27/06/2006	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	130
BH109	9.5-10	27/06/2006	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH113	3-3.45	27/06/2006	Fill	VMP & PDA - Block 4	0.878	9.2	-	-	-	<0.5	<0.5	-	0.6	0.9	0.7	-	0.8	<0.5	<0.5	0.8	<0.5	1.8	<0.5	<0.5	<0.5	1.8	1.8	1010
BH114	3-3.45	28/06/2006	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	980
BH115	3-3.45	28/06/2006	Fill	VMP & PDA - Block 4	0.756	6.5	-	-	-	<0.5	<0.5	-	<0.5	0.7	0.6	-	0.8	<0.5	<0.5	0.6	<0.5	1.6	<0.5	<0.5	<0.5	0.8	1.4	<200
BH119	**7.5-8**	**30/06/2006**	**Fill**	**VMP & PDA - Block 4**	217.559	**5173.3**	-	-	-	53.5	273	-	236	152	149	-	113	59.9	71.3	121	27.4	550	313	57.2	1620	880	497	17,690
BH119	**9.5-10**	**30/06/2006**	**Fill**	**VMP & PDA - Block 4**	111.363	**3325.3**	-	-	-	39.7	240	-	163	88.9	80	-	55.5	23.5	43.5	69.8	9	289	239	26.4	1210	504	244	10,050
BH132	8-8.5	6/07/2006	Natural Clayey Sand	VMP & PDA - Block 4	40.715	1700.3	-	-	-	18.4	148	-	57	45	28	-	27.4	11	11.6	37.5	3	77.6	76.9	8.3	825	228	97.6	4230
BH135A	3-3.45	11/07/2006	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
BH141	**3-3.45**	**7/07/2006**	**Fill**	**VMP & PDA - Block 4**	489.37	**13,659**	-	-	-	127	600	-	499	429	344	-	359	149	140	328	35.4	1160	725	124	5840	1820	980	5920
BH145	3-3.45	11/07/2006	Fill	VMP & PDA - Block 5	<1.21	1.4	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	0.7	<200
BH146	3-3.33	11/07/2006	Fill	VMP & PDA - Block 4	99.1	951.4	-	-	-	8.8	58.8	-	35.4	89.7	67.3	-	72.8	33	28.9	69	8.5	184	10.9	31.4	28.3	26.6	198	-
BH146	4.1-4.6	11/07/2006	Fill	VMP & PDA - Block 4	48.479	1274.6	-	-	-	16	78.8	-	58.6	43.5	32.9	-	37.2	16.2	14.8	34.7	4.1	107	71.6	14.2	454	186	105	4610
BH197	5	9/04/2008	Fill	VMP & PDA - Block 5	49.087	546.8	-	-	-	5.1	27	-	19.2	57.7	34.2	-	31.4	9.2	15.7	36.5	3	86.6	10.1	9.5	83	23.6	95	5300
BH197	6.5	9/04/2008	Natural Sandy Clay	VMP & PDA - Block 5	0.05	10	-	-	-	<0.5	<0.5	-	0.5	0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1	0.6	<0.5	4.8	1.6	1	<200
BH197	11.5	9/04/2008	Natural Clayey Sand	VMP & PDA - Block 5	1.587	91.3	-	-	-	1.7	9.9	-	3.6	2.7	1.2	-	1	<0.5	<0.5	1.7	<0.5	3.8	9.2	<0.5	31.1	19.3	6.1	400
BH197	15.9	10/04/2008	Natural Sandstone	VMP & PDA - Block 5	0.06	10.5	-	-	-	<0.5	1	-	0.7	0.6	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	1	<0.5	2	2.7	1.2	<200
BH197	18.6	10/04/2008	Natural Sandstone	VMP & PDA - Block 5	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH198	3	6/03/2008	Fill	VMP & PDA - Block 5	37.064	274.8	-	-	-	3.4	16.3	-	12.7	13.3	26.3	-	26.5	12.7	10.5	12.7	4.3	26.6	4.7	11.8	17.2	21	54.8	8130
BH198	4.5	6/03/2008	Natural Sandy Clay	VMP & PDA - Block 5	<1.21	1	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1	<0.5	<0.5	<200
BH198	6.9	6/03/2008	Natural Clayey Sand	VMP & PDA - Block 5	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH199	2.7	11/03/2008	Fill	VMP & PDA - Block 5	20.52	217.2	-	-	-	2	11.6	-	9	20.3	14.4	-	14.6	5.4	6.5	14.6	1.3	42.7	3.8	4.8	1.5	25.3	39.4	1120
BH199	3.7	11/03/2008	Natural Silty Clay	VMP & PDA - Block 5	39.473	1158.9	-	-	-	14.2	47.2	-	44.7	39.8	27.4	-	29.8	10.3	11.9	28	2.5	122	69	10.4	439	164	98.7	3540
BH199	5.6	11/03/2008	Natural Clayey Sand	VMP & PDA - Block 5	1.454	25.2	-	-	-	<0.5	1.4	-	1.3	1.8	1.1	-	1	<0.5	0.6	1.4	<0.5	4.8	1	<0.5	3.5	2.9	4.4	<200
BH199	6	17/03/2008	Natural Sandstone	VMP & PDA - Block 5	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH200	2.5	7/04/2008	Fill	VMP & PDA - Block 4	19.759	220.1	-	-	-	1	6.7	-	9.9	16.9	12.4	-	18.2	8.3	7.3	14.6	2.2	34.7	5.4	6.9	10.1	32.4	33.1	1560
BH200	6.53	7/04/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH201	2.4	4/03/2008	Fill	VMP & PDA - Block 5	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200

					PAHs																						
					CPAH (TEF)	PAH (Total)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	TPH C15-C36
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL							0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
SSTC[VMP]					67																							
TCM Criteria						**2000**									**150**													
Location	**Sample Depth**	**Sample Date**	**Matrix Description**	**Area**																			-					
BH202	2.3	10/03/2008	Fill	VMP & PDA - Block 4	9.474	66.6	-	-	-	<0.5	1	-	1.6	6.5	6.5	-	6.4	3.9	3	5.5	0.9	11.4	<0.5	3.9	1	3.4	11.6	510
BH202	4.7	10/03/2008	Fill	VMP & PDA - Block 4	4.748	47.6	-	-	-	1.1	0.8	-	2	4	3.6	-	3.5	1.7	1.8	3.1	<0.5	8.9	0.8	1.7	<0.5	4.8	9.8	620
BH202	6.8	10/03/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH201	10.3	18/03/2008	Fill	VMP & PDA - Block 5	21.747	160.4	-	-	-	1.5	6.5	-	5.5	13.1	15.6	-	16.7	6.7	4.7	11	1.9	21.9	4.3	6.2	5	16.2	23.6	3280
BH201	11	18/03/2008	Natural Clayey Sand	VMP & PDA - Block 5	0.72	4.4	-	-	-	<0.5	<0.5	-	<0.5	0.6	0.6	-	0.6	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	<0.5	1.5	<200
BH203	7.3	10/03/2008	Fill	VMP & PDA - Block 4	3.394	31.5	-	-	-	<0.5	0.8	-	1.3	2.9	2.6	-	2.4	1.2	1.1	2.2	<0.5	5.5	0.6	1.2	0.7	3.4	5.6	1010
BH204D	**3**	**7/04/2008**	**Fill**	**VMP & PDA - Block 4**	265.142	**6223.3**	-	-	-	85.6	234	-	283	255	**195**	-	210	38.2	40.4	184	13.3	655	384	40.8	1970	1090	545	25,740
BH204D	**4**	**7/04/2008**	**Fill**	**VMP & PDA - Block 4**	305.575	**7972.5**	-	-	-	73.4	336	-	338	299	**224**	-	239	42.5	41	212	16.3	777	462	48.3	2930	1290	644	29,420
BH205	13	1/04/2008	Natural Sandstone	VMP & PDA - Block 4	2.566	81.5	-	-	-	1.2	3.8	-	3.9	2.9	1.9	-	2.1	0.6	0.8	2	<0.5	7.5	6	0.6	28.8	13.1	6.3	<200
BH205	13.8	1/04/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH205	19.2	2/04/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	4	-	-	-	<0.5	0.7	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.7	1.4	0.7	<200
BH205	22.2	2/04/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH205	7.8	27/03/2008	Natural Sandy Clay	VMP & PDA - Block 4	<1.21	1.2	-	-	-	<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	0.7	0.5	<0.5	<200
BH205	9.3	27/03/2008	Natural Clayey Sand	VMP & PDA - Block 4	22.484	738.1	-	-	-	11	57.6	-	30.7	25.2	15.5	-	14.3	5.6	6.7	20.8	1.6	42.4	42.9	5	291	117	50.8	3350
BH206	4.6	17/04/2008	Fill	VMP & PDA - Block 4	1.658	18.7	-	-	-	<0.5	0.6	-	0.7	1.7	1.2	-	1.5	0.7	0.6	1.1	<0.5	4	<0.5	0.6	<0.5	2.4	3.6	460
BH206	7.1	17/04/2008	Natural Clayey Sand	VMP & PDA - Block 4	2.862	110.1	-	-	-	1.4	10	-	5.6	4.1	2.1	-	1.9	0.7	0.7	2.5	<0.5	6.7	8.3	0.6	39.8	16.9	8.8	350
BH206	10.7	21/04/2008	Natural Sandstone	VMP & PDA - Block 4	0.909	21.7	-	-	-	<0.5	1.9	-	1.6	1.2	0.7	-	0.8	<0.5	<0.5	0.9	<0.5	2.1	1.4	<0.5	3.5	5.1	2.5	110
BH207	7.45	3/04/2008	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH207	12	3/04/2008	Fill	VMP & PDA - Block 4	6.811	53.6	-	-	-	<0.5	2.2	-	1.9	4.4	4.8	-	5.2	2.5	1.7	3.6	0.6	8.8	0.7	2.2	1.2	4.3	9.5	770
BH207	13.1	3/04/2008	Fill	VMP & PDA - Block 4	1.525	33	-	-	-	<0.5	2.4	-	2	1.8	1.2	-	1.3	<0.5	<0.5	1.5	<0.5	3.5	2.4	<0.5	6.1	6.5	4.3	140
BH207	15	3/04/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	0.6	-	-	-	<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	0.6	<0.5	<0.5	<200
BH208	2.25	4/04/2008	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH208	9.5	4/04/2008	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH208	13.5	4/04/2008	Natural Sandy Clay	VMP & PDA - Block 4	13.108	109.8	-	-	-	<0.5	1.8	-	3.2	9.4	9.3	-	11.4	4.9	3	8.9	0.9	20.5	0.7	3.9	0.7	8.4	22.8	5840
BH209	2.3	22/04/2008	Fill	VMP & PDA - Block 4	23.217	168	-	-	-	0.7	7.5	-	4.8	10.8	16.5	-	19.8	7.7	6.4	8	2.2	20.1	1.9	6.6	2.6	7.6	44.8	1460
BH209	4.5	22/04/2008	Natural Clay	VMP & PDA - Block 4	16.094	497	-	-	-	5.9	33.8	-	19.1	17.7	11.2	-	11.4	4.5	2.7	12.9	1.2	28.3	24.8	3.4	203	75.5	41.6	2410
BH209	6.1	22/04/2008	Natural Sandstone	VMP & PDA - Block 4	12.992	814	-	-	-	6.8	54.9	-	22.3	15.4	9.1	-	7	3.2	2.9	11	1	24.6	27	2.2	498	86.5	42.1	2780
BH209	9.4	23/04/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH210	15.9	27/03/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH211	14	26/03/2008	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH211	15.5	26/03/2008	Natural Clayey Sand	VMP & PDA - Block 4	0.086	17.7	-	-	-	<0.5	1.9	-	1.4	0.8	<0.5	-	<0.5	<0.5	<0.5	0.6	<0.5	1.2	1.2	<0.5	5.2	3.6	1.8	<200
BH211	16.05-16.15	26/03/2008	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH34	6-6.2	25/02/2010	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH34	11-11.2	25/02/2010	Natural Sandstone	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH35	4.9-5	22/02/2010	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH35	9.9-10	22/02/2010	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH405	4-4.3	10/02/2011	Fill	VMP & PDA - Block 4	7.736	58.5	-	-	-	<0.5	0.9	-	1.2	5	5.9	-	8	2.6	2.4	5	<0.5	6.8	<0.5	2.2	<0.5	1.4	17.1	1020
BH405	7-7.3	10/02/2011	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH405	13-13.2	11/02/2011	Natural Sand	VMP & PDA - Block 4	31.691	750.2	-	-	-	11.2	45.2	-	40.9	30.2	21.6	-	25.7	7.5	14.3	23.6	2	72.9	46.5	7.6	208	130	63	2320
BH405	**14-14.4**	**11/02/2011**	**Natural Sandy Clay**	**VMP & PDA - Block 4**	129.201	**3296.3**	-	-	-	44.9	221	-	182	130	86.2	-	96.3	49.1	44.5	93	10.3	301	236	42	1040	470	250	9030
BH408	2-2.4	14/02/2011	Fill	VMP & PDA - Block 4	9.097	74.5	-	-	-	<0.5	2.2	-	3.5	6.2	6.3	-	7.1	4.5	3.1	5.2	0.7	12.6	<0.5	3.6	<0.5	6.6	12.9	450
BH408	8-8.3	15/02/2011	Natural Sandy Clay	VMP & PDA - Block 4	1.695	62.2	-	-	-	1.8	6.1	-	6.2	2.6	1.3	-	1.1	0.6	<0.5	1.9	<0.5	4.3	7	<0.5	13	9.4	6.9	350
BH408	9-9.4	15/02/2011	Natural Clayey Sand	VMP & PDA - Block 4	8.162	252.6	-	-	-	4.2	22.9	-	12.5	9.7	5.6	-	4.6	2.6	2.3	7.6	0.6	14.5	16.6	2	89.8	38.8	18.3	860
BH409	3.7-4	14/02/2011	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH409	5-5.3	14/02/2011	Natural Sand	VMP & PDA - Block 4	0.06	56.7	-	-	-	5.6	2.8	-	1.9	0.6	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	2.2	<0.5	33.8	6.8	1.8	180
BH409	6-6.4	15/02/2011	Natural Sandy Clay	VMP & PDA - Block 4	-	-	-	<0.5	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-
BH409	7-7.3	15/02/2011	Natural Clayey Sand	VMP & PDA - Block 4	<1.21	5.2	-	-	-	<0.5	0.7	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.8	1.1	0.6	<200
BH42	**3.2-3.3**	**23/02/2010**	**Fill**	**VMP & PDA - Block 4**	140.429	**3497.6**	<1.2	431	<1.2	35	250	<1.2	217	157	113	136	-	22.9	-	122	7.9	369	243	23.8	926	660	351	17,350
BH42	3.5-3.6	23/02/2010	Natural Sandstone	VMP & PDA - Block 4	<1.21	6.4	-	-	-	<0.5	0.8	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	0.6	<0.5	1	2.4	0.8	<200
BH44	4.9-5	23/02/2010	Natural Sandstone	VMP & PDA - Block 4	18.96	962.7	<1.2	204	<1.2	11.3	90	<1.2	41.9	27.6	15.6	18	-	3.2	-	22.8	<1.2	59.2	54.5	3.4	410	156	67.2	3300
BH45	3.2-3.4	23/02/2010	Fill	VMP & PDA - Block 4	<1.21	1	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.5	<0.5	<200
BH45	7.2-7.4	23/02/2010	Fill	VMP & PDA - Block 4	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200

					PAHs																								
					CPAH (TEF)	PAH (Total)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	TPH C15-C36
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL							0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
SSTC[VMP]					67																							
TCM Criteria						**2000**									**150**													
Location	**Sample Depth**	**Sample Date**	**Matrix Description**	**Area**																								
BH45	13.2-13.4	23/02/2010	Natural Sandstone	VMP & PDA - Block 4	<1.21	3.3	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	1.2	1	<200
BH49	4.2-4.4	22/02/2010	Fill	VMP & PDA - Block 4	29.264	374.2	-	-	-	4.1	23.8	-	16	23.2	19.2	-	27.6	9.2	13.4	16.2	2.6	38.8	12.5	7.9	64.7	41.7	53.3	2690
BH49	6.2-6.4	22/02/2010	Fill	VMP & PDA - Block 4	2.91	50.1	<0.5	4	<0.5	0.8	2.3	<0.5	1.7	3.1	2.5	3	-	0.6	-	2.4	<0.5	4.4	2.7	0.7	19.5	5.7	3.7	600
BH49	8.2-8.4	22/02/2010	Fill	VMP & PDA - Block 4	25.723	946.5	-	-	-	11.2	55.1	-	43.6	30.9	16.4	-	21.4	6.7	12	22.6	2	83.3	62	6	373	130	70.3	3440
BH49	10.2-10.4	22/02/2010	Fill	VMP & PDA - Block 4	17.52	813.1	-	-	-	5.3	32.6	-	25.8	23.1	11.4	-	14.8	4.7	6.5	15.3	1.1	54.6	33.4	3.8	343	191	46.7	1660
BH49	12.2-12.4	22/02/2010	Natural Clayey Sand	VMP & PDA - Block 4	45.485	1760.5	<1.2	211	<1.2	16.5	132	<1.2	59.1	48.4	35.8	45	-	8.7	-	37.8	3.4	161	125	9.8	703	283	137	-
BH52	2.2-2.6	22/02/2010	Fill	VMP & PDA - Block 4	2.288	23.3	-	-	-	<0.5	1	-	1	2.4	1.6	-	2.4	0.9	1	1.9	<0.5	4.1	<0.5	0.8	<0.5	2.3	3.9	<200
BH52	4.2-4.4	22/02/2010	Fill	VMP & PDA - Block 4	127.752	1994.9	-	-	-	36.1	85.7	-	115	140	82.2	-	93.8	43.2	52.9	109	11.6	306	123	37.6	55.8	412	291	8970
BH54	2.8-3	23/02/2010	Natural Sand	VMP & PDA - Block 4	27.593	678.1	<1.2	41.8	<1.2	11.1	29.3	<1.2	32.6	27.5	21.7	28	-	5.8	-	22.5	2.2	66.1	40.2	6.6	227	131	54.5	3980
BH55	**2.2-2.4**	**25/02/2010**	**Fill**	**VMP & PDA - Block 4**	102.892	**3476.4**	<1.2	308	<1.2	25.3	149	<1.2	119	107	84	102	-	17.2	-	87	5.4	274	151	17.5	1740	463	237	14,340
BH55	**2.7-2.9**	**25/02/2010**	**Fill**	**VMP & PDA - Block 4**	242.28	**10,435**	-	<4	-	67.1	386		341	294	160	-	187	65	117	200	14.5	783	440	53.3	4810	1840	677	19,550
BH58	3.2-3.4	22/02/2010	Fill	VMP & PDA - Block 4	2.979	50.8	-	-	-	1.6	1.1		2.2	2.8	2.1	-	3.6	1.4	1	2.5	<0.5	6.6	1.3	1	10.9	5.9	6.8	830
BH58	5.2-5.4	22/02/2010	Fill	VMP & PDA - Block 4	3.688	45.6	-	-	-	1.2	0.9		2	3.3	2.6	-	3.8	1.7	1.9	3.1	<0.5	7.5	1.3	1.4	1.3	6.2	7.4	620
BH58	8.6-8.8	22/02/2010	Fill	VMP & PDA - Block 4	6.05	47.5	<0.5	<0.5	<0.5	<0.5	2.1	<0.5	2.2	5.6	5.3	7	-	1.4	-	4.6	<0.5	7.9	0.7	1.3	1.2	4.6	10.6	1150
BH58	10.8-11.2	22/02/2010	Fill	VMP & PDA - Block 4	3.161	39.8	-	-	-	0.8	0.9		1.3	3.3	2.2	-	3.2	1.3	1.7	2.8	<0.5	7.3	0.7	1	1.2	3.6	8.5	850
BH59	**3.4-3.5**	**22/02/2010**	**Fill**	**VMP & PDA - Block 4**	245.605	**8362.4**	<1.2	967	<1.2	104	404	<1.2	368	271	**189**	232		44.5	-	214	21.7	669	462	52.2	3560	1400	603	25,340
BH59	4.2-4.3	22/02/2010	Fill	VMP & PDA - Block 4	4.859	147.6	-	-	-	1.4	9.1	-	8.3	6.2	3.4	-	4.6	1.4	2	4.5	<0.5	14.2	8.8	1.2	46.4	23.5	12.6	510
BH62	3.4-3.8	26/02/2010	Fill	VMP & PDA - Block 5	<1.21	<8	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	380
BH62	5.4-5.6	26/02/2010	Fill	VMP & PDA - Block 5	4.247	52.5	-	<0.5	-	<0.5	0.6	-	2.2	5.1	2.9	-	4.3	1.7	2.2	4	<0.5	10.8	0.5	1.3	0.5	6.1	10.3	720
BH62	11.8-12	26/02/2010	Fill	VMP & PDA - Block 5	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH64	2.5-2.7	1/03/2010	Fill	VMP & PDA - Block 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1230
BH64	5.5-5.7	1/03/2010	Fill	VMP & PDA - Block 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<200
BH64	10-10.3	1/03/2010	Natural Sandstone	VMP & PDA - Block 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<200
BH65	3.4-3.6	24/02/2010	Fill	VMP & PDA - Block 5	41.546	532.8	-	-	-	5.2	13.8	-	28.1	40.6	27	-	32.3	17.4	17.2	30.2	3.7	82.9	29.1	13.6	10.1	98.8	82.8	13,260
BH65	8.2-8.6	24/02/2010	Fill	VMP & PDA - Block 5	12.071	115	-	-	-	0.8	3	-	5	9.2	7.9	-	9.5	4.7	3.9	7.4	1.4	17.1	5	3.9	2.3	15.6	18.3	1030
BH65	11.2-11.4	24/02/2010	Natural Clayey Sand	VMP & PDA - Block 5	3.415	216.8	<0.5	57.6	<0.5	3.1	24.9	<0.5	11.7	4.7	2.9	3	-	<0.5	-	4.5	<0.5	10.8	20.8	<0.5	65	51.5	16.9	1330
BH65	13.4-13.6	24/02/2010	Natural Sandy Clay	VMP & PDA - Block 5	2.755	114.4	-	-	-	2.4	7.3	-	6.6	3.8	2.1	-	1.8	0.5	0.6	3	<0.5	6.4	10.8	<0.5	34.6	25.1	9.4	380
BH66	2.3-2.4	24/02/2010	Fill	VMP & PDA - Block 5	16.292	105	-	-	-	0.8	1.5	-	3.5	8.8	10.9	-	11.9	7.3	4.2	6.9	2.2	12.4	1.5	5.6	5.3	9.2	13	810
BH66	3.2-3.6	24/02/2010	Fill	VMP & PDA - Block 5	<1.21	<8	-			<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH66	7-7.2	24/02/2010	Natural Sandstone	VMP & PDA - Block 5	<1.21	1.4	-			<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	0.7	<200
BH68	2.5-2.9	2/03/2010	Fill	VMP & PDA - Block 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	770
BH68	4-4.3	2/03/2010	Fill	VMP & PDA - Block 5	<1.21	<8	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<200
BH68	7-7.1	2/03/2010	Natural Silty Sand	VMP & PDA - Block 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<200

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC[VMP] - Site Specific Target Criteria for the VMP Area
Shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)

TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons (note TPH in table not speciated)
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

					TPH					BTEX						Inorganics
					TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Total Xylene	Ammonias N
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					50	100	100	10	50	0.2	0.2	0.2	0.2	0.2		1
SSTC[VMP]					54000	72000	21,000			380						
TCM Criteria																
Location	**Sample Depth**	**Sample Date**	**Matrix Description**	**Area**												
BH 199	6	17/03/2008	Natural Sandstone	VMP & PDA - Block 5	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH001	4	2/05/2006	Fill	VMP & PDA - Block 5	<50	160	<100	<2	160	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH019	2.5-3	8/05/2006	Fill	VMP & PDA - Block 4	2180	3840	1060	354	7080	-	-	-	-	-	-	-
BH019	**3-3.45**	**8/05/2006**	**Fill**	**VMP & PDA - Block 4**	3160	5450	1870	210	10,480	-	-	-	-	-	-	-
BH028	13-13.5	12/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	780	1370	250	119	2400	8.2	2.7	14.8	15.4	6.9	22.3	-
BH058	6-6.5	31/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	220	510	<100	40	730	3.1	5.9	0.4	8.5	4.3	12.8	-
BH059	3-3.45	31/05/2006	Fill	VMP & PDA - Block 5	<50	170	120	<2	290	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH059	8.5-9	31/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH060	9.5-10	31/05/2006	Natural Clayey Sand	VMP & PDA - Block 5	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH062	3-3.45	31/05/2006	Fill	VMP & PDA - Block 5	<50	420	410	<2	830	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH065	3-3.45	1/06/2006	Fill	VMP & PDA - Block 4	90	1040	720	3	1850	<0.2	<0.2	<0.2	0.5	0.3	0.8	-
BH067	3-3.45	1/06/2006	Fill	VMP & PDA - Block 5	<50	1490	3020	2	4510	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH071	3-3.45	2/05/2006	Fill	VMP & PDA - Block 4	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH072	3-3.45	2/05/2006	Fill	VMP & PDA - Block 4	<50	120	<100	<2	120	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH072	9.5-10	2/05/2006	Fill	VMP & PDA - Block 4	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH073	2-2.4	2/05/2006	Fill	VMP & PDA - Block 4	260	1340	260	8	1860	<0.2	2.1	<0.2	3.4	2.1	5.5	-
BH074	3-3.45	2/05/2006	Fill	VMP & PDA - Block 5	<50	260	<100	3	260	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH074	9.5-10	2/05/2006	Natural Sandy Clay	VMP & PDA - Block 5	1510	2480	870	122	4860	14.9	1.6	21.1	20.7	7.6	28.3	-
BH075	3-3.45	6/06/2006	Fill	VMP & PDA - Block 4	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH087	**3-3.45**	**8/06/2006**	**Fill**	**VMP & PDA - Block 4**	4560	7310	1670	271	13,540	15	47.5	24.9	79.9	38.6	118.5	-
BH087	**7-7.5**	**8/06/2006**	**Fill**	**VMP & PDA - Block 4**	4360	6720	1550	442	12,630	82.7	24.3	149	116	57.1	173.1	-
BH089	3-3.45	9/06/2006	Fill	VMP & PDA - Block 4	<50	170	<100	<2	170	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH090	3-3.45	9/06/2006	Fill	VMP & PDA - Block 4	<50	140	<100	<2	140	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH109	3-3.45	27/06/2006	Fill	VMP & PDA - Block 4	<50	<100	130	<2	130	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH109	9.5-10	27/06/2006	Fill	VMP & PDA - Block 4	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH113	3-3.45	27/06/2006	Fill	VMP & PDA - Block 4	70	540	470	<2	1080	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH114	3-3.45	28/06/2006	Fill	VMP & PDA - Block 4	60	620	360	<2	1040	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH115	3-3.45	28/06/2006	Fill	VMP & PDA - Block 4	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH119	**7.5-8**	**30/06/2006**	**Fill**	**VMP & PDA - Block 4**	6750	13,000	4690	1140	24,440	82.4	63	118	182	69.8	251.8	-
BH119	**9.5-10**	**30/06/2006**	**Fill**	**VMP & PDA - Block 4**	5320	7940	2110	1060	15,370	97.8	14.7	124	152	53	205	-
BH132	8-8.5	6/07/2006	Natural Clayey Sand	VMP & PDA - Block 4	1870	3040	1190	1050	6100	140	44.7	232	225	120	345	-
BH135A	3-3.45	11/07/2006	Fill	VMP & PDA - Block 4	-	-	-	-	-	-	-	-	-	-	-	-
BH141	**3-3.45**	**7/07/2006**	**Fill**	**VMP & PDA - Block 4**	1800	4490	1430	325	7720	41.8	49.1	17.3	86.5	60.3	146.8	-
BH145	3-3.45	11/07/2006	Fill	VMP & PDA - Block 5	<50	<100	<100	<2	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-
BH146	3-3.33	11/07/2006	Fill	VMP & PDA - Block 4	-	-	-	-	-	-	-	-	-	-	-	-
BH146	4.1-4.6	11/07/2006	Fill	VMP & PDA - Block 4	3020	3750	860	222	7630	15.2	13.9	25.3	56	31	87	-
BH197	5	9/04/2008	Fill	VMP & PDA - Block 5	560	3820	1480	26	5860	4.8	1.9	8	4.2	1.9	6.1	-
BH197	6.5	9/04/2008	Natural Sandy Clay	VMP & PDA - Block 5	<50	<100	<100	<10	<250	0.5	<0.5	0.8	0.6	<0.5	0.6	-
BH197	11.5	9/04/2008	Natural Clayey Sand	VMP & PDA - Block 5	160	400	<100	<10	560	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH197	15.9	10/04/2008	Natural Sandstone	VMP & PDA - Block 5	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH197	18.6	10/04/2008	Natural Sandstone	VMP & PDA - Block 5	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH198	3	6/03/2008	Fill	VMP & PDA - Block 5	1360	6690	1440	<10	9490	<0.2	<0.5	<0.5	0.7	<0.5	0.7	-
BH198	4.5	6/03/2008	Natural Sandy Clay	VMP & PDA - Block 5	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH198	6.9	6/03/2008	Natural Clayey Sand	VMP & PDA - Block 5	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH199	2.7	11/03/2008	Fill	VMP & PDA - Block 5	<50	740	380	<10	1120	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH199	3.7	11/03/2008	Natural Silty Clay	VMP & PDA - Block 5	950	2620	920	96	4490	6.4	16.3	2.6	22.4	22.9	45.3	-
BH199	5.6	11/03/2008	Natural Clayey Sand	VMP & PDA - Block 5	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH199	6	17/03/2008	Natural Sandstone	VMP & PDA - Block 5	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH200	2.5	7/04/2008	Fill	VMP & PDA - Block 4	110	1060	500	<10	1670	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH200	6.53	7/04/2008	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH201	2.4	4/03/2008	Fill	VMP & PDA - Block 5	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-

					TPH					BTEX						Inorganics
					TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Total Xylene	Ammonias N
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					50	100	100	10	50	0.2	0.2	0.2	0.2	0.2		1
SSTC[VMP]					54000	72000	21,000			380						
TCM Criteria																
Location	**Sample Depth**	**Sample Date**	**Matrix Description**	**Area**												
BH202	2.3	10/03/2008	Fill	VMP & PDA - Block 4	<50	240	270	<10	510	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH202	4.7	10/03/2008	Fill	VMP & PDA - Block 4	<50	280	340	<10	620	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH202	6.8	10/03/2008	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH201	10.3	18/03/2008	Fill	VMP & PDA - Block 5	<50	1930	1350	<10	3280	<0.2	0.7	<0.5	<0.5	<0.5	<1	-
BH201	11	18/03/2008	Natural Clayey Sand	VMP & PDA - Block 5	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH203	7.3	10/03/2008	Fill	VMP & PDA - Block 4	<50	560	450	<10	1010	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH204D	**3**	**7/04/2008**	**Fill**	**VMP & PDA - Block 4**	11,600	19,400	6340	289	37,340	36.8	34.9	49.3	112	39.9	151.9	-
BH204D	**4**	**7/04/2008**	**Fill**	**VMP & PDA - Block 4**	12,600	22,400	7020	215	42,020	44.3	15.1	53	72.8	26.7	99.5	-
BH205	13	1/04/2008	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	13	<250	2.5	<0.5	3.3	2.8	1.2	4	-
BH205	13.8	1/04/2008	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	<10	<250	0.7	<0.5	0.5	<0.5	<0.5	<1	-
BH205	19.2	2/04/2008	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	0.5	<0.5	0.5	-
BH205	22.2	2/04/2008	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH205	7.8	27/03/2008	Natural Sandy Clay	VMP & PDA - Block 4	<50	<100	<100	<10	<250	1.4	<0.5	0.7	<0.5	<0.5	<1	-
BH205	9.3	27/03/2008	Natural Clayey Sand	VMP & PDA - Block 4	1500	2710	640	138	4850	7.5	5.4	34.7	42.4	21.9	64.3	-
BH206	4.6	17/04/2008	Fill	VMP & PDA - Block 4	<50	230	230	<10	460	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH206	7.1	17/04/2008	Natural Clayey Sand	VMP & PDA - Block 4	200	350	<100	15	550	<0.2	1	<0.5	2.7	2.2	4.9	-
BH206	10.7	21/04/2008	Natural Sandstone	VMP & PDA - Block 4	<50	110	<100	<10	110	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH207	7.45	3/04/2008	Fill	VMP & PDA - Block 4	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH207	12	3/04/2008	Fill	VMP & PDA - Block 4	<50	430	340	<10	770	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH207	13.1	3/04/2008	Fill	VMP & PDA - Block 4	<50	140	<100	<10	140	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH207	15	3/04/2008	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH208	2.25	4/04/2008	Fill	VMP & PDA - Block 4	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH208	9.5	4/04/2008	Fill	VMP & PDA - Block 4	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH208	13.5	4/04/2008	Natural Sandy Clay	VMP & PDA - Block 4	80	3320	2520	<10	5920	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH209	2.3	22/04/2008	Fill	VMP & PDA - Block 4	<50	880	580	<10	1460	<0.2	<0.5	0.5	<0.5	<0.5	<1	-
BH209	4.5	22/04/2008	Natural Clay	VMP & PDA - Block 4	1190	1950	460	227	3600	15.5	37.2	4.3	36	50	86	-
BH209	6.1	22/04/2008	Natural Sandstone	VMP & PDA - Block 4	2280	2350	430	929	5060	88.2	34.8	213	165	94.8	259.8	-
BH209	9.4	23/04/2008	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH210	15.9	27/03/2008	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH211	14	26/03/2008	Fill	VMP & PDA - Block 4	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH211	15.5	26/03/2008	Natural Clayey Sand	VMP & PDA - Block 4	<50	<100	<100	19	<250	3.4	0.6	5.5	3.3	1.8	5.1	-
BH211	16.05-16.15	26/03/2008	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH34	6-6.2	25/02/2010	Fill	VMP & PDA - Block 4	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH34	11-11.2	25/02/2010	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH35	4.9-5	22/02/2010	Fill	VMP & PDA - Block 4	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH35	9.9-10	22/02/2010	Fill	VMP & PDA - Block 4	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH405	4-4.3	10/02/2011	Fill	VMP & PDA - Block 4	<50	400	620	<10	1020	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH405	7-7.3	10/02/2011	Fill	VMP & PDA - Block 4	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH405	13-13.2	11/02/2011	Natural Sand	VMP & PDA - Block 4	510	1760	560	<10	2830	0.7	0.6	0.6	3	1.3	4.3	-
BH405	**14-14.4**	**11/02/2011**	**Natural Sandy Clay**	**VMP & PDA - Block 4**	3390	7020	2010	156	12420	5.9	4	33	57.2	19.4	76.6	-
BH408	2-2.4	14/02/2011	Fill	VMP & PDA - Block 4	<50	190	260	<10	450	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH408	8-8.3	15/02/2011	Natural Sandy Clay	VMP & PDA - Block 4	100	350	<100	<10	450	0.6	0.7	<0.5	0.7	0.6	1.3	-
BH408	9-9.4	15/02/2011	Natural Clayey Sand	VMP & PDA - Block 4	360	710	150	24	1220	2.1	4.6	<0.5	5.1	3.8	8.9	-
BH409	3.7-4	14/02/2011	Fill	VMP & PDA - Block 4	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH409	5-5.3	14/02/2011	Natural Sand	VMP & PDA - Block 4	150	180	<100	12	330	1.8	3.5	<0.5	1.1	1.8	2.9	-
BH409	6-6.4	15/02/2011	Natural Sandy Clay	VMP & PDA - Block 4	<50	-	-	<10	<50	0.3	<0.5	<0.5	<0.5	<0.5	<1	<20
BH409	7-7.3	15/02/2011	Natural Clayey Sand	VMP & PDA - Block 4	<50	<100	<100	106	<50	2.8	3.5	22.3	17.8	8.9	26.7	-
BH42	**3.2-3.3**	**23/02/2010**	**Fill**	**VMP & PDA - Block 4**	4680	13,200	4150	234	22030	1	40.8	1.5	39.9	83.6	123.5	-
BH42	3.5-3.6	23/02/2010	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH44	4.9-5	23/02/2010	Natural Sandstone	VMP & PDA - Block 4	1040	2650	650	147	4340	2.1	18.1	5.4	25.7	20.9	46.6	-
BH45	3.2-3.4	23/02/2010	Fill	VMP & PDA - Block 4	<50	<100	<100	10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH45	7.2-7.4	23/02/2010	Fill	VMP & PDA - Block 4	<50	<100	<100	12	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-

					TPH					BTEX						Inorganics
					TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Total Xylene	Ammonias N
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					50	100	100	10	50	0.2	0.2	0.2	0.2	0.2		1
SSTC[VMP]					54000	72000	21,000			380						
TCM Criteria																
Location	**Sample Depth**	**Sample Date**	**Matrix Description**	**Area**												
BH45	13.2-13.4	23/02/2010	Natural Sandstone	VMP & PDA - Block 4	<50	<100	<100	<10	<50	-	-	-	-	-	-	-
BH49	4.2-4.4	22/02/2010	Fill	VMP & PDA - Block 4	250	1610	1080	13	2940	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH49	6.2-6.4	22/02/2010	Fill	VMP & PDA - Block 4	160	450	150	<10	760	1.6	<0.5	1.8	2	0.8	2.8	-
BH49	8.2-8.4	22/02/2010	Fill	VMP & PDA - Block 4	1160	2650	790	348	4600	49.7	5.2	74.6	61.5	22.6	84.1	-
BH49	10.2-10.4	22/02/2010	Fill	VMP & PDA - Block 4	670	1240	420	56	2330	5.5	1.4	10.8	9.9	4.7	14.6	-
BH49	12.2-12.4	22/02/2010	Natural Clayey Sand	VMP & PDA - Block 4	-	-	-	-	-	10.2	2	16.6	21.2	7.7	28.9	-
BH52	2.2-2.6	22/02/2010	Fill	VMP & PDA - Block 4	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH52	4.2-4.4	22/02/2010	Fill	VMP & PDA - Block 4	<50	6600	2370	10	8970	1.7	1	1.1	1.4	0.7	2.1	-
BH54	2.8-3	23/02/2010	Natural Sand	VMP & PDA - Block 4	900	2980	1000	13	4880	<0.2	0.8	<0.5	3.2	1.6	4.8	-
BH55	**2.2-2.4**	**25/02/2010**	**Fill**	**VMP & PDA - Block 4**	6420	10,600	3740	304	20760	22.2	29.6	2.3	48.8	51.6	100.4	-
BH55	**2.7-2.9**	**25/02/2010**	**Fill**	**VMP & PDA - Block 4**	9150	14,800	4750	104	28,700	9.4	8.9	2	19.8	21.1	40.9	-
BH58	3.2-3.4	22/02/2010	Fill	VMP & PDA - Block 4	80	450	380	<10	910	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH58	5.2-5.4	22/02/2010	Fill	VMP & PDA - Block 4	<50	320	300	<10	620	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH58	8.6-8.8	22/02/2010	Fill	VMP & PDA - Block 4	<50	640	510	<10	1150	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH58	10.8-11.2	22/02/2010	Fill	VMP & PDA - Block 4	<50	420	430	<10	850	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<20
BH59	**3.4-3.5**	**22/02/2010**	**Fill**	**VMP & PDA - Block 4**	9120	19,200	6140	459	34460	82.4	88.3	32.5	103	51.2	154.2	-
BH59	4.2-4.3	22/02/2010	Fill	VMP & PDA - Block 4	140	380	130	14	650	3.4	<0.5	2.9	2.4	0.9	3.3	-
BH62	3.4-3.8	26/02/2010	Fill	VMP & PDA - Block 5	<50	140	240	<10	380	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH62	5.4-5.6	26/02/2010	Fill	VMP & PDA - Block 5	<50	390	330	<10	720	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH62	11.8-12	26/02/2010	Fill	VMP & PDA - Block 5	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH64	2.5-2.7	1/03/2010	Fill	VMP & PDA - Block 5	<50	640	590	<10	1230	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH64	5.5-5.7	1/03/2010	Fill	VMP & PDA - Block 5	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH64	10-10.3	1/03/2010	Natural Sandstone	VMP & PDA - Block 5	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH65	3.4-3.6	24/02/2010	Fill	VMP & PDA - Block 5	710	7500	5760	<10	13970	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH65	8.2-8.6	24/02/2010	Fill	VMP & PDA - Block 5	<50	560	470	<10	1030	-	-	-	-	-	-	-
BH65	11.2-11.4	24/02/2010	Natural Clayey Sand	VMP & PDA - Block 5	450	1110	220	14	1780	<0.2	0.8	<0.5	3.5	2.3	5.8	-
BH65	13.4-13.6	24/02/2010	Natural Sandy Clay	VMP & PDA - Block 5	100	380	<100	<10	480	<0.2	<0.5	<0.5	1.1	0.7	1.8	-
BH66	2.3-2.4	24/02/2010	Fill	VMP & PDA - Block 5	<50	420	390	<10	810	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH66	3.2-3.6	24/02/2010	Fill	VMP & PDA - Block 5	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH66	7-7.2	24/02/2010	Natural Sandstone	VMP & PDA - Block 5	<50	<100	<100	<10	<50	-	-	-	-	-	-	-
BH68	2.5-2.9	2/03/2010	Fill	VMP & PDA - Block 5	<50	320	450	<10	770	-	-	-	-	-	-	-
BH68	4-4.3	2/03/2010	Fill	VMP & PDA - Block 5	<50	<100	<100	<10	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-
BH68	7-7.1	2/03/2010	Natural Silty Sand	VMP & PDA - Block 5	<50	<100	<100	<10	<50	-	-	-	-	-	-	-

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC[VMP] - Site Specific Target Criteria for the VMP Area
Shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)

TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons (note TPH in table not speciated)
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

					Asbestos Identification in Bulk Solids	Type
					Asbestos fibres	
Consultant	Field_ID	Sampled_Date	Batch	Area	Yes/No	
ERM	BH198/3.0	06/03/2010	-	Declaration Area - Block 5	No	-
ERM	BH198/5.2	06/03/2010	-	Declaration Area - Block 5	No	-
ERM	BH199/2.7	11/03/2008	-	Declaration Area - Block 5	No	-
ERM	BH200/1.0	07/04/2008	-	Declaration Area - Block 4	No	-
ERM	BH201/2.2	04/03/2008	-	Declaration Area - Block 5	No	-
ERM	BH201/5.5	18/03/2008	-	Declaration Area - Block 4	No	-
ERM	BH202/4.7	10/03/2008	-	Declaration Area - Block 4	No	-
ERM	BH203/1.5	10/03/2008	-	Declaration Area - Block 4	Yes	amosite and chrysotile
ERM	BH204D/1.5	07/04/2008	-	Declaration Area - Block 4	No	-
ERM	BH206/1.8	17/04/2008	-	Declaration Area - Block 4	No	-
ERM	BH207/7.45	03/04/2008	-	Declaration Area- Block 4	No	-
ERM	BH208/1.5	04/04/2008	-	Declaration Area - Block 4	No	-
AECOM	BH42_2.0-2.1	23/02/2010	ES1003672	Declaration Area - Block 4	No	-
AECOM	BH66_1.9-2.0	24/02/2010	ES1003672	Declaration Area - Block 5	No	-
AECOM	BH68_1.0-1.3	02/03/2010	ES1004018	Declaration Area - Block 5	No	-
AECOM	BH405_12.0-12.2	11/02/2011	ES1103042	Declaration Area - Block 4	Yes	chrysotile

					Location	BH4	BH5	BH5	BH8	BH8	BH9	BH9	MW10_Coffey	MW15_Coffey	MW15_Coffey
					Field ID	BH4 0.4-0.5	BH5 0.4-0.5	BH5 1.2-1.3	BH8 0.26-0.4	BH8 0.6-0.7	BH9 0.4-0.5	BH9 0.9-1.0	MW10 1.9-2.0	MW15 0.4-0.5	MW15 1.4-1.5
					Sample Date	21/02/2008	23/02/2008	23/02/2008	19/02/2008	19/02/2008	21/02/2008	21/02/2008	21/02/2008	10/04/2008	10/04/2008
					Consultant	Coffey	Coffey	Coffey	Coffey	Coffey	Coffey	Coffey	Coffey	Coffey	Coffey
					Matrix	Fill	Fill	Natural Clayey Sand	Fill	Fill	Fill	Natural Sandstone	Fill	Fill	Fill
					Area	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road
Chemical Group	**Chemical Name**	**Units**	**EQL**	**Tar Containing Material (TCM) Criteria**	**SSTC^{VMP}**										
PAHs	CPAH (TEF)	mg/kg			67	<1.11	8.491	0.06	21.841	37.753	0.06	1.546	12.023	<1.11	<1.11
	PAH (Total)	mg/kg		**2000**		<7	82.9	4.6	136.7	274.5	1.7	14.1	87.2	<7	<7
	2-chloronaphthalene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	2-methylnaphthalene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	1.4	<0.5	<0.5	<0.5	<0.5	<0.5
	3-methylcholanthrene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Acenaphthene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Acenaphthylene	mg/kg	0.5			<0.5	6.4	<0.5	7.4	17.1	<0.5	0.6	1.6	<0.5	<0.5
	Anthracene	mg/kg	0.5			<0.5	4.4	<0.5	5.9	11.5	<0.5	0.5	2.4	<0.5	<0.5
	Benz(a)anthracene	mg/kg	0.5			<0.5	11.8	0.6	24	33.5	0.6	2.6	21.1	<0.5	<0.5
	Benzo(a) pyrene	mg/kg	0.5	**150**		<0.5	6.9	<0.5	16.1	31.3	<0.5	1.2	8.6	<0.5	<0.5
	Benzo(b)&(k)fluoranthene	mg/kg	1			<1	20	<1	34	57	<1	2	14	<1	<1
	Benzo(b)fluoranthene	mg/kg	0.5												
	Benzo(g,h,i)perylene	mg/kg	0.5			<0.5	2.2	<0.5	4.5	4.8	<0.5	0.6	1.2	<0.5	<0.5
	Benzo(k)fluoranthene	mg/kg	0.5												
	Chrysene	mg/kg	0.5			<0.5	4.9	<0.5	7.6	10.5	<0.5	1	7.1	<0.5	<0.5
	Dibenz(a,h)anthracene	mg/kg	0.5			<0.5	<0.5	<0.5	2.5	2	<0.5	<0.5	1	<0.5	<0.5
	Fluoranthene	mg/kg	0.5			<0.5	15.9	0.8	23	62	0.5	2.6	16.8	<0.5	<0.5
	Fluorene	mg/kg	0.5			<0.5	<0.5	<0.5	0.8	1.9	<0.5	<0.5	<0.5	<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5			<0.5	3.4	<0.5	7.2	9.5	<0.5	0.7	2.3	<0.5	<0.5
	Naphthalene	mg/kg	0.5			<0.5	0.7	1.6	0.9	2.3	<0.5	<0.5	<0.5	<0.5	<0.5
	PAHs (Sum of total)	mg/kg	0.5												
	Phenanthrene	mg/kg	0.5			<0.5	11.6	0.7	12.6	24.8	<0.5	1.6	7.6	<0.5	<0.5
	Pyrene	mg/kg	0.5			<0.5	14.7	0.9	24.2	63.3	0.6	2.7	17.5	<0.5	<0.5
TPH	TPH C15-C36	mg/kg				<200	1700	<200	510	2370	<200	<200	830	<200	<200
	TPH C10 - C14	mg/kg	50		54000	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
	TPH C15-C28	mg/kg	100		72000	<100	1060	<100	310	1380	<100	<100	370	<100	<100
	TPH C29-C36	mg/kg	100		21,000	<100	640	<100	200	990	<100	<100	460	<100	<100
	TPH C6 - C9	mg/kg	10			<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	TPH+C10 - C36 (Sum of total)	mg/kg	50			<250	1700	<250	510	2370	<250	<250	830	<250	<250
BTEX	Total Xylene (ESDAT)	mg/kg	0.15			<1	<1	0.8	<1	<1	<1	<1	<1	<1	<1
	Benzene	mg/kg	0.2		380	<0.2	<0.2	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Ethylbenzene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Toluene	mg/kg	0.5			<0.5	<0.5	0.7	<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	0.8	<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	<0.5	<0.5

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC^{VMP} - Site Specific Target Criteria for the VMP Area
Shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated

					Location	MW15_Coffey	MW3	MW3	MW6	MW7	AECOM_BH51	AECOM_BH43	AECOM_BH53	AECOM_BH61	AECOM_BH67	TBH01
					Field ID	QC1A	MW3 0.4-0.5	MW3 0.9-1.0	MW6 0.8-0.9	MW7 1.4-1.5	BH51_0.4-0.5	BH43_0.4-0.5	BH53_1.1-1.5	BH61_0.3-0.4	BH67_0.4-0.43	TBH01_0.43-0.5
					Sample Date	21/02/2008	23/02/2008	23/02/2008	20/02/2008	25/02/2008	6/03/2010	6/03/2010	6/03/2010	6/03/2010	6/03/2010	5/02/2011
					Consultant	Coffey	Coffey	Coffey	Coffey	Coffey	AECOM	AECOM	AECOM	AECOM	AECOM	AECOM
					Matrix	Fill	Fill	Fill	Fill	FILL	Fill	Fill	Fill	Fill	Fill	Fill
					Area	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road
Chemical Group	**Chemical Name**	**Units**	**EQL**	**Tar Containing Material (TCM) Criteria**	**SSTC^{VMP}**											
PAHs	CPAH (TEF)	mg/kg			67		0.16	19.996	<1.11	38.745	1.256		56.149		12.389	2.22
	PAH (Total)	mg/kg		**2000**			5.1	468.5	<7	218	10.6		668.3		131.2	16.5
	2-chloronaphthalene	mg/kg	0.5				<0.5	<0.5	<0.5	<0.5						
	2-methylnaphthalene	mg/kg	0.5				<0.5	<0.5	<0.5	0.7	<0.5		<0.5		<0.5	
	3-methylcholanthrene	mg/kg	0.5				<0.5	<0.5	<0.5	<0.5						
	Acenaphthene	mg/kg	0.5				<0.5	1.7	<0.5	0.7	<0.5		5.4		<0.5	<0.5
	Acenaphthylene	mg/kg	0.5				0.6	42.5	<0.5	7.7	<0.5		13		3.2	<0.5
	Anthracene	mg/kg	0.5				<0.5	13.8	<0.5	9.6	<0.5		25.7		3.4	0.5
	Benz(a)anthracene	mg/kg	0.5				0.8	44.6	<0.5	41.2	1.3		52.3		16.2	1.9
	Benzo(a) pyrene	mg/kg	0.5	**150**			<0.5	11.7	<0.5	32.1	0.9		38.1		5.5	1.7
	Benzo(b)&(k)fluoranthene	mg/kg	1				1	62	<1	49						
	Benzo(b)fluoranthene	mg/kg	0.5								1.4		50.4		20.3	1.8
	Benzo(g,h,i)perylene	mg/kg	0.5				1	4.2	<0.5	1.4	0.5		16.8		6.3	0.6
	Benzo(k)fluoranthene	mg/kg	0.5								0.7		13.8		8.7	0.7
	Chrysene	mg/kg	0.5				<0.5	23.4	<0.5	16.1	1.1		36.1		17.6	1.4
	Dibenz(a,h)anthracene	mg/kg	0.5				<0.5	2.7	<0.5	1.7	<0.5		4.4		1.6	<0.5
	Fluoranthene	mg/kg	0.5				0.7	91.1	<0.5	36.6	1.9		142		17.7	3.1
	Fluorene	mg/kg	0.5				<0.5	8.5	<0.5	2	<0.5		15.6		<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5				0.7	8.6	<0.5	6.5	<0.5		14.7		5.3	0.6
	Naphthalene	mg/kg	0.5				<0.5	2.5	<0.5	1.6	<0.5		20.8		0.9	<0.5
	PAHs (Sum of total)	mg/kg	0.5								10.6		668		131	
	Phenanthrene	mg/kg	0.5				0.5	120	<0.5	24.9	0.8		91.2		7.9	1.2
	Pyrene	mg/kg	0.5				0.8	93.2	<0.5	35.9	2		128		16.6	3
TPH	TPH C15-C36	mg/kg					<200	3270	<200	2660	<200		3250	<200	1270	<200
	TPH C10 - C14	mg/kg	50		54000		<50	1010	<50	<50	<50		<50	<50	<50	<50
	TPH C15-C28	mg/kg	100		72000		<100	2510	<100	1400	<100		1920	<100	700	<100
	TPH C29-C36	mg/kg	100		21,000		<100	760	<100	1260	<100		1330	<100	570	<100
	TPH C6 - C9	mg/kg	10				<10	<10	<10	<10	<10		<10	<10	<10	<10
	TPH+C10 - C36 (Sum of total)	mg/kg	50				<250	4280	<250	2660	<50		3250	<50	1270	<50
BTEX	Total Xylene (ESDAT)	mg/kg	0.15			<1.5	<1	<1	<1	<1	<1		<1	<1	<1	<1
	Benzene	mg/kg	0.2		380	<0.5	<0.2	<0.2	<0.2	0.2	<0.2		0.4	<0.2	<0.2	<0.2
	Ethylbenzene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
	Toluene	mg/kg	0.5			<0.5	<0.5	<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	<0.5
	Xylene (o)	mg/kg	0.5				<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC^{VMP} - Site Specific Target Criteria for the VMP Area
Shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated

					Location	TBH03	TBH03	TBH05	TBH05	TBH05	TBH06	TBH06	TBH07	TBH08
					Field ID	TBH03_1.2-1.3	TBH03_1.5-1.6	TBH05_0.6-0.7	TBH05_1.3-1.7	TBH05_1.8-2.0	TBH06_0.55-0.6	TBH06_1.5-2.0	TBH07_0.1-0.15	TBH08_0.13-0.25
					Sample Date	5/02/2011	5/02/2011	12/02/2011	12/02/2011	12/02/2011	5/02/2011	12/02/2011	4/02/2011	4/02/2011
					Consultant	AECOM	AECOM	AECOM	AECOM	AECOM	AECOM	AECOM	AECOM	AECOM
					Matrix	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill	Fill
					Area	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road
Chemical Group	**Chemical Name**	**Units**	**EQL**	**Tar Containing Material (TCM) Criteria**	**SSTC^{VMP}**									
PAHs	CPAH (TEF)	mg/kg			67	<1.21	<1.21	<1.21	0.85	28.753	0.967	<1.21	10.663	1.828
	PAH (Total)	mg/kg		**2000**		<8	<8	<8	4.1	161.8	7.3	<8	58.6	12.3
	2-chloronaphthalene	mg/kg	0.5											
	2-methylnaphthalene	mg/kg	0.5											
	3-methylcholanthrene	mg/kg	0.5											
	Acenaphthene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5
	Acenaphthylene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	1.4	<0.5
	Anthracene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	3.1	<0.5	<0.5	1.4	<0.5
	Benz(a)anthracene	mg/kg	0.5			<0.5	<0.5	<0.5	0.7	15.6	0.9	<0.5	4.7	1.3
	Benzo(a) pyrene	mg/kg	0.5	**150**		<0.5	<0.5	<0.5	0.7	18.8	0.8	<0.5	7.8	1.5
	Benzo(b)&(k)fluoranthene	mg/kg	1											
	Benzo(b)fluoranthene	mg/kg	0.5			<0.5	<0.5	<0.5	0.8	23.8	0.7	<0.5	8	1.3
	Benzo(g,h,i)perylene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	15.1	<0.5	<0.5	6.5	0.7
	Benzo(k)fluoranthene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	9.3	<0.5	<0.5	2.7	0.5
	Chrysene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	13.2	0.7	<0.5	4.8	1.1
	Dibenz(a,h)anthracene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	3.4	<0.5	<0.5	0.8	<0.5
	Fluoranthene	mg/kg	0.5			<0.5	<0.5	<0.5	1	19.1	1.7	<0.5	6.4	2.8
	Fluorene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	14	<0.5	<0.5	4.1	<0.5
	Naphthalene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5
	PAHs (Sum of total)	mg/kg	0.5											
	Phenanthrene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	8.3	0.6	<0.5	1.4	<0.5
	Pyrene	mg/kg	0.5			<0.5	<0.5	<0.5	0.9	16	1.9	<0.5	8.6	3.1
TPH	TPH C15-C36	mg/kg				<200	<200	<200	<200	1210	<200	<200	700	370
	TPH C10 - C14	mg/kg	50		54000	<50	<50	<50	<50	<50	<50	<50	<50	<50
	TPH C15-C28	mg/kg	100		72000	<100	<100	<100	<100	600	<100	<100	280	110
	TPH C29-C36	mg/kg	100		21,000	<100	<100	<100	<100	610	<100	<100	420	260
	TPH C6 - C9	mg/kg	10			<10	<10	<10	<10	<10	<10	<10	<10	<10
	TPH+C10 - C36 (Sum of total)	mg/kg	50			<50	<50	<50	<50	1210	<50	<50	700	370
BTEX	Total Xylene (ESDAT)	mg/kg	0.15			<1	<1	<1	<1	<1	<1	<1	<1	<1
	Benzene	mg/kg	0.2		380	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Ethylbenzene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Toluene	mg/kg	0.5			<0.5	<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	<0.5
	Xylene (o)	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC^{VMP} - Site Specific Target Criteria for the VMP Area
Shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated

						PAHs																				
						CPAH (TEF)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL							0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SSTC[VMP]						67																					
Tar Containing Material (TCM) Criteria															**150**												
Location	**Field ID**	**Sample Depth**	**Sample Date**	**Matrix**	**Area**																						
BH4	BH4 2.3-2.4	2.3-2.4	21/02/08	Fill	VMP & PDA - Hickson Road	17.265	<1.2	7.2	<1.2	<1.2	52.8		12.3	9.4	11.4	23		8.4		8.1	3.9	10.1	<1.2	8.6	4.6		5.3	4.6
BH4	BH4 4.2-4.3	4.2-4.3	21/02/08	Fill	VMP & PDA - Hickson Road	<1.11	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<1		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
BH53	BH53_2.0-2.4	2-2.4	6/03/10	Fill	VMP & PDA - Hickson Road	100.803		<0.5		11.4	28.3		84.8	92.8	70.7		77.8	23.9	27.5	63.4	7.1	316	56.1	23.2	48.3	1510	302	277
BH53	**BH53_4.0-4.4**	**4-4.4**	**6/03/10**	**Fill**	**VMP & PDA - Hickson Road**	338.605	<2.5	757	<2.5	108	657	<2.5	343	275	**291**	305		53.5		257	12.1	747	344	49	4330		1390	710
BH61	**BH61_2-2.4**	**2-2.4**	**7/03/10**	**Fill**	**VMP & PDA - Hickson Road**	223.905		2		4.8	47.6		91.6	217	**162**		182	41.5	28	164	13.2	423	23.8	39.5	51.2	2170	267	412
BH61	BH61_3-3.4	3-3.4	7/03/10	Natural Clayey Sand	VMP & PDA - Hickson Road	18.103	<1.2	81.2	<1.2	7.3	47.8	<1.2	30.1	18.9	14.3	17		4.7		14.6	1.3	60.1	38.4	4.2	318		113	55.7
MW10	**MW10 4.9-5.0**	**4.9-5**	**21/02/08**	**Fill**	**VMP & PDA - Hickson Road**	386.828	<1.2	102	<1.2	212	652		523	934	**278**	698		21.8		61	9.4	966	662	52	224		1740	947
MW10	**MW10 8.6-8.7**	**8.6-8.7**	**22/02/08**	**Fill**	**VMP & PDA - Hickson Road**	590.52	<1.2	7650	<1.2	511	1700		2150	1470	**412**	968		26		771	20.3	2440	2100	32.5	10,200		5180	2640
MW3	MW3 2.9-3.0	2.9-3	23/02/08	Natural Clayey Sand	VMP & PDA - Hickson Road	14.51	<0.5	22.6	<0.5	3.2	20		25.3	15.8	10.9	26		4.4		10.6	1.3	35.8	20.9	5.8	55		65.8	37.2
MW6	MW6 2.5-2.6	2.5-2.6	20/02/08	Fill	VMP & PDA - Hickson Road	2.181	<0.5	<0.5	<0.5	<0.5	1.9		1.2	3.8	1.7	3		0.6		1.5	<0.5	5	<0.5	0.8	<0.5		2.7	5.2
MW6	MW6 4.4-4.5	4.4-4.5	20/02/08	Fill	VMP & PDA - Hickson Road	<1.11	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<1		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5
MW7	MW7 3.5-3.6	3.5-3.6	25/02/08	FILL	VMP & PDA - Hickson Road	71.045	<0.5	92.7	<0.5	33.7	48.7		28.7	86.7	59.7	70		2.9		8.6	1.7	62.3	39.6	8.6	150		116	48.8
MW7	**MW7 4.5-4.6**	**4.5-4.6**	**25/02/08**	**FILL**	**VMP & PDA - Hickson Road**	486.608	<1.2	3680	<1.2	210	3060		800	863	**359**	608		59.8		341	22.9	1470	1160	144	7800		3350	2030
MW7	**MW7 5.0-5.1**	**5-5.1**	**25/02/08**	**FILL**	**VMP & PDA - Hickson Road**	884.497	<1.2	5130	<1.2	282	4140		1200	1240	**677**	1170		87.7		582	57.2	2160	1980	196	10,200		4870	3110

Notes
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CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

						TPH						BTEX					
						TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Total Xylene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL							50	100	100	10	50	0.2	0.5	0.5	0.5	0.5	
SSTC[VMP]							54,000	72,000	21,000			380					
Tar Containing Material (TCM) Criteria																	
Location	**Field ID**	**Sample Depth**	**Sample Date**	**Matrix**	**Area**												
BH4	BH4 2.3-2.4	2.3-2.4	21/02/08	Fill	VMP & PDA - Hickson Road	8660	200	5700	2960	<10	8860	<0.2	<0.5	<0.5	<0.5	<0.5	<1
BH4	BH4 4.2-4.3	4.2-4.3	21/02/08	Fill	VMP & PDA - Hickson Road	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1
BH53	BH53_2.0-2.4	2-2.4	6/03/10	Fill	VMP & PDA - Hickson Road	6970	260	4540	2430	<10	7230	2.7	<0.5	1.4	0.8	<0.5	0.8
BH53	**BH53_4.0-4.4**	**4-4.4**	**6/03/10**	**Fill**	**VMP & PDA - Hickson Road**	57,800	28,400	46,800	11,000	3000	86,200	678	50.7	670	470	197	667
BH61	**BH61_2-2.4**	**2-2.4**	**7/03/10**	**Fill**	**VMP & PDA - Hickson Road**	12,790	450	8130	4660	67	13,240	32.7	<0.5	9.5	5.4	1.4	6.8
BH61	BH61_3-3.4	3-3.4	7/03/10	Natural Clayey Sand	VMP & PDA - Hickson Road	1680	320	1220	460	75	2000	11.2	5.9	14.7	16.2	5.8	22
MW10	**MW10 4.9-5.0**	**4.9-5**	**21/02/08**	**Fill**	**VMP & PDA - Hickson Road**	55,600	4600	41,400	14,200	64	60,200	12.4	4.1	2.2	4.1	1.5	5.6
MW10	**MW10 8.6-8.7**	**8.6-8.7**	**22/02/08**	**Fill**	**VMP & PDA - Hickson Road**	112,400	69,400	93,200	19,200	7590	181,800	1510	261	2650	1830	746	2576
MW3	MW3 2.9-3.0	2.9-3	23/02/08	Natural Clayey Sand	VMP & PDA - Hickson Road	8840	1100	6760	2080	<10	9940	0.4	0.9	<0.5	1.1	0.7	1.8
MW6	MW6 2.5-2.6	2.5-2.6	20/02/08	Fill	VMP & PDA - Hickson Road	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1
MW6	MW6 4.4-4.5	4.4-4.5	20/02/08	Fill	VMP & PDA - Hickson Road	<200	<50	<100	<100	<10	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1
MW7	MW7 3.5-3.6	3.5-3.6	25/02/08	FILL	VMP & PDA - Hickson Road	7770	2140	5680	2090	227	9910	87.7	10.3	57.5	49.8	19	68.8
MW7	**MW7 4.5-4.6**	**4.5-4.6**	**25/02/08**	**FILL**	**VMP & PDA - Hickson Road**	74,600	31,500	61,000	13,600	7710	106,100	2080	147	1930	1210	502	1712
MW7	**MW7 5.0-5.1**	**5-5.1**	**25/02/08**	**FILL**	**VMP & PDA - Hickson Road**	80,400	45,900	65,200	15,200	7890	126,300	1980	154	1990	1300	563	1863

Notes
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note TPH in table not speciated
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

					PAHs																								
					CPAH (Total)	CPAH (TEF)	PAH (Total)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene
					µg/L	ug/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL								0.5	0.1	0.1	0.1	0.1	0.5	0.1	0.1	0.05	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.1
Groundwater SSTC[VMP]						1000						47,000													1300			
Well																													
Wells screened within fill material																													
IT3S	BH405	25/02/2011	Fill	VMP & PDA - Block 4	19.9	5.014	26.3				<1	<1		<1	2.2	3.8		4.8	3	2.5	1.4	<1	1.9	<1	2.2	<1		<1	4.5
IT3M	BH405	25/02/2011	Fill	VMP & PDA - Block 4	<7.5	<1.92	1				<1	<1		<1	<1	<0.5		<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	1
MW15	BH087A	15/03/2010	Fill	VMP & PDA - Block 4	<54	<19.98	8226	<9	541	<9	49	155	13	18	<9	<9	<19		<9		<9	<9	18	83	<9	7800	8230	87	16
MW52	AECOM_BH52	19/03/2010	Fill	VMP & PDA - Block 4	<12	<4.44	12	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4		<2		<2	<2	4	<2	<2	4	12	<2	4
MW58	AECOM_BH58	17/03/2010	Fill	VMP & PDA - Block 4	<12	<4.44	<28	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4		<2		<2	<2	<2	<2	<2	<2	<2	<2	<2
MW62	AECOM_BH62	24/02/2011	Fill	VMP & PDA - Block 5	<7.5	<1.92	<15.5				<1	<1		<1	<1	<0.5		<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1
MW64	AECOM_BH64	20/03/2010	Fill	VMP & PDA - Block 5	<12	<4.44	57	<2	5	<2	3	11	<2	2	<2	<2	<4		<2		<2	<2	2	10	<2	11	57	15	3
Wells screened within marine sediments																													
MW198	BH198	25/02/2011	Fill + Marine Sediments	VMP & PDA - Block 5	<7.5	<1.92	1.4				<1	1.4		<1	<1	<0.5		<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1
MW68	AECOM_BH68	24/02/2011	Fill + Marine Sediments	VMP & PDA - Block 5	<7.5	<1.92	<15.5				<1	<1		<1	<1	<0.5		<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1
MW206	BH206	19/03/2010	Marine Sediments	VMP & PDA - Block 4	1523	371.81	21,097	<47	4040	<47	274	1380	<47	680	592	299	362		89		462	<47	1250	1030	81	10,600	21,400	2840	1520
MW54	AECOM_BH54	19/03/2010	Marine Sediments	VMP & PDA - Block 4	5	0.32	9072	<2	294	<2	72	113	<2	19	3	<2	<4		<2		2	<2	19	92	<2	8640	9070	98	14
IT3D	BH405	25/02/2011	Marine Sediments	VMP & PDA - Block 4	56.1	16.113	3048.8				25	158		25.7	19.6	12.8		12.4	<10	<10	11.3	<10	28.6	75.9	<10	2560		77.7	41.8
MW45	AECOM_BH45	19/03/2010	Fill + Marine Sediments + Sandstone	VMP & PDA - Block 4	<12	<4.44	8	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4		<2		<2	<2	<2	<2	<2	8	8	<2	<2
MW209	BH209	28/02/2011	Fill + Marine Sediments + Sandstone	VMP & PDA - Block 4	1.8	0.9	26.6				1.8	6.2		1	1	0.8		<1	<1	<1	<1	<1	1.2	<1	<1	10.8		2	1.8
MW200	BH200	28/02/2011	Sandstone	VMP & PDA - Block 4	<784	<237.16	5450				<98	<98		<98	<98	<98		<98	<98	<98	<98	<98	<98	<98	<98	5450		<98	<98
MW204S	BH204	25/02/2011	Sandstone	VMP & PDA - Block 4	<80	<24.2	8846.1				85.5	45.4		<10	<10	<10		<10	<10	<10	<10	<10	<10	80.6	<10	8580		54.6	<10
MW205	BH205	17/03/2010	Sandstone	VMP & PDA - Block 4	36,188	11,556	530,568	<74	105,000	131	4480	43,200	<74	15,400	12,600	9260	9860		1910		9780	728	25,200	21,100	1910	283,000	540,000	74,100	27,900
MW210	BH210	24/02/2011	Sandstone	VMP & PDA - Block 4	2	1.01	11.9				<1	3.1		<1	1.1	0.9		<1	<1	<1	<1	<1	2.6	<1	<1	<1		<1	4.2

Notes

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TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
**TPH C10-C36 aliphatic and aromatic
note TPH in table not speciated

					TPH						BTEX						Inorganics
					TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Total Xylene	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonia as N
					mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
EQL						50	100	50	20	50		1	2	2	10	2	0.01
Groundwater SSTC[VMP]						17,000	220,000	250,000				2100					150
Well																	
Wells screened within fill material																	
IT3S	BH405	25/02/2011	Fill	VMP & PDA - Block 4	0.65	<50	410	240	<20	650	<4	<1	<2	<5	<2	<2	
IT3M	BH405	25/02/2011	Fill	VMP & PDA - Block 4	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	
MW15	BH087A	15/03/2010	Fill	VMP & PDA - Block 4	14.87	41,000	14,400	470	46,200	55,870	6100	13,100	3010	5030	3920	2180	37.2
MW52	AECOM_BH52	19/03/2010	Fill	VMP & PDA - Block 4	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	<0.1
MW58	AECOM_BH58	17/03/2010	Fill	VMP & PDA - Block 4	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	13.6
MW62	AECOM_BH62	24/02/2011	Fill	VMP & PDA - Block 5	0.39	<50	390	<50	<20	390	<4	<1	<2	<5	<2	<2	
MW64	AECOM_BH64	20/03/2010	Fill	VMP & PDA - Block 5	2.39	270	1850	540	<20	2660	10	4	3	6	6	4	2.66
Wells screened within marine sediments																	
MW198	BH198	25/02/2011	Fill + Marine Sediments	VMP & PDA - Block 5	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	
MW68	AECOM_BH68	24/02/2011	Fill + Marine Sediments	VMP & PDA - Block 5	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	
MW206	BH206	19/03/2010	Marine Sediments	VMP & PDA - Block 4	85.4	68,000	70,600	14,800	13,300	153,400	2770	5450	1250	101	1230	1540	
MW54	AECOM_BH54	19/03/2010	Marine Sediments	VMP & PDA - Block 4	11.3	28,000	10,900	400	3730	39,300	954	621	206	502	626	328	10.8
IT3D	BH405	25/02/2011	Marine Sediments	VMP & PDA - Block 4	3.23	5590	2970	260	2120	8820	461	595	51	465	325	136	
MW45	AECOM_BH45	19/03/2010	Fill + Marine Sediments + Sandstone	VMP & PDA - Block 4	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	<0.1
MW209	BH209	28/02/2011	Fill + Marine Sediments + Sandstone	VMP & PDA - Block 4	0.22	100	220	<50	100	320	18	56	15	5	8	10	
MW200	BH200	28/02/2011	Sandstone	VMP & PDA - Block 4	17.2	47,400	17,200	<50	37,600	64,600	1910	17,900	659	1660	1350	560	
MW204S	BH204	25/02/2011	Sandstone	VMP & PDA - Block 4	2.82	8430	2690	130	2380	11250	695	237	169	440	466	229	
MW205	BH205	17/03/2010	Sandstone	VMP & PDA - Block 4	1852	1,730,000	1,520,000	332,000		3,582,000							
MW210	BH210	24/02/2011	Sandstone	VMP & PDA - Block 4	0.8	80	730	70	<20	880	<4	2	3	<5	<2	<2	

Notes

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note TPH in table not speciated

				PAHs																						
				CPAH (TEF)	PAH (Total)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene
				ug/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL						0.5	0.1	0.1	0.1	0.1	0.5	0.1	0.1	0.05	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Groundwater SSTC[VMP]				1000						47,000														1300		
Well	**Location**	**Sample Date**	**Area**																							
IT3S	BH405	25/02/2011	VMP & PDA - Block 4	5.014	26.3				<1	<1		<1	2.2	3.8		4.8	3	2.5	1.4	<1	1.9	<1	2.2	<1	<1	4.5
IT3M	BH405	25/02/2011	VMP & PDA - Block 4	<1.92	1				<1	<1		<1	<1	<0.5		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
IT3D	BH405	25/02/2011	VMP & PDA - Block 4	16.113	3048.8				25	158		25.7	19.6	12.8		12.4	<10	<10	11.3	<10	28.6	75.9	<10	2560	77.7	41.8
MW015	BH087	25/07/2006	VMP & PDA - Block 4	59.106	23,350				80.1	376		94.7	54.6	41.1		27.8	12.9	29.3	47.7	4.9	135	236	13.3	21,700	367	130
MW15	BH087	14/08/2006	VMP & PDA - Block 4	133.678	15,287				112	696		161	145	91		118	37.5	31.3	97.3	8.4	480	491	35	11,400	932	451
MW15	BH087	15/08/2007	VMP & PDA - Block 4	64.95	5152.9				60.8	227		66.3	53.5	45.4		37.1	20.2	26.8	42.8	5.2	116	150	19.8	3930	242	110
MW15	BH087	12/05/2008	VMP & PDA - Block 4	<44.286	2525.7				<18.3	51.5		<18.3	<18.3	<18.3		<18.3	<18.3	<18.3	<18.3	<18.3	<18.3	25	<18.3	2430	19.2	<18.3
MW15	BH087	15/03/2010	VMP & PDA - Block 4	<19.98	8226	<9	541	<9	49	155	13	18	<9	<9	<19		<9		<9	<9	18	83	<9	7800	87	16
MW198	BH198	9/05/2008	VMP & PDA - Block 5	<1.92	24.5				2.2	9.7		<1	<1	<0.5		<1	<1	<1	<1	<1	1.1	1.6	<1	6.5	2.1	1.3
MW198	BH198	16/03/2010	VMP & PDA - Block 5	<4.44	14	<2	<2	<2	2	12	<2	<2	<2	<2	<4		<2		<2	<2	<2	<2	<2	<2	<2	<2
MW198	BH198	25/02/2011	VMP & PDA - Block 5	<1.92	1.4				<1	1.4		<1	<1	<0.5		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW200	BH200	13/05/2008	VMP & PDA - Block 4	<46.464	2350.9				<19.2	39.1		<19.2	<19.2	<19.2		<19.2	<19.2	<19.2	<19.2	<19.2	<19.2	21.8	<19.2	2290	<19.2	<19.2
MW200	BH200	16/03/2010	VMP & PDA - Block 4	<19.98	8028	<9	209	<9	15	40	<9	<9	<9	<9	<19		<9		<9	<9	<9	11	<9	7950	12	<9
MW200	BH200	28/02/2011	VMP & PDA - Block 4	<237.16	5450				<98	<98		<98	<98	<98		<98	<98	<98	<98	<98	<98	<98	<98	5450	<98	<98
MW204D	BH204D	13/05/2008	VMP & PDA - Block 4	205.028	11,241				122	334		476	254	145		185	63.8	80.9	210	<39	767	508	53	5920	1390	732
MW204S	BH204	15/03/2010	VMP & PDA - Block 4	<19.98	7080	<9	314	<9	96	55	<9	<9	<9	<9	<19		<9		<9	<9	<9	92	<9	6740	97	<9
MW204S	BH204	25/02/2011	VMP & PDA - Block 4	<24.2	8846.1				85.5	45.4		<10	<10	<10		<10	<10	<10	<10	<10	<10	80.6	<10	8580	54.6	<10
MW205	BH205	9/05/2008	VMP & PDA - Block 4	<46.222	1656.8				<19.1	66.8		<19.1	<19.1	<19.1		<19.1	<19.1	<19.1	<19.1	<19.1	<19.1	<19.1	<19.1	1590	<19.1	<19.1
MW205	BH205	17/03/2010	VMP & PDA - Block 4	11,556	530,568	<74	105,000	131	4480	43,200	<74	15,400	12,600	9260	9860		1910		9780	728	25,200	21,100	1910	283,000	74,100	27,900
MW206	BH206	12/05/2008	VMP & PDA - Block 4	<2.32	945.1				6.3	42.6		2.2	<1	<0.9		<1	<1	<1	<1	<1	1.2	11.6	<1	870	10	1.2
MW206	BH206	19/03/2010	VMP & PDA - Block 4	371.81	21,097	<47	4040	<47	274	1380	<47	680	592	299	362		89		462	<47	1250	1030	81	10,600	2840	1520
MW209	BH209	12/05/2008	VMP & PDA - Block 4	<4.356	281.3				8.1	50		5.6	<1.8	<1.8		<1.8	<1.8	<1.8	<1.8	<1.8	3.2	18.9	<1.8	175	17	3.5
MW209	BH209	16/03/2010	VMP & PDA - Block 4	3.2	753	<2	14	<2	7	26	<2	4	2	3	<4		<2		<2	<2	4	10	<2	677	14	6
MW209	BH209	28/02/2011	VMP & PDA - Block 4	0.9	26.6				1.8	6.2		1	1	0.8		<1	<1	<1	<1	<1	1.2	<1	<1	10.8	2	1.8
MW210	BH210	8/05/2008	VMP & PDA - Block 4	0.594	1589.7				24.4	156		15.4	3.5	<2		2.2	<2	<2	2.4	<2	15.6	73.8	<2	1220	63.8	12.6
MW210	BH210	16/03/2010	VMP & PDA - Block 4	<4.44	42	<2	<2	<2	7	12	<2	2	<2	<2	<4		<2		<2	<2	6	<2	<2	6	5	4
MW210	BH210	24/02/2011	VMP & PDA - Block 4	1.01	11.9				<1	3.1		<1	1.1	0.9		<1	<1	<1	<1	<1	2.6	<1	<1	<1	<1	4.2
MW45	AECOM_BH45	19/03/2010	VMP & PDA - Block 4	<4.44	8	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4		<2		<2	<2	<2	<2	<2	8	<2	<2
MW52	AECOM_BH52	19/03/2010	VMP & PDA - Block 4	<4.44	12	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4		<2		<2	<2	4	<2	<2	4	<2	4
MW54	AECOM_BH54	19/03/2010	VMP & PDA - Block 4	0.32	9072	<2	294	<2	72	113	<2	19	3	<2	<4		<2		2	<2	19	92	<2	8640	98	14
MW58	AECOM_BH58	17/03/2010	VMP & PDA - Block 4	<4.44	<28	<2	<2	<2	<2	<2	<2	<2	<2	<2	<4		<2		<2	<2	<2	<2	<2	<2	<2	<2
MW62	AECOM_BH62	17/03/2010	VMP & PDA - Block 5	0.7	18.7	<0.9	2	<0.9	1	<0.9	<0.9	1	<0.9	0.7	<2		<0.9		<0.9	<0.9	2	1	<0.9	7	4	2
MW62	AECOM_BH62	24/02/2011	VMP & PDA - Block 5	<1.92	<15.5				<1	<1		<1	<1	<0.5		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
MW64	AECOM_BH64	20/03/2010	VMP & PDA - Block 5	<4.44	57	<2	5	<2	3	11	<2	2	<2	<2	<4		<2		<2	<2	2	10	<2	11	15	3
MW68	AECOM_BH68	18/03/2010	VMP & PDA - Block 5	<1.998	4	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<2		<0.9		<0.9	<0.9	<0.9	<0.9	<0.9	3	1	<0.9
MW68	AECOM_BH68	24/02/2011	VMP & PDA - Block 5	<1.92	<15.5				<1	<1		<1	<1	<0.5		<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

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				TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Total Xylene	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonia as N
				mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L
EQL					50	100	50	20	50		1	1	1	10	1	0.01
Groundwater SSTC[VMP]					17,000	220,000	250,000				2100					150
Well	**Location**	**Sample Date**	**Area**													
IT3S	BH405	25/02/2011	VMP & PDA - Block 4	0.65	<50	410	240	<20	650	<4	<1	<2	<5	<2	<2	
IT3M	BH405	25/02/2011	VMP & PDA - Block 4	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	
IT3D	BH405	25/02/2011	VMP & PDA - Block 4	3.23	5590	2970	260	2120	8820	461	595	51	465	325	136	
MW015	BH087	25/07/2006	VMP & PDA - Block 4	20.36	46,000	19,600	760	31,500	66,360	6700	14,400	3020	5740	4490	2210	
MW15	BH087	14/08/2006	VMP & PDA - Block 4	24.04	50,500	22,700	1340	23,200	74,540	5510	8890	2590	3980	3670	1840	
MW15	BH087	15/08/2007	VMP & PDA - Block 4	25.99	48,200	23,800	2190	14,500	74,190	3140	7270	1470	2330	1990	1150	
MW15	BH087	12/05/2008	VMP & PDA - Block 4	15.65	104,000	15,500	150	10,100	119,650	667	4140	68	1760	443	224	
MW15	BH087	15/03/2010	VMP & PDA - Block 4	14.87	41,000	14,400	470	46,200	55,870 - 55,900	6100	13,100	3010	5030	3920	2180	
MW198	BH198	9/05/2008	VMP & PDA - Block 5	1.27	550	1200	70	190	1820	11	85	30	<5	3	8	
MW198	BH198	16/03/2010	VMP & PDA - Block 5	0.59	120	590	<50	<20	710	<4	<1	<2	<5	<2	<2	13.6
MW198	BH198	25/02/2011	VMP & PDA - Block 5	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	
MW200	BH200	13/05/2008	VMP & PDA - Block 4	22.12	97,200	22,000	120	28,500	119,320	1987	12,900	473	1620	1380	607	
MW200	BH200	16/03/2010	VMP & PDA - Block 4	22.65	100,000	22,500	150	22,400	122,650 - 123,000	2336	16,200	686	1820	1800	536	
MW200	BH200	28/02/2011	VMP & PDA - Block 4	17.2	47,400	17,200	<50	37,600	64,600	1910	17,900	659	1660	1350	560	8.47
MW204D	BH204D	13/05/2008	VMP & PDA - Block 4	85.64	422,000	75,800	9840	27,900	507,640	2944	7700	411	3650	2030	914	<0.1
MW204S	BH204	15/03/2010	VMP & PDA - Block 4	7.85	19,600	7400	450	890	27,400 - 27,450	254	92	60	180	172	82	10.8
MW204S	BH204	25/02/2011	VMP & PDA - Block 4	2.82	8430	2690	130	2380	11,200 - 11,250	695	237	169	440	466	229	<0.1
MW205	BH205	9/05/2008	VMP & PDA - Block 4	8.18	72,800	8100	80	73,600	80,980	5140	27,800	745	17,600	3140	2000	2.66
MW205	BH205	17/03/2010	VMP & PDA - Block 4	1852	1,730,000	1,520,000	332,000	3,580,000 - 3,582,000								5.46
MW206	BH206	12/05/2008	VMP & PDA - Block 4	1.5	6940	1500	<50	8380	8440	1419	2960	306	430	807	612	
MW206	BH206	19/03/2010	VMP & PDA - Block 4	85.4	68,000	70,600	14,800	13,300	153,000 - 153,400	2770	5450	1250	101	1230	1540	
MW209	BH209	12/05/2008	VMP & PDA - Block 4	1.9	7980	1900	<50	8150	9880	655	2370	118	1700	380	275	6.56
MW209	BH209	16/03/2010	VMP & PDA - Block 4	1.16	2230	1000	160	1380	3390	180	772	149	48	76	104	110
MW209	BH209	28/02/2011	VMP & PDA - Block 4	0.22	100	220	<50	100	320	18	56	15	5	8	10	42.8
MW210	BH210	8/05/2008	VMP & PDA - Block 4	4.61	14,800	4400	210	2650	19,410	619	511	69	617	401	218	5.72
MW210	BH210	16/03/2010	VMP & PDA - Block 4	0.73	210	730	<50	30	940	6	12	8	<5	3	3	3.84
MW210	BH210	24/02/2011	VMP & PDA - Block 4	0.8	80	730	70	<20	880	<4	2	3	<5	<2	<2	6.7
MW45	AECOM_BH45	19/03/2010	VMP & PDA - Block 4	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	12
MW52	AECOM_BH52	19/03/2010	VMP & PDA - Block 4	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	103
MW54	AECOM_BH54	19/03/2010	VMP & PDA - Block 4	11.3	28,000	10,900	400	3730	39,300	954	621	206	502	626	328	87
MW58	AECOM_BH58	17/03/2010	VMP & PDA - Block 4	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	37.2
MW62	AECOM_BH62	17/03/2010	VMP & PDA - Block 5	1.46	<50	1260	200	<20	1460	<4	<1	<2	<5	<2	<2	27.4
MW62	AECOM_BH62	24/02/2011	VMP & PDA - Block 5	0.39	<50	390	<50	<20	390	<4	<1	<2	<5	<2	<2	5.36
MW64	AECOM_BH64	20/03/2010	VMP & PDA - Block 5	2.39	270	1850	540	<20	2660	10	4	3	6	6	4	<0.01
MW68	AECOM_BH68	18/03/2010	VMP & PDA - Block 5	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	5.24
MW68	AECOM_BH68	24/02/2011	VMP & PDA - Block 5	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2	7.48

Notes

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TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
**TPH C10-C36 aliphatic and aromatic
note TPH in table not speciated

						PAHs																					Phenols									
						CPAH (TEF)	PAH (Total)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	3-Methylphenol	4-chloro-3-methylphenol	4-methylphenol	4-nitrophenol	Phenol
						ug/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL								0.5	0.1	0.1	0.1	0.1	0.5	0.1	0.1	0.05	1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.05	0.1	0.1	0.1
SSTC[VMP]						1000						47,000														1300											
MWQC									2.1		5.8	5.8		0.01	0.01	0.1	0.01	0.01	0.001	0.01	0.001	0.1	1	3	0.01	70		0.6	0.025	2	13		13	13		13000		400
Well	**Field ID**	**Location**	**Sample Date**	**Screened Lithology**	**Area**																																
Wells screened within fill material																																					
IT3S	IT3S	BH405	25/02/11	Fill	VMP & PDA - Block 4	5.014	26.3				<1	<1		<1	2.2	3.8		4.8	3	2.5	1.4	<1	1.9	<1	2.2	<1		<1	4.5	<1	<1	<1	<2		<1			<1
IT3S	IT3S FILTRATE	BH405	25/02/11	Fill	VMP & PDA - Block 4	<0.192	0.5		<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.05		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5		<0.1	<0.1	<0.2	0.3	<0.2		0.5	<0.1	<0.2	<0.2	1
IT3M	IT3M	BH405	25/02/11	Fill	VMP & PDA - Block 4	<1.92	1				<1	<1		<1	<1	<0.5		<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	1	<1	<1	<1	<2		<1			<1
IT3M	IT3M FILTRATE	BH405	25/02/11	Fill	VMP & PDA - Block 4	<0.192	0.2		<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.05		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2		<0.1	<0.1	<0.2	<0.2	<0.2		<0.2	<0.1	<0.2	<0.2	0.2
MW62	MW62	AECOM_BH62	17/03/10	Fill	VMP & PDA - Block 5	0.7	18.7	<0.9	2	<0.9	1	<0.9	<0.9	1	<0.9	0.7	<2		<0.9		<0.9	<0.9	2	1	<0.9	7	19	4	2	<0.9	<0.9	<0.9	<2		<0.6			<0.9
MW62	MW62	AECOM_BH62	24/02/11	Fill	VMP & PDA - Block 5	<1.92	<15.5				<1	<1		<1	<1	<0.5		<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1	<1	<1	<1	<2		<1			<1
MW62	MW62 FILTRATE	AECOM_BH62	24/02/11	Fill	VMP & PDA - Block 5	<0.192	0.4		<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.05		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4		<0.1	<0.1	<0.2	0.3	<0.2		0.4	<0.1	<0.2	<0.2	0.3
Wells screened within marine sediments																																					
MW40	MW40	AECOM_BH40	20/03/10	Fill + Marine Sediments	Block 4	<1.998	297	<0.9	36	<0.9	4	16	<0.9	3	<0.9	<0.9	<2		<0.9		<0.9	<0.9	2	12	<0.9	244	297	14	2	69	15	<0.9	20		<0.9			2
MW69	MW69	AECOM_BH69	19/03/10	Fill + Sandstone	Block 5	7.52	2444	<2	326	<2	35	158	5	28	14	6	6		<2		12	<2	34	64	<2	1920	2450	126	47	138	20	<2	20		<2			2
MW69	MW69	AECOM_BH69	25/02/11	Fill + Sandstone	Block 5	<12.1	320				11.7	37.2		8.9	<5	<5		<5	<5	<5	<5	<5	7.4	5.7	<5	202		32	15.1	<5	<5	<5	<10		<5			<5
MW69	MW 69 FILTRATE	AECOM_BH69	25/02/11	Fill + Sandstone	Block 5	<0.192	5		<0.1	<0.1	<0.1	<0.1		<0.1	<0.1	<0.05		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	5		<0.1	<0.1	0.3	0.3	<0.2		0.5	<0.1	<0.2	<0.2	0.5
MW401	MW401	BH401	24/02/11	Marine Sediments	Block 5	<11.858	249.2				10.5	12.8		<4.9	<4.9	<4.9		<4.9	<4.9	<4.9	<4.9	<4.9	<4.9	9.4	<4.9	195		16.3	5.2	108	63.4	<4.9	111		<4.9			15
MW401	MW401 FILTRATE	BH401	24/02/11	Marine Sediments	Block 5	<0.192	49.9		2.1	<0.1	1.2	1		<0.1	<0.1	<0.05		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	47.7		<0.1	<0.1	50	27.8	<0.2		31.1	<0.1	18.7	<0.2	6.6

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* TPH C6-C9 aliphatic
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							TPH						BTEX						Inorganics											
							TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Total Xylene (ESDAT)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Alkalinity as CaCO3	Ammonia as N	Anions Total	Bicarbonate as CaCO3	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Carbonate as CaCO3)	Carbonate	Cations Total	Chloride	Cyanide (Free)
							mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	meq/L	mg/L	mg/L	mg/L	mg/L	meq/L	mg/L	mg/L
EQL								50	100	50	20	50		1	2	2	2	2	1	0.01	0.01	1	1	1	1	0.01	0.5	0.004
SSTC[VMP]								17,000	220,000	250,000				2100						150								
MWQC								40			110			700	80	180	75	75		0.91								0.004
Well	**Field ID**	**Location**	**Sample Date**	**Screened Lithology**	**Area**																									
Wells screened within fill material																														
IT3S	IT3S	BH405	25/02/11	Fill	VMP & PDA - Block 4	0.65	<50	410	240	<20	650	<4	<1	<2	<5	<2	<2											<0.004
IT3S	IT3S FILTRATE	BH405	25/02/11	Fill	VMP & PDA - Block 4																									
IT3M	IT3M	BH405	25/02/11	Fill	VMP & PDA - Block 4	<0.15	<50	<100	<50	<20	<50	<4	<1	<2	<5	<2	<2											<0.004
IT3M	IT3M FILTRATE	BH405	25/02/11	Fill	VMP & PDA - Block 4																									
MW62	MW62	AECOM_BH62	17/03/10	Fill	VMP & PDA - Block 5	1.46	<50	1260	200	<20	1460	<4	<1	<2	<5	<2	<2	96	8.47	398	96	96	<1	<1	438	13,700	<0.004
MW62	MW62	AECOM_BH62	24/02/11	Fill	VMP & PDA - Block 5	0.39	<50	390	<50	<20	390	<4	<1	<2	<5	<2	<2											<0.004
MW62	MW62 FILTRATE	AECOM_BH62	24/02/11	Fill	VMP & PDA - Block 5																									
Wells screened within marine sediments																														
MW40	MW40	AECOM_BH40	20/03/10	Fill + Marine Sediments	Block 4							38	52	2	46	26	12	556	9.7	434	556			<1	456	14,500	
MW69	MW69	AECOM_BH69	19/03/10	Fill + Sandstone	Block 5	4.26	7200	3900	360	3400	11,460 - 11,500	384	868	77	804	240	144	761	90.4	333	761			<1	335	9520	0.004
MW69	MW69	AECOM_BH69	25/02/11	Fill + Sandstone	Block 5	0.33	530	330	<50	210	860	26	52	16	9	13	13										<0.004
MW69	MW 69 FILTRATE	AECOM_BH69	25/02/11	Fill + Sandstone	Block 5																							
MW401	MW401	BH401	24/02/11	Marine Sediments	Block 5	1.07	790	1070	<50	350	1860	42	127	<5	108	27	15										<0.004
MW401	MW401 FILTRATE	BH401	24/02/11	Marine Sediments	Block 5																							

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* TPH C6-C9 aliphatic
**TPH C10-C36 aliphatic and aromatic
note TPH in table not speciated
FILTRATE = Sample analysed following double filtration in laboratory

						Metals																					SVOCs		VOCs
						Aluminium (Filtered)	Antimony (Filtered)	Arsenic (Filtered)	Barium (Filtered)	Beryllium (Filtered)	Cadmium (Filtered)	Calcium (Filtered)	Chromium (Filtered)	Chromium (hexavalent)	Cobalt (Filtered)	Copper (Filtered)	Iron (Filtered)	Lead (Filtered)	Magnesium (Filtered)	Manganese (Filtered)	Mercury (Filtered)	Nickel (Filtered)	Potassium (Filtered)	Selenium (Filtered)	Silver (Filtered)	Sodium (Filtered)	Vanadium (Filtered)	Zinc (Filtered)	Dibenzofuran	Pentachlorophenol	Styrene
						mg/L	mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	mg/L	µg/L	mg/L	mg/L	µg/L	µg/L	mg/L	mg/L	µg/L	mg/L	µg/L	mg/L	µg/L	µg/L	µg/L
EQL						0.01	0.0005	0.5	0.001	0.1	0.2	1	0.5	0.002	0.2	1	0.05	0.2	1	0.0005	0.1	0.5	1	0.002	0.1	1	0.5	0.005	0.5	0.05	5
SSTC[VMP]																															
MWQC								2.3			0.7		27.4	0.0044	1	1.3		4.4			0.1	70				100	0.015	3.7	22	72
Well	**Field ID**	**Location**	**Sample Date**	**Screened Lithology**	**Area**																									
Wells screened within fill material																														
IT3S	IT3S	BH405	25/02/11	Fill	VMP & PDA - Block 4	<0.01	0.0017	1.7	0.096	<0.1	0.9		<0.5		0.8	<1		0.8		0.072	<0.1	5.4		<0.002	<0.1		1.9	0.017		<2	
IT3S	IT3S FILTRATE	BH405	25/02/11	Fill	VMP & PDA - Block 4																									<0.1	
IT3M	IT3M	BH405	25/02/11	Fill	VMP & PDA - Block 4	0.01	0.0021	0.8	0.1	<0.1	0.4		<0.5		0.3	<1		2.4		0.0336	<0.1	1.2		<0.002	<0.1		0.9	0.046		<2	
IT3M	IT3M FILTRATE	BH405	25/02/11	Fill	VMP & PDA - Block 4																									<0.1	
MW62	MW62	AECOM_BH62	17/03/10	Fill	VMP & PDA - Block 5			0.6	0.492	<0.1	<0.2	936	<0.5	<0.002	0.2	<1	<0.5	<0.2	372	0.0891	<0.1	<0.5	324			8090	0.9	0.012	1	<1	<5
MW62	MW62	AECOM_BH62	24/02/11	Fill	VMP & PDA - Block 5	<0.01	<0.0005	0.7	0.433	<0.1	<0.2		<0.5		0.2	<1		<0.2		0.0725	<0.1	3		<0.002	<0.1		0.7	<0.005		<2	
MW62	MW62 FILTRATE	AECOM_BH62	24/02/11	Fill	VMP & PDA - Block 5																									<0.1	
Wells screened within marine sediments																														
MW40	MW40	AECOM_BH40	20/03/10	Fill + Marine Sediments	Block 4			5.2	0.468	<0.1	0.4	540	<0.5	0.016	1.9	4	14.1	0.2	995	0.437	<0.1	19.5	195			7860	1.7	0.021	9	<2	8
MW69	MW69	AECOM_BH69	19/03/10	Fill + Sandstone	Block 5			0.9	0.104	<0.1	<0.2	249	<0.5	<0.002	6.3	<1	10.3	<0.2	574	0.69	<0.1	2	216			6200	<0.5	<0.005	11	<4	194
MW69	MW69	AECOM_BH69	25/02/11	Fill + Sandstone	Block 5	0.01	<0.0005	0.6	0.123	<0.1	<0.2		<0.5		0.3	<1		<0.2		0.168	<0.1	<0.5		<0.002	<0.1		<0.5	0.012		<10	
MW69	MW 69 FILTRATE	AECOM_BH69	25/02/11	Fill + Sandstone	Block 5																									<0.1	
MW401	MW401	BH401	24/02/11	Marine Sediments	Block 5	<0.01	<0.0005	2.8	5.25	<0.1	1.6		<0.5		1.6	<1		0.2		0.406	<0.1	66.4		<0.002	<0.1		0.5	0.016		<9.8	
MW401	MW401 FILTRATE	BH401	24/02/11	Marine Sediments	Block 5																									<0.1	

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Well	MW3	MW6	MW7	MW10_Coff	MW15_Coff	MW61
Consultant	AECOM	AECOM	Coffey	Coffey	Coffey	AECOM_BH61
Field_ID	BH3	BH6	MW7POST	MW10	MW15	MW61
Location	MW3	MW6	MW7	MW10_Coffey	MW15_Coffey	AECOM_BH61
Sample Date	20/03/2010	20/03/2010	26/03/2008	26/03/2008	1/05/2008	20/03/2010
Area	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road	VMP & PDA - Hickson Road

Chemical Group	Chemical Name	output unit	EQL	Groundwater SSTC[VMP]						
PAHs	CPAH (TEF)	ug/L		1000	3.88	<4.44	12.264	1054.69	11,162	10.05
	PAH (Total)	µg/L			1049	<28	5442.5	34,451	383,602	434
	2-chloronaphthalene	µg/L	2		<2	<2				<2
	2-methylnaphthalene	µg/L	2		130	<2				57
	3-methylcholanthrene	µg/L	2		<2	<2				<2
	Acenaphthene	µg/L	0.2		12	<2	38.5	369	3870	6
	Acenaphthylene	µg/L	0.2	47,000	40	<2	246	1140	18,700	21
	Acetophenone	µg/L	2		<2	<2				<2
	Anthracene	µg/L	0.2		25	<2	34.3	1680	13,700	18
	Benz(a)anthracene	µg/L	0.2		8	<2	11.2	1150	10,400	16
	Benzo(a) pyrene	µg/L	0.2		3	<2	9.3	709	7750	8
	Benzo(b)&(k)fluoranthene	µg/L	4		5	<4				12
	Benzo(b)fluoranthene	µg/L	0.2				9.2	944	8330	
	Benzo(g,h,i)perylene	µg/L	0.2		<2	<2	4.2	260	4220	3
	Benzo(k)fluoranthene	µg/L	0.2				4.2	192	2930	
	Chrysene	µg/L	0.2		8	<2	9.2	829	7630	12
	Dibenz(a,h)anthracene	µg/L	0.2		<2	<2	<1.9	80.4	822	<2
	Fluoranthene	µg/L	0.2		38	<2	39.8	2420	25,900	48
	Fluorene	µg/L	0.2		57	<2	86.5	1670	19,100	26
	Indeno(1,2,3-c,d)pyrene	µg/L	0.2		<2	<2	3.7	258	3050	3
	Naphthalene	µg/L	0.2	1300	699	<2	4800	15,800	192,000	150
	Phenanthrene	µg/L	0.2		125	<2	110	4390	42,000	79
	Pyrene	µg/L	0.2		34	<2	36.4	2560	23,200	44
TPH	TPH C15-C36	mg/L			3.04	<0.15	47.57	182.6	959	1.79
	TPH C10 - C14	µg/L	50	17,000	2900	<50	830,000	528,000	494,000	860
	TPH C15-C28	µg/L	100	220,000	2780	<100	46,900	152,000	754,000	1420
	TPH C29-C36	µg/L	50	250,000	260	<50	670	30,600	205,000	370
	TPH C6 - C9	µg/L	20		40	<20	30,300	9690	55,800	520
	TPH+C10 - C36 (Sum of total)	µg/L	50		5940	<50	877,570	710,600	1,453,000	2650
BTEX	Total Xylene (ESDAT)	µg/L			12	<4	1742	611	2841	96
	Benzene	µg/L	1	2100	11	<1	25,200	5450	40,200	16
	Ethylbenzene	µg/L	2		5	<2	159	52	<500	20
	Toluene	µg/L	2		<5	<5	6440	2140	7890	102
	Xylene (m & p)	µg/L	2		7	<2	1150	331	2000	66
	Xylene (o)	µg/L	2		5	<2	592	280	841	30
Inorganics	Ammonia as N	mg/L	0.01	150	1.81	<0.1	294	348	23.3	0.12

Notes
mg/L - milligrams pre litre
µg/L - micrograms per litre
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC [VMP]- Site Specific Target Criteria for the VMP Area
shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)

TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
**TPH C10-C36 aliphatic and aromatic
note TPH in table not speciated

						PAHs																										
						CPAH (TEF)	PAH (ESDAT TOTAL)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Polycyclic aromatic hydrocarbons EPA448	Pyrene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								0.5	0.01	0.01	0.01	0.01	0.5	0.01	0.01	0.01	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.5	0.01	0.5	0.01
SSTC[VMP]						67																										
Field ID	**Sample Depth**	**Matrix Type**	**Area**	**Location**	**Sample Date**																											
BH022_0.3-0.5	0.3-0.5	Fill	Outside Investigation Area	BH022	10/05/2006	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<0.5
BH023_1.5-1.95	1.5-1.95	Fill	Outside Investigation Area	BH023	10/05/2006	0.05	0.5	-	-	-	<0.5	<0.5	-	<0.5	0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<0.5
BH025_0.3-0.5	0.3-0.5	Fill	Outside Investigation Area	BH025	10/05/2006	1.017	9.4	-	-	-	<0.5	<0.5	-	<0.5	0.9	0.7	-	1.3	0.5	0.8	1.2	<0.5	1.6	<0.5	<0.5	<0.5	-	0.7	-	1.7
BH027_0.3-0.5	0.3-0.5	Fill	Outside Investigation Area	BH027	12/05/2006	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<0.5
BH035_ 0.3-0.5	0.3-0.5	Fill	Block 4 - Proposed Southern Cove	BH035	18/05/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH042_ 0.3-0.5	0.3-0.5	Fill	Block 5	BH042	23/05/2006	6.057	53.5	-	-	-	<0.5	1	-	1.9	4.2	3.9	-	2.8	2.6	3.6	4.1	0.8	9.2	0.7	2.3	0.7	-	6.8	-	8.9
BH042_ 1.5-1.7	1.5-1.7	Fill	Block 5	BH042	23/05/2006	2.656	20.6	-	-	-	<0.5	0.8	-	<0.5	2.6	1.9	-	1.9	1	1.6	2.6	<0.5	2.7	<0.5	1.1	<0.5	-	0.9	-	3.5
BH044_ 0.3-0.5	0.3-0.5	Fill	Block 5	BH044	23/05/2006	19.602	146.2	-	-	-	<0.5	3.1	-	3.8	12.7	12.7	-	10.6	8.3	11.2	11.9	2.5	24	<0.5	7.5	1.4	-	12.2	-	24.3
BH045_ 0.3-0.5	0.3-0.5	Fill	Block 5	BH045	24/05/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH046_ 1.5-1.95	1.5-1.95	Fill	Outside Investigation Area	BH046	24/05/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH049_ 0.3-0.5	0.3-0.5	Fill	ORWN - Proposed Southern Cove	BH049	25/05/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH050-0.3-0.5	0.3-0.5	Fill	Outside Investigation Area	BH050	26/05/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH050-1.5-1.8	1.5-1.8	Fill	Outside Investigation Area	BH050	26/05/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH051-1.5-1.7	1.5-1.7	Fill	Outside Investigation Area	BH051	26/05/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH053-1.5-1.95	1.5-1.95	Fill	ORWN - Public Domain Blocks 4&5	BH053	29/05/2006	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<0.5
BH054-1.5-1.6	1.5-1.6	Fill	ORWN - Public Domain Blocks 4&5	BH054	29/05/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH055-0.8-1.0	0.8-1	Fill	Block 4	BH055	30/05/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH055-1.8-2.0	1.8-2	Fill	Block 4	BH055	30/05/2006	1.176	9.2	-	-	-	<0.5	<0.5	-	<0.5	0.8	0.9	-	1.2	0.8	<0.5	0.8	<0.5	1.5	<0.5	0.6	<0.5	-	1	-	1.6
BH063-1.5-1.65	1.5-1.65	Fill	ORWN - Public Domain Blocks 4&5	BH063	1/06/2006	12.731	104.9	-	-	-	1.1	1.1	-	3.2	8.1	8.8	-	10.4	6.3	3.6	7.8	1.1	18.3	1.6	4.8	0.7	-	9.1	-	18.9
BH064-1.5-1.95	1.5-1.95	Fill	ORWN - Public Domain Blocks 4&5	BH064	1/06/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH066-0.3-0.5	0.3-0.5	Fill	Block 5	BH066	1/06/2006	1.275	9.4	-	-	-	<0.5	<0.5	-	<0.5	0.9	1	-	1.2	0.7	<0.5	0.8	<0.5	1.6	<0.5	0.5	<0.5	-	1	-	1.7
BH066-1.5-1.95	1.5-1.95	Fill	Block 5	BH066	1/06/2006	0.05	3.4	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	0.5	<0.5	<0.5	<0.5	<0.5	1	<0.5	<0.5	<0.5	-	0.9	-	1
BH068-0.3-0.5	0.3-0.5	Fill	Block 4	BH068	1/06/2006	1.638	13.1	-	-	-	<0.5	<0.5	-	<0.5	1.4	1.2	-	1.6	0.7	0.6	1.1	<0.5	2.5	<0.5	0.6	<0.5	-	1	-	2.4
BH076_0.3-0.5	0.3-0.5	Fill	ORWN - Public Domain Blocks 4&5	BH076	6/06/2006	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<0.5
BH076_1.5-1.95	1.5-1.95	Fill	ORWN - Public Domain Blocks 4&5	BH076	6/06/2006	0.06	2.9	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	0.6	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	-	0.5	-	0.9
BH077_0.3-0.5	0.3-0.5	Fill	Block 5	BH077	6/06/2006	0.63	5	-	-	-	<0.5	<0.5	-	<0.5	0.6	0.5	-	0.7	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	-	0.8	-	1.2
BH078_1.5-1.95	1.5-1.95	Fill	Block 5	BH078	6/06/2006	0.881	7.7	-	-	-	<0.5	<0.5	-	<0.5	0.8	0.7	-	0.9	0.5	<0.5	0.6	<0.5	1.8	<0.5	<0.5	<0.5	-	0.7	-	1.7
BH079_0.3-0.5	0.3-0.5	Fill	Block 5	BH079	6/06/2006	1.388	15.5	-	-	-	<0.5	0.8	-	0.6	1.2	1	-	1.3	0.8	0.6	1	<0.5	2.7	<0.5	0.6	<0.5	-	2.3	-	2.6
BH079_1.5-1.95	1.5-1.95	Fill	Block 5	BH079	6/06/2006	2.175	28.7	-	-	-	0.6	<0.5	-	1.8	2	1.6	-	1.9	1	0.8	1.5	<0.5	5.4	0.7	0.8	<0.5	-	5.7	-	4.9
BH116 1.5_1.95	1.5-1.95	Fill	ORWN - Proposed Southern Cove	BH116	27/06/2006	0.07	2.5	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	0.7	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	-	<0.5	-	0.9
BH116 1.5_1.95	1.5-1.95	Fill	ORWN - Proposed Southern Cove	BH116	28/06/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH128_1.5-1.7	1.5-1.7	Fill	Outside Investigation Area	BH128	3/07/2006	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<0.5
BH129_0.4-0.6	0.4-0.6	Fill	Outside Investigation Area	BH129	5/07/2006	0.982	7.1	-	-	-	<0.5	<0.5	-	<0.5	0.8	0.8	-	0.9	0.5	<0.5	0.7	<0.5	1.4	<0.5	<0.5	<0.5	-	0.6	-	1.4
BH137 1.5_1.95	1.5-1.95	Fill	Block 4	BH137	6/07/2006	0.56	2.7	-	-	-	<0.5	<0.5	-	<0.5	<0.5	0.5	-	0.6	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	-	<0.5	-	0.8
BH142 1.5_1.95	1.5-1.95	Fill	Block 4 - Proposed Southern Cove	BH142	10/07/2006	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<0.5
BH404_0.4-0.5	0.4-0.5	Fill	Block 4	BH404	8/02/2011	8.963	86.1	-	-	-	<0.5	3	-	3.7	6.4	6.2	-	7	3.2	2.5	5.1	0.8	17.4	1.5	2.9	1.4	-	8	-	17
BH41_1.0-1.4	1-1.4	Fill	Block 4 - Proposed Southern Cove	AECOM_BH41	4/03/2010	<1.21	<8	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
BH46-1.0-1.2	1-1.2	Fill	ORWN - Proposed Southern Cove	AECOM_BH46	23/02/2010	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<0.5
BH48-1.0-1.2	1-1.2	Fill	Block 4	AECOM_BH48	22/02/2010	0.887	7.7	-	-	-	<0.5	<0.5	-	<0.5	0.9	0.7	-	0.9	<0.5	<0.5	0.7	<0.5	1.7	<0.5	<0.5	<0.5	-	1	-	1.8
BH517	0.5	Fill	Block 5 (Non-DECC)	JBS_BH517	23/05/2012	-	-	-	-	-	0.1	2.1	-	2.1	7.9	9.6	14	-	5	-	7.5	1.2	13	0.5	5	0.9	-	5.7	-	14
BH517	1	Fill	Block 5 (Non-DECC)	JBS_BH517	23/05/2012	-	-	-	-	-	0.3	3.7	-	3.6	13	15	21	-	7.1	-	12	1.8	22	1.1	7	1.6	-	11	-	24
BH517	1.5	Fill	Block 5 (Non-DECC)	JBS_BH517	23/05/2012	-	-	-	-	-	0.2	2.9	-	3.2	8.7	10	14	-	4.7	-	7.8	1.2	16	1	4.6	1.2	-	9.5	-	17
BH518	0.1-0.2	Fill	Block 5 (Non-DECC)	JBS_BH518	18/05/2012	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.05	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	0.1	-	<0.1
BH518	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH518	18/05/2012	-	-	-	-	-	0.4	0.7	-	1	3.4	3.8	5.9	-	2.1	-	3.4	0.5	7	0.4	2.3	0.8	-	4	-	7.1
BH518	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH518	18/05/2012	-	-	-	-	-	0.8	0.8	-	3.3	6.9	6.6	9.9	-	3.1	-	6.2	0.8	15	1.2	3.7	0.5	-	12	-	13
BH529D	0.6	Fill	Block 5 (Non-DECC)	JBS_BH529D	14/05/2012	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.2	0.27	0.4	-	0.1	-	0.2	<0.1	0.4	<0.1	0.1	<0.1	-	0.3	-	0.5
BH529D	1	Fill	Block 5 (Non-DECC)	JBS_BH529D	14/05/2012	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.2	0.25	0.4	-	0.1	-	0.2	<0.1	0.5	<0.1	0.1	<0.1	-	0.3	-	0.5
BH539	0.15-0.25	Fill	Block 5 (Non-DECC)	JBS_BH539	18/05/2012	-	-	-	-	-	<0.1	<0.1	-	0.1	0.3	0.34	0.5	-	0.2	-	0.3	<0.1	0.6	<0.1	0.2	<0.1	-	0.3	-	0.6
BH539	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH539	18/05/2012	-	-	-	-	-	<0.1	0.2	-	0.2	0.7	0.66	1	-	0.4	-	0.6	<0.1	1.3	<0.1	0.4	<0.1	-	0.9	-	1.3
BH539	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH539	18/05/2012	-	-	-	-	-	0.2	0.6	-	1.1	3.4	4	5.7	-	2.2	-	3.3	0.5	7.3	0.3	2.3	0.2	-	3.8	-	7.2
BH540D	0.15-0.25	Fill	Block 5 (Non-DECC)	JBS_BH540D	17/05/2012	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.05	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1
BH540D	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH540D	17/05/2012	-	-	-	-	-	<0.1	0.3	-	0.3	1.2	1.3	1.7	-	0.7	-	1.1	0.1	2.5	<0.1	0.7	<0.1	-	1.3	-	2.6
BH540D	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH540D	17/05/2012	-	-	-	-	-	<0.1	0.2	-	0.2	0.6	0.6	0.8	-	0.3	-	0.5	<0.1	1.4	0.1	0.3	<0.1	-	0.9	-	1.4
BH540D	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH540D	17/05/2012	-	-	-	-	-	0.9	0.2	-	1.3	2	2.1	2.8	-	1.1	-	1.8	0.2	5.1	0.8	1.1	0.4	-	4.2	-	5.1
BH541D	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH541D	19/05/2012	-	-	-	-	-	0.1	0.5	-	0.6	1.3	1.3	1.9	-	0.4	-	1.1	0.1	2.7	0.3	0.5	0.5	-	1.9	-	2.6
BH541D	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH541D	19/05/2012	-	-	-	-	-	<0.1	0.3	-	0.5	1.5	1.5	2.1	-	0.5	-	1.3	0.1	2.6	0.2	0.6	0.2	-	1.6	-	2.6
BH541D	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH541D	19/05/2012	-	-	-	-	-	0.9	5.6	-	7.2	14	12	18	-	3.3	-	11	1.1	31	3.5	4.6	0.8	-	27	-	27

						PAHs																										
						CPAH (TEF)	PAH (ESDAT TOTAL)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Polycyclic aromatic hydrocarbons EPA448	Pyrene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								0.5	0.01	0.01	0.01	0.01	0.5	0.01	0.01	0.01	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.5	0.01	0.5	0.01
SSTC[VMP]						67																										
Field ID	**Sample Depth**	**Matrix Type**	**Area**	**Location**	**Sample Date**																											
BH541D	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH541D	19/05/2012	-	-	-	-	-	3.6	1	-	6.5	12	11	16	-	3.6	-	10	1.1	27	3.8	4.6	0.3	-	19	-	27
BH542	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH542	19/05/2012	-	-	-	-	-	<0.1	0.2	-	0.4	1.1	1.2	1.9	-	0.5	-	1.2	0.1	2.2	0.2	0.6	0.1	-	1.5	-	2.2
BH542	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH542	19/05/2012	-	-	-	-	-	0.1	0.3	-	0.7	1.7	1.8	2.6	-	0.7	-	1.5	0.2	3.2	0.4	0.8	0.2	-	2.4	-	3.4
BH542	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH542	19/05/2012	-	-	-	-	-	4.5	1.4	-	7.6	10	10	14	-	3.4	-	9	0.9	29	4.4	4	1.1	-	26	-	26
BH542	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH542	19/05/2012	-	-	-	-	-	0.8	0.2	-	1.2	1.3	1.2	1.7	-	0.4	-	1.1	0.1	4	0.7	0.5	0.5	-	3.4	-	3.6
BH543	0.6-0.7	Fill	Block 5 (Non-DECC)	JBS_BH543	15/05/2012	-	-	-	-	-	0.2	0.8	-	1.1	2.4	2.4	3.2	-	1	-	2	0.3	4.9	0.6	1.1	0.8	-	3.7	-	4.1
BH543	1.5-1.6	Fill	Block 5 (Non-DECC)	JBS_BH543	15/05/2012	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.1	0.15	0.2	-	<0.1	-	0.1	<0.1	0.3	<0.1	<0.1	<0.1	-	0.3	-	0.3
BH543	1-1.1	Fill	Block 5 (Non-DECC)	JBS_BH543	15/05/2012	-	-	-	-	-	0.1	0.5	-	0.8	1.5	1.4	1.8	-	0.6	-	1.2	0.1	3.4	0.4	0.6	0.8	-	3.2	-	3.4
BH544D	0.55-0.65	Fill	ORWN - Public Domain Blocks 4&5	JBS_BH544D	16/05/2012	-	-	-	-	-	<0.1	<0.1	-	0.1	0.3	0.3	0.4	-	0.2	-	0.3	<0.1	0.6	<0.1	0.2	<0.1	-	0.4	-	0.6
BH544D	0.9-1	Fill	ORWN - Public Domain Blocks 4&5	JBS_BH544D	16/05/2012	-	-	-	-	-	<0.1	0.1	-	0.2	0.8	0.99	1.2	-	0.6	-	0.6	0.1	1.6	<0.1	0.5	<0.1	-	0.8	-	1.7
BH544D	1.4-1.5	Fill	ORWN - Public Domain Blocks 4&5	JBS_BH544D	16/05/2012	-	-	-	-	-	<0.1	<0.1	-	0.1	0.4	0.42	0.6	-	0.2	-	0.4	<0.1	0.8	<0.1	0.2	<0.1	-	0.5	-	0.9
BH544D	1.9-2	Fill	ORWN - Public Domain Blocks 4&5	JBS_BH544D	16/05/2012	-	-	-	-	-	<0.1	<0.1	-	0.1	0.5	0.57	0.8	-	0.3	-	0.4	<0.1	1	<0.1	0.3	<0.1	-	0.5	-	1.1
BH545	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH545	24/05/2012	-	-	-	-	-	0.1	0.7	-	1.4	4.5	4.5	6.3	-	2.1	-	4.4	0.4	9.1	0.4	2	0.3	-	6.3	-	9.3
BH545	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH545	24/05/2012	-	-	-	-	-	0.2	0.9	-	1.1	2.7	2.9	4.1	-	1.3	-	2.5	0.3	5.8	0.5	1.4	0.5	-	4.4	-	5.6
BH545	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH545	24/05/2012	-	-	-	-	-	0.3	1.4	-	2	3.7	3.9	5.3	-	1.8	-	3.2	0.4	8.7	1.1	2	0.7	-	7.1	-	7.9
BH545	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH545	24/05/2012	-	-	-	-	-	0.1	1	-	1.3	2.3	2.9	3.8	-	2	-	2.1	0.3	5.6	0.7	1.8	0.3	-	4.2	-	5.3
BH546	0.5	Fill	Block 5 (Non-DECC)	JBS_BH546	23/05/2012	-	-	-	-	-	<0.1	0.1	-	0.2	0.5	0.5	0.7	-	0.2	-	0.4	<0.1	0.9	<0.1	0.2	<0.1	-	0.5	-	0.9
BH546	1	Fill	Block 5 (Non-DECC)	JBS_BH546	23/05/2012	-	-	-	-	-	<0.1	0.2	-	0.4	1	1.1	1.5	-	0.4	-	1	<0.1	2.5	0.1	0.4	0.2	-	1.4	-	2.3
BH546	1.5	Fill	Block 5 (Non-DECC)	JBS_BH546	23/05/2012	-	-	-	-	-	<0.1	0.1	-	0.2	0.5	0.84	1.1	-	0.5	-	0.6	<0.1	1.1	<0.1	0.4	<0.1	-	0.6	-	1.1
BH547	0.5	Fill	Block 5 (Non-DECC)	JBS_BH547	23/05/2012	-	-	-	-	-	0.7	5.8	-	7.3	16	18	26	-	7.4	-	15	2	31	3.6	8.7	2.8	-	21	-	29
BH547	1	Fill	Block 5 (Non-DECC)	JBS_BH547	23/05/2012	-	-	-	-	-	1.1	8.7	-	11	24	30	37	-	10	-	22	2.8	64	5.9	12	4.2	-	33	-	61
BH547	1.5	Fill	Block 5 (Non-DECC)	JBS_BH547	23/05/2012	-	-	-	-	-	0.6	5.7	-	7.4	17	19	27	-	7.5	-	16	2	31	3.6	8.7	2.8	-	21	-	31
BH548	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH548	24/05/2012	-	-	-	-	-	<0.1	0.6	-	0.6	1.7	1.9	2.7	-	0.9	-	1.6	0.2	3.5	0.2	1	0.3	-	2.2	-	3.4
BH548	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH548	24/05/2012	-	-	-	-	-	<0.1	0.3	-	0.3	0.8	0.85	1.3	-	0.5	-	0.8	0.1	1.6	0.1	0.5	0.1	-	1.2	-	1.6
BH548	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH548	24/05/2012	-	-	-	-	-	<0.1	0.3	-	0.3	1	1.1	1.6	-	0.6	-	0.9	0.1	2	0.1	0.6	0.2	-	1.4	-	2
BH548	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH548	24/05/2012	-	-	-	-	-	<0.1	0.2	-	0.3	0.9	1.3	1.8	-	0.9	-	0.9	0.1	2	<0.1	0.8	<0.1	-	2	-	2
BH549	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH549	25/05/2012	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.2	0.24	0.4	-	0.2	-	0.3	<0.1	0.4	<0.1	0.2	<0.1	-	0.2	-	0.4
BH549	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH549	25/05/2012	-	-	-	-	-	<0.1	<0.1	-	0.3	0.9	1.1	1.6	-	0.6	-	0.9	<0.1	1.6	0.1	0.7	<0.1	-	1	-	1.6
BH550	0.15-0.25	Fill	Block 5 (Non-DECC)	JBS_BH550	25/05/2012	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	<0.05	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	<0.1
BH550	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH550	25/05/2012	-	-	-	-	-	<0.1	0.2	-	0.3	1	1.1	1.6	-	0.6	-	0.9	<0.1	2	0.1	0.6	<0.1	-	1.1	-	2
BH550	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH550	25/05/2012	-	-	-	-	-	<0.1	<0.1	-	0.2	0.8	1.1	1.5	-	0.6	-	0.7	0.1	1.1	<0.1	0.6	<0.1	-	0.5	-	1.5
BH551	0.45-0.55	Fill	Block 5 (Non-DECC)	JBS_BH551	24/05/2012	-	-	-	-	-	0.2	1.4	-	1.7	4	4.4	6.2	-	1.9	-	3.7	0.5	8.7	1	2.1	1	-	5.7	-	8.2
BH551	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH551	24/05/2012	-	-	-	-	-	0.4	2.7	-	3.5	8.4	9.1	13	-	3.7	-	7.9	1	17	1.5	4.2	1.5	-	12	-	16
BH551	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH551	24/05/2012	-	-	-	-	-	0.2	1	-	1.3	3.1	3.3	4.6	-	1.3	-	2.8	0.3	6.6	0.6	1.5	0.6	-	4.4	-	6.3
BH551	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH551	24/05/2012	-	-	-	-	-	<0.1	<0.1	-	0.1	0.2	0.22	0.3	-	0.1	-	0.2	<0.1	0.5	<0.1	0.1	<0.1	-	0.5	-	0.5
BH552	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH552	25/05/2012	-	-	-	-	-	<0.1	0.3	-	0.6	2.1	2.1	3.1	-	0.9	-	1.9	0.1	4.2	0.2	1.1	0.1	-	2.6	-	4.2
BH552	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH552	25/05/2012	-	-	-	-	-	<0.1	0.2	-	0.3	1.1	1.1	1.7	-	0.5	-	1	<0.1	2	<0.1	0.6	<0.1	-	1.2	-	2
BH552	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH552	25/05/2012	-	-	-	-	-	<0.1	0.2	-	0.3	1.3	1.4	2	-	0.6	-	1.2	<0.1	2.5	0.1	0.7	<0.1	-	1.3	-	2.6
BH69_1.0-1.15	1-1.15	Fill	Block 5	AECOM_BH69	26/02/2010	4.937	68.8	-	<0.5	-	<0.5	2.3	-	3.3	5.8	3.4	-	5.8	1.9	1.7	4.8	<0.5	11.6	1.8	1.4	2.9	68.8	11.3	-	10.8
BH70_0.1-0.2	0.1-0.2	Fill	Block 5	AECOM_BH70	3/03/2010	<1.21	<8	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
BH71_0.08-0.15	0.08-0.15	Fill	Outside Investigation Area	AECOM_BH71	3/03/2010	<1.21	<8	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
BH72_0.15-0.25	0.15-0.25	Fill	ORWN - Public Domain Blocks 4&5	AECOM_BH72	25/02/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH72_1.0-1.2	1-1.2	Fill	ORWN - Public Domain Blocks 4&5	AECOM_BH72	3/03/2010	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	<0.5
BH74_1.0-1.12	1-1.12	Fill	Outside Investigation Area	AECOM_BH74	3/03/2010	3.407	84.5	<0.5	2.8	<0.5	1.3	3.1	<0.5	5.4	4.6	2.8	4	-	1	-	3.7	<0.5	17.1	4.2	1	5.2	-	20.3	-	14.8
BH75_1.0-1.2	1-1.2	Fill	Outside Investigation Area	AECOM_BH75	25/02/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC[VMP] - Site Specific Target Criteria for the VMP Area
Shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

						TPH								BTEX					
						TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	C10 - C40 (Sum of total)	TPH C6-C10	Total Xylene (ESDAT)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL							50	100	100	10	50	50	10	0.5	0.1	0.2	0.2	0.2	0.2
SSTC[VMP]							54000	72000	21,000						380				
Field ID	**Sample Depth**	**Matrix Type**	**Area**	**Location**	**Sample Date**														
BH022_0.3-0.5	0.3-0.5	Fill	Outside Investigation Area	BH022	10/05/2006	120	<50	<100	120	<2	120	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BH023_1.5-1.95	1.5-1.95	Fill	Outside Investigation Area	BH023	10/05/2006	100	<50	100	<100	<2	100	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BH025_0.3-0.5	0.3-0.5	Fill	Outside Investigation Area	BH025	10/05/2006	110	<50	110	<100	<2	110	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BH027_0.3-0.5	0.3-0.5	Fill	Outside Investigation Area	BH027	12/05/2006	<200	<50	<100	<100	<2	<250	-	-	<0.01	<0.2	<0.2	<0.2	<0.2	<0.2
BH035_ 0.3-0.5	0.3-0.5	Fill	Block 4 - Proposed Southern Cove	BH035	18/05/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH042_ 0.3-0.5	0.3-0.5	Fill	Block 5	BH042	23/05/2006	150	<50	150	<100	<2	150	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH042_ 1.5-1.7	1.5-1.7	Fill	Block 5	BH042	23/05/2006	170	<50	170	<100	<2	170	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH044_ 0.3-0.5	0.3-0.5	Fill	Block 5	BH044	23/05/2006	690	<50	410	280	<2	690	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH045_0.3-0.5	0.3-0.5	Fill	Block 5	BH045	24/05/2006	360	<50	190	170	<2	360	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH046_1.5-1.95	1.5-1.95	Fill	Outside Investigation Area	BH046	24/05/2006	700	<50	380	320	<2	700	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH049_0.3-0.5	0.3-0.5	Fill	ORWN - Proposed Southern Cove	BH049	25/05/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH050-0.3-0.5	0.3-0.5	Fill	Outside Investigation Area	BH050	26/05/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH050-1.5-1.8	1.5-1.8	Fill	Outside Investigation Area	BH050	26/05/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH051-1.5-1.7	1.5-1.7	Fill	Outside Investigation Area	BH051	26/05/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH053-1.5-1.95	1.5-1.95	Fill	ORWN - Public Domain Blocks 4&5	BH053	29/05/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH054-1.5-1.6	1.5-1.6	Fill	ORWN - Public Domain Blocks 4&5	BH054	29/05/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH055-0.8-1.0	0.8-1	Fill	Block 4	BH055	30/05/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH055-1.8-2.0	1.8-2	Fill	Block 4	BH055	30/05/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH063-1.5-1.65	1.5-1.65	Fill	ORWN - Public Domain Blocks 4&5	BH063	1/06/2006	820	<50	420	400	<2	820	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH064-1.5-1.95	1.5-1.95	Fill	ORWN - Public Domain Blocks 4&5	BH064	1/06/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH066-0.3-0.5	0.3-0.5	Fill	Block 5	BH066	1/06/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH066-1.5-1.95	1.5-1.95	Fill	Block 5	BH066	1/06/2006	370	<50	160	210	<2	370	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH068-0.3-0.5	0.3-0.5	Fill	Block 4	BH068	1/06/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH076_0.3-0.5	0.3-0.5	Fill	ORWN - Public Domain Blocks 4&5	BH076	6/06/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH076_1.5-1.95	1.5-1.95	Fill	ORWN - Public Domain Blocks 4&5	BH076	6/06/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH077_0.3-0.5	0.3-0.5	Fill	Block 5	BH077	6/06/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH078_1.5-1.95	1.5-1.95	Fill	Block 5	BH078	6/06/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH079_0.3-0.5	0.3-0.5	Fill	Block 5	BH079	6/06/2006	110	<50	110	<100	<2	110	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH079_1.5-1.95	1.5-1.95	Fill	Block 5	BH079	6/06/2006	250	<50	150	100	<2	250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH116 1.5_1.95	1.5-1.95	Fill	ORWN - Proposed Southern Cove	BH116	27/06/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH116 1.5_1.95	1.5-1.95	Fill	ORWN - Proposed Southern Cove	BH116	28/06/2006	760	<50	350	410	<2	760	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH128_1.5-1.7	1.5-1.7	Fill	Outside Investigation Area	BH128	3/07/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH129_0.4-0.6	0.4-0.6	Fill	Outside Investigation Area	BH129	5/07/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH137 1.5_1.95	1.5-1.95	Fill	Block 4	BH137	6/07/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH142 1.5_1.95	1.5-1.95	Fill	Block 4 - Proposed Southern Cove	BH142	10/07/2006	<200	<50	<100	<100	<2	<250	-	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2
BH404_0.4-0.5	0.4-0.5	Fill	Block 4	BH404	8/02/2011	490	<50	280	210	<10	490	-	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH41_1.0-1.4	1-1.4	Fill	Block 4 - Proposed Southern Cove	AECOM_BH41	4/03/2010	<200	<50	<100	<100	<10	<50	-	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH46-1.0-1.2	1-1.2	Fill	ORWN - Proposed Southern Cove	AECOM_BH46	23/02/2010	<200	<50	<100	<100	<10	<50	-	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH48-1.0-1.2	1-1.2	Fill	Block 4	AECOM_BH48	22/02/2010	350	<50	200	150	<10	350	-	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH517	0.5	Fill	Block 5 (Non-DECC)	JBS_BH517	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH517	1	Fill	Block 5 (Non-DECC)	JBS_BH517	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH517	1.5	Fill	Block 5 (Non-DECC)	JBS_BH517	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH518	0.1-0.2	Fill	Block 5 (Non-DECC)	JBS_BH518	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH518	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH518	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH518	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH518	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH529D	0.6	Fill	Block 5 (Non-DECC)	JBS_BH529D	14/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH529D	1	Fill	Block 5 (Non-DECC)	JBS_BH529D	14/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH539	0.15-0.25	Fill	Block 5 (Non-DECC)	JBS_BH539	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH539	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH539	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH539	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH539	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH540D	0.15-0.25	Fill	Block 5 (Non-DECC)	JBS_BH540D	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH540D	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH540D	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH540D	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH540D	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH540D	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH540D	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH541D	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH541D	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH541D	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH541D	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH541D	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH541D	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-

						TPH								BTEX					
						TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	C10 - C40 (Sum of total)	TPH C6-C10	Total Xylene (ESDAT)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL							50	100	100	10	50	50	10	0.5	0.1	0.2	0.2	0.2	0.2
SSTC[VMP]							54000	72000	21,000						380				
Field ID	**Sample Depth**	**Matrix Type**	**Area**	**Location**	**Sample Date**														
BH541D	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH541D	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH542	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH542	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH542	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH542	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH542	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH542	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH542	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH542	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH543	0.6-0.7	Fill	Block 5 (Non-DECC)	JBS_BH543	15/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH543	1.5-1.6	Fill	Block 5 (Non-DECC)	JBS_BH543	15/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH543	1-1.1	Fill	Block 5 (Non-DECC)	JBS_BH543	15/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH544D	0.55-0.65	Fill	ORWN - Public Domain Blocks 4&5	JBS_BH544D	16/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH544D	0.9-1	Fill	ORWN - Public Domain Blocks 4&5	JBS_BH544D	16/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH544D	1.4-1.5	Fill	ORWN - Public Domain Blocks 4&5	JBS_BH544D	16/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH544D	1.9-2	Fill	ORWN - Public Domain Blocks 4&5	JBS_BH544D	16/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH545	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH545	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH545	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH545	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH545	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH545	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH545	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH545	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH546	0.5	Fill	Block 5 (Non-DECC)	JBS_BH546	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH546	1	Fill	Block 5 (Non-DECC)	JBS_BH546	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH546	1.5	Fill	Block 5 (Non-DECC)	JBS_BH546	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH547	0.5	Fill	Block 5 (Non-DECC)	JBS_BH547	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH547	1	Fill	Block 5 (Non-DECC)	JBS_BH547	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH547	1.5	Fill	Block 5 (Non-DECC)	JBS_BH547	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH548	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH548	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH548	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH548	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH548	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH548	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH548	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH548	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH549	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH549	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH549	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH549	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH550	0.15-0.25	Fill	Block 5 (Non-DECC)	JBS_BH550	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH550	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH550	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH550	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH550	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH551	0.45-0.55	Fill	Block 5 (Non-DECC)	JBS_BH551	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH551	0.9-1	Fill	Block 5 (Non-DECC)	JBS_BH551	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH551	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH551	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH551	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH551	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH552	0.4-0.5	Fill	Block 5 (Non-DECC)	JBS_BH552	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH552	1.4-1.5	Fill	Block 5 (Non-DECC)	JBS_BH552	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH552	1.9-2	Fill	Block 5 (Non-DECC)	JBS_BH552	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH69_1.0-1.15	1-1.15	Fill	Block 5	AECOM_BH69	26/02/2010	460	<50	260	200	<10	460	-	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH70_0.1-0.2	0.1-0.2	Fill	Block 5	AECOM_BH70	3/03/2010	<200	<50	<100	<100	<10	<50	-	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH71_0.08-0.15	0.08-0.15	Fill	Outside Investigation Area	AECOM_BH71	3/03/2010	<200	<50	<100	<100	<10	<50	-	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH72_0.15-0.25	0.15-0.25	Fill	ORWN - Public Domain Blocks 4&5	AECOM_BH72	25/02/2010	<200	<50	<100	<100	<10	<50	-	-	-	-	-	-	-	-
BH72_1.0-1.2	1-1.2	Fill	ORWN - Public Domain Blocks 4&5	AECOM_BH72	3/03/2010	<200	<50	<100	<100	<10	<50	-	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH74_1.0-1.12	1-1.12	Fill	Outside Investigation Area	AECOM_BH74	3/03/2010	490	<50	340	150	<10	490	-	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5
BH75_1.0-1.2	1-1.2	Fill	Outside Investigation Area	AECOM_BH75	25/02/2010	<200	<50	<100	<100	<10	<50	-	-	-	-	-	-	-	-

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC[VMP] - Site Specific Target Criteria for the VMP Area
Shading denotes concentration greater than criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

						PAHs																						
					Ammonia as N	CPAH (TEF)	PAH (TOTAL)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								0.5	0.01	0.01	0.01	0.01	0.5	0.01	0.01	0.01	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Tar Containing Material (TCM) Criteria							**2000**									**150**												
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**																								
AECOM_BH01	BH01_17.65-17.75	17.65-17.75	ORWN - Proposed Southern Cove	12/03/2009	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH01	BH01_25.0-25.1	25-25.1	ORWN - Proposed Southern Cove	12/10/2009	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH01	BH01_4.0-4.1	4-4.1	ORWN - Proposed Southern Cove	12/02/2009	-	1.65	23.6	-	-	-	<0.5	<0.5	-	1.5	1.9	1.2	-	1.2	0.6	0.7	1.4	<0.5	4.9	<0.5	0.5	<0.5	5.3	4.4
AECOM_BH01	BH01_7.0-7.1	7-7.1	ORWN - Proposed Southern Cove	12/02/2009	-	1.641	18	-	-	-	<0.5	<0.5	-	0.8	1.8	1.3	-	1.4	0.6	<0.5	1.5	<0.5	4.1	<0.5	<0.5	<0.5	2.3	4.2
BH021	BH021 16.0-16.5	16-16.5	ORWN - Public Domain Blocks 4&5	9/05/2006	-	5.123	150.8	-	-	-	1.5	8.9	-	7.3	5.1	3.8	-	4.5	1.4	1.8	3.9	<0.5	13.8	8.9	1.3	56.2	20.8	11.6
BH025	BH025_8.5-9.0	8.5-9	Outside Investigation Area	10/05/2006	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH035	BH035_ 4.0-4.5	4-4.5	Block 4 - Proposed Southern Cove	18/05/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH042	BH042_ 6.0-6.5	6-6.5	Block 5	23/05/2006	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH044	BH044_ 2.3-2.7	2.3-2.7	Block 5	23/05/2006	-	<1.21	1.2	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	0.6
BH044	BH044_ 4.0-4.5	4-4.5	Block 5	23/05/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH045	BH045_3.0-3.45	3-3.45	Block 5	24/05/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH053	BH053-3.0-3.25	3-3.25	ORWN - Public Domain Blocks 4&5	29/05/2006	-	0.06	2	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	0.6	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	0.9
BH055	BH055-3.3-3.5	3.3-3.5	Block 4	30/05/2006	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH063	BH063-2.8-3.0	2.8-3	ORWN - Public Domain Blocks 4&5	1/06/2006	-	1.275	10.8	-	-	-	<0.5	<0.5	-	<0.5	1	1	-	1.1	0.6	<0.5	0.9	<0.5	2.2	<0.5	0.5	<0.5	1.3	2.2
BH068	BH068-3.0-3.45	3-3.45	Block 4	1/06/2006	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH068	BH068-9.5-10.0	9.5-10	Block 4	1/06/2006	-	<1.21	2.8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	0.7	1
BH077	BH077_3.0-3.45	3-3.45	Block 5	6/06/2006	-	10.453	122.2	-	-	-	<0.5	0.7	-	9.4	8.7	7.1	-	8.7	4.5	3.4	6.8	0.8	36.6	<0.5	3.6	<0.5	1.2	30.7
BH078	BH078_3.0-3.45	3-3.45	Block 5	6/06/2006	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH116	BH116 3.0_3.45	3-3.45	ORWN - Proposed Southern Cove	27/06/2006	-	0.13	4.7	-	-	-	<0.5	<0.5	-	<0.5	0.6	<0.5	-	0.7	<0.5	<0.5	<0.5	<0.5	1.3	<0.5	<0.5	<0.5	1	1.1
BH128	BH128_2.0-20.5	20-20.5	Outside Investigation Area	3/07/2006	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH129	BH129_12.5-1.3	12.5-13	Outside Investigation Area	3/07/2006	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH136	BH136 3.0_3.45	3-3.45	Block 5	6/07/2006	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH136	BH136 8.0_8.5	8-8.5	Block 5	6/07/2006	-	<1.21	1.5	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	0.8
BH137	BH137 3.0_3.45	3-3.45	Block 4	6/07/2006	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH143	BH143 3.0_3.45	3-3.45	ORWN - Proposed Southern Cove	10/07/2006	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH191	BH191/16.5	16.5	ORWN - Public Domain Blocks 4&5	14/04/2008	-	11.345	298	-	-	-	3.4	15.8	-	14.2	11.7	7.7	-	9.8	3.3	2.9	8.2	0.8	28	18.2	2.9	104	44.7	22.4
BH191	BH191/18.2	18.2	ORWN - Public Domain Blocks 4&5	14/04/2008	-	<1.21	2	-	-	-	<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	0.6	0.9	<0.5
BH191	BH191/3.7	3.7	ORWN - Public Domain Blocks 4&5	27/03/2008	-	18.977	228.5	-	-	-	4.7	4	-	10.4	15	12.6	-	13.6	7.3	7.6	12.4	1.9	32.2	3.9	6.6	28.5	38.4	29.4
BH191	BH191/5.6	5.6	ORWN - Public Domain Blocks 4&5	11/04/2008	-	0.14	4.8	-	-	-	<0.5	<0.5	-	0.8	<0.5	<0.5	-	0.7	<0.5	0.7	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	0.8	0.9
BH212	BH212/12.2	12.2	ORWN - Public Domain Blocks 4&5	28/03/2008	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH212	BH212/26.0	26	ORWN - Public Domain Blocks 4&5	31/03/2008	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH212	BH212/4.8	4.8	ORWN - Public Domain Blocks 4&5	25/03/2008	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH213	BH213/10.5	10.5	Outside Investigation Area	14/04/2008	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH213	BH213/18.5	18.5	Outside Investigation Area	17/04/2008	-	1.546	13.7	-	-	-	<0.5	0.6	-	0.6	1.5	1.2	-	1.1	0.5	0.7	1.1	<0.5	2.7	<0.5	<0.5	<0.5	1	2.7
BH213	BH213/3.6	3.6	Outside Investigation Area	14/04/2008	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH37	BH37_15.8-16.0	15.8-16	Block 4 - Proposed Southern Cove	18/02/2010	-	0.05	10.6	-	-	-	<0.5	1	-	0.6	0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	0.9	<0.5	3.3	2.3	1.2
AECOM_BH37	BH37_20.4-20.5	20.4-20.5	Block 4 - Proposed Southern Cove	18/02/2010	-	0.929	51.9	<0.5	14.4	<0.5	0.6	3.8	<0.5	1.5	1.2	0.8	<1	-	<0.5	-	0.9	<0.5	1.6	1.9	<0.5	31.1	5.9	2.6
AECOM_BH37	BH37_22.2-AUGER	22.2	Block 4 - Proposed Southern Cove	18/02/2010	-	29.156	1536	<0.6	396	<0.6	16.1	112	<0.6	39.9	35	22.8	18	-	5.5	-	24.1	2.1	44.6	54.1	4.6	948	159	68.2
AECOM_BH37	BH37_5.5-5.7	5.5-5.7	Block 4 - Proposed Southern Cove	18/02/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH37	BH37_8.3-8.5	8.3-8.5	Block 4 - Proposed Southern Cove	18/02/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH38	BH38_11.5-11.7	11.5-11.7	ORWN - Proposed Southern Cove	19/02/2010	-	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH38	BH38_14.5-14.7	14.5-14.7	ORWN - Proposed Southern Cove	19/02/2010	-	<1.21	1.4	-	-	-	<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	0.9	0.5
AECOM_BH38	BH38_20.5-20.7	20.5-20.7	ORWN - Proposed Southern Cove	19/02/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH38	BH38_8.5-8.7	8.5-8.7	ORWN - Proposed Southern Cove	19/02/2010	-	<1.21	0.5	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5
AECOM_BH39	BH39-11.5-11.7	11.5-11.7	ORWN - Proposed Southern Cove	24/02/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH39	BH39-16.0-16.2	16-16.2	ORWN - Proposed Southern Cove	24/02/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH39	BH39-20.5-20.7	20.5-20.7	ORWN - Proposed Southern Cove	24/02/2010	-	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH39	BH39-4.0-4.2	4-4.2	ORWN - Proposed Southern Cove	24/02/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

							PAHs																						
						Ammonia as N	CPAH (TEF)	PAH (TOTAL)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL									0.5	0.01	0.01	0.01	0.01	0.5	0.01	0.01	0.01	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Tar Containing Material (TCM) Criteria								**2000**									**150**												
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**																									
AECOM_BH40	BH40_16.5-16.7	16.5-16.7	ORWN - Proposed Southern Cove	18/02/2010	-	8.52	288.6	<0.5	28.6	<0.5	2.5	13.1	<0.5	10	8.4	6.8	6	-	2	-	6	0.6	31.8	12.6	2	137	36.6	19.2
AECOM_BH40	BH40_17.8-18.0	17.8-18	ORWN - Proposed Southern Cove	18/02/2010	-	<1.11	2.2	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.4	0.8	<0.5
AECOM_BH40	BH40_19.0-19.4	19-19.4	ORWN - Proposed Southern Cove	18/02/2010	-	1.042	35.3	-	-	-	<0.5	2	-	2	1.4	0.8	-	0.9	<0.5	<0.5	1.2	<0.5	3.8	2.7	<0.5	10.5	6.6	3.4
AECOM_BH40	BH40_7.0-7.2	7-7.2	ORWN - Proposed Southern Cove	18/02/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH400	BH400_12.0-12.4	12-12.4	Block 5	14/02/2011	-	2.559	26.4	-	-	-	<0.5	<0.5	-	1.2	2.3	1.9	-	2.4	1	0.8	1.9	<0.5	5.4	<0.5	0.8	<0.5	3.4	5.3
BH400	BH400_13.2-13.4	13.2-13.4	Block 5	14/02/2011	-	<1.21	2.3	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	0.5	0.9
BH400	BH400_14.0-14.2	14-14.2	Block 5	14/02/2011	-	0.146	19.4	-	-	-	<0.5	1.3	-	1.2	0.8	<0.5	-	0.6	<0.5	<0.5	0.6	<0.5	2	1.3	<0.5	6	3.8	1.8
BH400	BH400_15-15.4	15-15.4	Block 5	14/02/2011	<20	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH400	BH400_16.0-16.4	16-16.4	Block 5	14/02/2011	-	37.389	1992.3	-	-	-	26.2	215	-	78.4	46.1	26	-	26.7	7.6	8	35.3	2.2	111	156	6.8	734	363	150
BH400	BH400_6.0-6.4	6-6.4	Block 5	11/02/2011	-	<1.21	8.4	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	6.1	0.7	0.8
BH400	BH400_9.0-9.4	9-9.4	Block 5	14/02/2011	-	3.398	37.4	-	-	-	<0.5	0.6	-	0.8	3.2	2.5	-	3.2	1.3	1.2	2.5	<0.5	10.3	<0.5	1	<0.5	1.4	9.4
BH401	BH401_10-10.4	10-10.4	Block 5	10/02/2011	<20	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH401	BH401_11-11.4	11-11.4	Block 5	10/02/2011	-	2.147	24.8	-	-	-	<0.5	<0.5	-	1.2	1.8	1.6	-	1.8	1.2	0.7	1.5	<0.5	4.7	0.6	0.9	0.8	3.6	4.4
BH401	BH401_13-13.4	13-13.4	Block 5	10/02/2011	-	3.77	41.1	-	-	-	0.6	0.7	-	1.8	3.1	2.8	-	3.7	1.5	1.3	2.5	<0.5	7.5	1	1.2	<0.5	6.3	7.1
BH401	BH401_14-14.2	14-14.2	Block 5	10/02/2011	-	19.378	156.4	-	-	-	0.8	5.4	-	5.1	14.6	13.5	-	16.7	5.8	7.6	11	1.3	27.1	1.3	5.2	1.3	9.5	30.2
BH401	BH401_14-17.4	17-17.4	Block 5	10/02/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH401	BH401_19.2-19.4	19.2-19.4	Block 5	11/02/2011	-	12.226	370.4	-	-	-	5	30.9	-	19.5	12.9	8.5	-	10	2.8	3.5	9.8	0.7	28.4	26	2.6	120	61.3	28.5
BH401	BH401_20-20.15	20-20.15	Block 5	11/02/2011	<20	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH401	BH401_3.0-3.4	3-3.4	Block 5	10/02/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH401	BH401_5.0-5.4	5-5.4	Block 5	10/02/2011	-	1.557	15.8	-	-	-	<0.5	<0.5	-	0.8	1.3	1.2	-	1.6	0.6	0.5	1.1	<0.5	3.2	<0.5	<0.5	<0.5	2.5	3
BH402	BH402_11.0-11.2	11-11.2	Block 5	9/02/2011	-	<1.21	2.3	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	0.5	0.9
BH402	BH402_14.0-14.5	14-14.5	Block 5	9/02/2011	-	14.315	463.9	-	-	-	4.3	28.4	-	24.8	16.7	11	-	10.5	4.6	4.3	11.9	<4	43.1	28.5	<4	168	69.7	38.1
BH402	BH402_15-15.5	15-15.5	Block 5	9/02/2011	<20	-	-	-	54.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH402	BH402_16-16.3	16-16.3	Block 5	10/02/2011	<20	-	-	-	4.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH402	BH402_17.0-17.4	17-17.4	Block 5	10/02/2011	-	98.672	**2865.2**	-	-	-	27.7	220	-	158	93.3	69.6	-	65.2	30.4	23	73.8	7.4	278	169	24.8	957	417	251
BH402	BH402_19.1-19.4	19.1-19.4	Block 5	10/02/2011	-	<9.68	70.5	-	-	-	<4	6.2	-	4.4	<4	<4	-	<4	<4	<4	<4	<4	7.7	5.1	<4	27.6	12.7	6.8
BH402	BH402_9.0-9.3	9-9.3	Block 5	9/02/2011	-	3.106	27.7	-	-	-	<0.5	0.6	-	1.1	2.7	2.3	-	2.6	1.5	1.2	2.1	<0.5	4.6	<0.5	1.2	<0.5	3.4	4.4
BH403	BH403_10-10.4	10-10.4	Block 5	9/02/2011	<20	-	-	-	528	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH403	BH403_12-12.4	12-12.4	Block 5	9/02/2011	-	95.248	**3215**	-	-	-	31.4	214	-	157	120	60.9	-	87.6	26.6	40	91.2	6.2	253	251	22.1	1160	480	214
BH403	BH403_15-15.4	15-15.4	Block 5	9/02/2011	<20	-	-	-	324	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH403	BH403_16-16.4	16-16.4	Block 5	9/02/2011	-	102.799	**2934.8**	-	-	-	31.9	200	-	170	115	68.4	-	93	25.5	34.2	86.4	6.8	280	192	22.6	941	420	248
BH403	BH403_17-17.3	17-17.3	Block 5	9/02/2011	-	36.868	1174.7	-	-	-	12	57	-	58.6	39.7	27.2	-	30.6	9.7	13.6	29.1	<4	114	80.9	8.9	441	160	92.4
BH403	BH403_2.0-2.4	2-2.4	Block 5	9/02/2011	-	1.269	15.5	-	-	-	<0.5	<0.5	-	0.8	1.5	1	-	1	0.6	<0.5	1.3	<0.5	3.2	<0.5	<0.5	<0.5	3	3.1
BH403	BH403_4.0-4.4	4-4.4	Block 5	9/02/2011	-	<9.68	42.4	-	-	-	6	<4	-	<4	<4	<4	-	<4	<4	<4	<4	<4	4.9	<4	<4	23.7	7.8	<4
BH403	BH403_8.0-8.4	8-8.4	Block 5	9/02/2011	-	104.421	1543.2	-	-	-	37.4	48.2	-	98	112	70.5	-	84.9	27.5	34.4	77.6	7.3	227	95	24.4	146	267	186
BH404	BH404_12-12.4	12-12.4	Block 4	8/02/2011	-	<1.21	1.8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<0.5	0.9
BH404	BH404_14-14.4	14-14.4	Block 4	8/02/2011	-	18.759	371.4	-	-	-	10.6	11.6	-	13.9	21.9	11.6	-	20	5.2	9	15.7	1.4	52.5	15.6	4.6	88	38.8	51
BH404	BH404_15-15.4	15-15.4	Block 4	8/02/2011	-	<1.21	10.2	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.6	<0.5	7.6	0.9	0.5
BH404	BH404_4.0-4.4	4-4.4	Block 4	8/02/2011	-	3.96	47.5	-	-	-	<0.5	1.6	-	2.5	3.5	3	-	3.5	1.5	1.2	2.5	<0.5	10	1.1	1	<0.5	6.6	9.5
BH404	BH404_7.0-7.4	7-7.4	Block 4	8/02/2011	-	77.246	1415.4	-	-	-	47.6	<4	-	93.3	75.2	52.7	-	53.5	26	28.4	68.6	5.8	212	62.4	20.9	127	323	219
BH406	BH406_10.0-10.3	10-10.3	Block 4	8/02/2011	-	1.356	17.4	-	-	-	0.9	<0.5	-	1	1.3	1.1	-	1.1	0.5	<0.5	1.1	<0.5	3.4	0.6	<0.5	<0.5	3.1	3.3
BH406	BH406_14.0-14.4	14-14.4	Block 4	8/02/2011	-	73.375	1132.6	-	-	-	31.3	33.5	-	68.2	77.5	50.8	-	49	19.1	22.9	55.4	5.1	200	57.2	17.9	76.7	200	168
BH406	BH406_15.0-15.4	15-15.4	Block 4	8/02/2011	-	33.071	1060	-	-	-	10	65.3	-	50.3	39.8	24.2	-	24.5	9.5	12.2	28.6	<4	94.8	58	8.4	401	153	80.4
BH406	BH406_16.0-16.5	16-16.5	Block 4	9/02/2011	-	112.741	**3403.1**	-	-	-	34.3	231	-	162	114	78.1	-	92	29.4	26.5	93.7	7.5	323	220	26.6	1170	529	266
BH406	BH406_4.0-4.2	4-4.2	Block 4	8/02/2011	-	2.188	20.2	-	-	-	<0.5	<0.5	-	0.6	1.2	1.7	-	2.1	0.9	0.7	0.9	<0.5	2.7	<0.5	0.7	<0.5	1.5	7.2
BH406	BH406_7.0-7.2	7-7.2	Block 4	8/02/2011	-	1.109	10.4	-	-	-	<0.5	<0.5	-	<0.5	1.1	0.9	-	0.9	<0.5	<0.5	0.9	<0.5	2.6	<0.5	<0.5	<0.5	1	3
BH407	BH407_12.0-12.18	12-12.18	Block 4 - Proposed Southern Cove	14/02/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH407	BH407_14.0-14.5	14-14.5	Block 4 - Proposed Southern Cove	14/02/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH407	BH407_15.1-15.45	15.1-15.45	Block 4 - Proposed Southern Cove	14/02/2011	<20	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

							PAHs																						
						Ammonia as N	CPAH (TEF)	PAH (TOTAL)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL									0.5	0.01	0.01	0.01	0.01	0.5	0.01	0.01	0.01	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Tar Containing Material (TCM) Criteria								**2000**									**150**												
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**																									
BH407	BH407_16.3-16.5	16.3-16.5	Block 4 - Proposed Southern Cove	14/02/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH407	BH407_17.4-17.6	17.4-17.6	Block 4 - Proposed Southern Cove	14/02/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH407	BH407_18.0-18.3	18-18.3	Block 4 - Proposed Southern Cove	14/02/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH407	BH407_8.0-8.1	8-8.1	Block 4 - Proposed Southern Cove	14/02/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH41	BH41_14.5-14.7	14.5-14.7	Block 4 - Proposed Southern Cove	8/03/2010	-	1.526	12.2	-	<0.5	-	<0.5	0.7	-	0.6	0.9	1.2	-	1.5	0.9	0.7	0.7	<0.5	1.3	<0.5	<0.5	<0.5	0.5	3.2
AECOM_BH41	BH41_16.0-16.2	16-16.2	Block 4 - Proposed Southern Cove	8/03/2010	-	0.056	10.4	-	0.5	-	<0.5	1.2	-	1.4	0.5	<0.5	-	<0.5	<0.5	<0.5	0.6	<0.5	1.1	<0.5	<0.5	0.6	3.3	1.7
AECOM_BH41	BH41_17.5-17.7	17.5-17.7	Block 4 - Proposed Southern Cove	8/03/2010	-	<1.11	1.3	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.7	<0.5
AECOM_BH41	BH41_4.0-4.4	4-4.4	Block 4 - Proposed Southern Cove	4/03/2010	-	<1.21	<8	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH41	BH41_8.5-8.9	8.5-8.9	Block 4 - Proposed Southern Cove	4/03/2010	-	<1.21	<8	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH410	BH410_17.0-17.5	17-17.5	ORWN - Public Domain Blocks 4&5	11/05/2011	-	11.248	141.9	-	-	-	4.1	5.2	-	9.7	9.6	7.7	-	8.9	3.9	4.5	7.9	0.8	23	4.8	3.3	<1 - 2.8	24.4	21.3
BH410	BH410_2.0-2.2	2-2.2	ORWN - Public Domain Blocks 4&5	10/05/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH410	BH410_23.0-23.2	23-23.2	ORWN - Public Domain Blocks 4&5	11/05/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH410	BH410_26.0-26.2	26-26.2	ORWN - Public Domain Blocks 4&5	12/05/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH410	BH410_32.0-32.2	32-32.2	ORWN - Public Domain Blocks 4&5	12/05/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH410	BH410_7.0-7.2	7-7.2	ORWN - Public Domain Blocks 4&5	10/05/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH411	BH411_10.0-10.1	10-10.1	ORWN - Public Domain Blocks 4&5	12/04/2011	<1	1.0194	11.55	-	0.08	<0.01	0.06	0.34	-	0.62	0.97	0.7	-	0.62	0.15	0.44	0.79	0.09	2.11	0.35	0.17	0.06	2.18	1.9
BH411	BH411_15.0-15.1	15-15.1	ORWN - Public Domain Blocks 4&5	12/04/2011	-	<1.21	1.9	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1	<0.5	<0.5	<0.5	<0.5	0.9
BH411	BH411_18.0-18.1	18-18.1	ORWN - Public Domain Blocks 4&5	12/04/2011	-	8.613	82.1	-	-	-	0.5	3.4	-	3.3	7.3	6.8	-	5.9	2.7	1.9	5.6	<0.5	17	1.2	2.2	<1 - 1.2	5.4	17.7
BH411	BH411_19.0-19.1	19-19.1	ORWN - Public Domain Blocks 4&5	12/04/2011	8	<0.0242	0.01	-	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
BH411	BH411_2.0-2.1	2-2.1	ORWN - Public Domain Blocks 4&5	12/04/2011	-	0.73	5.1	-	-	-	<0.5	<0.5	-	<0.5	0.7	0.6	-	0.6	<0.5	<0.5	<0.5	<0.5	1.3	<0.5	<0.5	<0.5	0.7	1.2
BH411	BH411_23.0-23.1	23-23.1	ORWN - Public Domain Blocks 4&5	12/04/2011	<1	<0.0242	<0.16	-	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
BH411	BH411_26.0-26.1	26-26.1	ORWN - Public Domain Blocks 4&5	12/04/2011	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
BH411	BH411_3.1-3.2	3.1-3.2	ORWN - Public Domain Blocks 4&5	12/04/2011	<1	0.6746	4.62	-	0.01	<0.01	0.01	0.09	-	0.12	0.46	0.48	-	0.44	0.14	0.26	0.42	0.06	0.75	0.02	0.13	0.03	0.42	0.79
BH411	BH411_4.0-4.1	4-4.1	ORWN - Public Domain Blocks 4&5	12/04/2011	-	1.118	10.4	-	-	-	<0.5	<0.5	-	0.6	1.1	0.9	-	1	<0.5	<0.5	0.8	<0.5	2.4	<0.5	<0.5	<0.5	1.3	2.3
BH411	BH411_8.0-8.1	8-8.1	ORWN - Public Domain Blocks 4&5	12/04/2011	-	0.62	7.8	-	-	-	<0.5	<0.5	-	0.6	0.7	0.5	-	0.5	<0.5	<0.5	<0.5	<0.5	1.8	<0.5	<0.5	<0.5	2	1.7
AECOM_BH46	BH46-14.5-14.7	14.5-14.7	ORWN - Proposed Southern Cove	23/02/2010	-	15.455	385.9	-	-	-	4.5	26.8	-	20.7	17.1	10.1	-	14.7	4.5	4.4	12	1.2	38.3	25.9	3.7	114	55.9	32.1
AECOM_BH46	BH46-19.0-19.2	19-19.2	ORWN - Proposed Southern Cove	23/02/2010	-	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH46	BH46-20.5-20.7	20.5-20.7	ORWN - Proposed Southern Cove	23/02/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH46	BH46-23.5-23.7	23.5-23.7	ORWN - Proposed Southern Cove	23/02/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH46	BH46-7.0-7.2	7-7.2	ORWN - Proposed Southern Cove	23/02/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH47	BH47-13.0-13.2	13-13.2	ORWN - Public Domain Blocks 4&5	22/02/2010	-	1.917	22	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	1.3	2	1.7	2	-	<0.5	-	1.7	<0.5	4.8	0.6	<0.5	<0.5	3.8	5.3
AECOM_BH47	BH47-4.0-4.2	4-4.2	ORWN - Public Domain Blocks 4&5	22/02/2010	-	2.68	20.5	-	-	-	<0.5	<0.5	-	0.6	2	2	-	2.5	1.4	1	1.6	<0.5	3.3	<0.5	1	<0.5	1.8	3.3
AECOM_BH47	BH47-8.5-8.7	8.5-8.7	ORWN - Public Domain Blocks 4&5	22/02/2010	-	13.099	146	-	-	-	0.8	2.8	-	6.2	12	8.3	-	11.4	4.9	5.2	10	1.4	28	1.6	3.9	1.1	20.6	27.8
AECOM_BH48	BH48-14.5-14.7	14.5-14.7	Block 4	23/02/2010	-	39.103	1352.5	<1.2	144	<1.2	12.9	113	<1.2	54	39.2	31	39	-	8.5	-	30.8	2.9	124	94.3	8.9	517	215	101
AECOM_BH48	BH48-17.0-17.2	17-17.2	Block 4	23/02/2010	-	0.809	31.4	-	-	-	<0.5	1.9	-	2	1.2	0.6	-	0.8	<0.5	<0.5	0.9	<0.5	3.1	2.3	<0.5	11	5.2	2.4
AECOM_BH48	BH48-8.5-8.7	8.5-8.7	Block 4	23/02/2010	-	0.116	5.2	-	-	-	<0.5	<0.5	-	<0.5	0.5	<0.5	-	0.6	<0.5	<0.5	0.6	<0.5	1.2	<0.5	<0.5	<0.5	0.9	1.4
JBS_BH517	BH517	2	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	0.2	0.6	-	1.1	2.4	3.1	4	-	2	-	2.3	0.4	4.4	0.3	1.7	0.2	3	4.9
JBS_BH517	BH517	3	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.2	0.8	0.92	1.3	-	0.5	-	0.7	0.1	1.3	<0.1	0.4	<0.1	0.8	1.5
JBS_BH517	BH517	4	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	0.1	0.1	-	0.3	0.7	0.82	1.2	-	0.4	-	0.8	<0.1	1.5	0.2	0.4	0.2	1.3	1.5
JBS_BH517	BH517	5	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	0.1	0.1	-	0.4	1	1.2	1.6	-	0.5	-	1	0.1	2	0.1	0.5	0.2	1.5	2.1
JBS_BH517	BH517	6	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	<0.1	0.1	-	0.3	0.7	0.77	1.1	-	0.4	-	0.6	<0.1	1.3	0.1	0.3	0.1	1	1.3
JBS_BH517	BH517	7	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	0.9	0.4	-	1.4	2.3	2.5	3.7	-	1.1	-	2.2	0.2	5.9	0.8	1.1	0.6	4.7	5.6
JBS_BH517	BH517	8	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	0.7	0.2	-	0.8	1.4	1.5	2.1	-	0.6	-	1.3	0.1	3.3	0.5	0.6	0.5	3	3.3
JBS_BH517	BH517	9	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	0.1	0.3	-	0.4	1.2	1.4	2	-	0.6	-	1.2	0.1	2.5	0.2	0.6	0.2	1.5	2.6
JBS_BH517	BH517	13	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	0.1	0.3	-	0.7	1.8	2	2.9	-	0.8	-	1.7	0.2	4.1	0.3	0.9	0.2	2.5	3.7
JBS_BH518	BH518	2.9-3	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	0.1	0.1	-	0.2	0.6	0.67	1	-	0.4	-	0.6	<0.1	1.1	<0.1	0.4	0.2	0.7	1.1
JBS_BH518	BH518	3.9-4	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	<0.1	0.4	-	1.2	3.7	3.4	5.1	-	1.3	-	3.2	0.4	6.8	0.3	1.6	0.2	2.3	6.3
JBS_BH518	BH518	4.9-5	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.5	1.8	1.6	2.3	-	0.6	-	1.5	0.1	3.3	0.1	0.7	<0.1	1	3.2
JBS_BH518	BH518	5.9-6	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.5	1.7	1.7	2.6	-	0.7	-	1.6	0.2	3.3	0.1	0.8	0.1	1.2	3.3

						PAHs																							
					Ammonia as N	CPAH (TEF)	PAH (TOTAL)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								0.5	0.01	0.01	0.01	0.01	0.5	0.01	0.01	0.01	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Tar Containing Material (TCM) Criteria							**2000**									**150**													
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**																									
JBS_BH529D	BH529D	2	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	0.09	<0.2	-	<0.1	-	0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.1	0.2
JBS_BH529D	BH529D	3	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.1	0.12	<0.2	-	<0.1	-	0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.2	0.2
JBS_BH529D	BH529D	4	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.2	0.29	0.4	-	0.2	-	0.3	<0.1	0.5	<0.1	0.1	<0.1	0.3	0.6
JBS_BH529D	BH529D	5	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.2	0.22	0.3	-	0.1	-	0.2	<0.1	0.3	<0.1	0.1	<0.1	0.2	0.4
JBS_BH529D	BH529D	6	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	0.07	<0.2	-	<0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1
JBS_BH529D	BH529D	7	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	<0.1	0.3	-	0.8	2.8	2.7	3.7	-	1.3	-	2.8	0.1	6.6	0.1	1.3	<0.1	3.9	7.1
JBS_BH529D	BH529D	8	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	<0.1	0.1	-	0.1	0.5	0.65	1	-	0.4	-	0.6	<0.1	1.1	<0.1	0.4	<0.1	0.6	1.3
JBS_BH529D	BH529D	9	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.2	0.19	0.3	-	0.1	-	0.2	<0.1	0.4	<0.1	0.1	<0.1	0.2	0.5
JBS_BH529D	BH529D	15	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.1	0.3	0.36	0.5	-	0.2	-	0.3	<0.1	0.7	<0.1	0.2	<0.1	0.4	0.7
JBS_BH539	BH539	10.9-11	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	0.1	0.4	-	0.9	1.8	1.8	2.6	-	0.9	-	1.7	0.2	4.1	0.3	0.9	0.2	3.4	4
JBS_BH539	BH539	11.9-12	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	0.1	0.5	-	1.3	2.7	2.8	4.1	-	1.6	-	2.8	0.4	6.3	0.4	1.6	0.2	5.3	6.5
JBS_BH539	BH539	12.9-13	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	0.4	1.6	-	1.8	2.1	2	2.9	-	0.9	-	1.9	0.2	4.8	1.8	0.9	13	5.5	4.7
JBS_BH539	BH539	2.9-3	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	<0.1	0.4	-	0.5	2	2.3	3.3	-	1.2	-	1.9	0.3	3.8	0.1	1.3	0.1	1.6	3.9
JBS_BH539	BH539	3.9-4	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	0.8	0.3	-	1.4	2.7	2.9	4.3	-	1.5	-	2.7	0.3	6.3	0.7	1.5	0.7	4.2	6.3
JBS_BH539	BH539	4.9-5	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	1.5	0.7	-	2.6	4.7	5.2	7.5	-	2.6	-	4.7	0.6	11	1.5	2.7	1.3	8.2	11
JBS_BH539	BH539	5.9-6	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	1	0.3	-	1.5	2.6	2.7	3.9	-	1.4	-	2.5	0.3	6.2	0.5	1.5	0.5	3.5	6.1
JBS_BH539	BH539	6.9-7	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	1.1	0.2	-	1	1.6	1.6	2.4	-	0.8	-	1.5	0.2	3.9	0.8	0.9	2.2	3.7	3.7
JBS_BH539	BH539	7.9-8	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	0.6	0.3	-	0.9	1.7	1.9	2.8	-	0.9	-	1.7	0.2	3.9	0.6	1	0.8	3.1	3.8
JBS_BH539	BH539	8.9-9	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	1.1	0.3	-	1.3	1.9	2	2.9	-	1	-	1.9	0.2	4.5	0.9	1	1.7	4.4	4.5
JBS_BH539	BH539	9.9-10	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	0.2	0.2	-	0.4	0.9	0.9	1.3	-	0.4	-	0.9	0.1	1.9	0.2	0.5	0.3	1.4	1.9
JBS_BH540D	BH540D	12.9-13	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	0.3	0.2	-	0.7	1.2	1.1	1.4	-	0.6	-	0.9	0.1	2.9	0.3	0.5	0.4	2.6	2.9
JBS_BH540D	BH540D	2.9-3	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	0.3	0.5	-	1.1	1.8	1.9	2.5	-	1	-	1.4	0.2	4.5	0.5	1	0.2	3.9	3.8
JBS_BH540D	BH540D	3.9-4	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	1.8	0.3	-	1.6	2.7	3.2	4.3	-	1.5	-	2.9	0.3	6.8	1.5	1.5	4.9	7	6.7
JBS_BH540D	BH540D	4.9-5	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	1.6	0.5	-	2	2.9	3.8	4.8	-	1.8	-	3.2	0.4	7.5	1.6	1.7	5.5	8.3	7.4
JBS_BH540D	BH540D	5.9-6	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	1.6	0.6	-	1.8	2.9	3.6	4.9	-	1.7	-	3.1	0.4	7	1.5	1.7	6.6	7.6	6.9
JBS_BH540D	BH540D	6.9-7	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	0.7	0.7	-	1.8	3.5	4.5	5.7	-	1.9	-	3.5	0.4	8.1	1	1.9	1.5	7.3	8.2
JBS_BH540D	BH540D	7.9-8	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	0.5	0.4	-	1.4	2.6	3.5	4.7	-	1.6	-	2.9	0.4	7.3	0.7	1.6	1.1	6.3	6.4
JBS_BH540D	BH540D	8.9-9	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	1.9	0.5	-	2	3.2	4.1	5.3	-	2.1	-	3.2	0.4	8.3	1.7	2	3.6	8.6	8.3
JBS_BH540D	BH540D	9.9-10	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	1.6	0.6	-	2	3.1	4.2	5.4	-	2.1	-	3	0.5	7.8	1.6	2	4.7	8.3	7.6
JBS_BH541D	BH541D	2.9-3	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	3	1.9	-	7.5	17	15	23	-	4.9	-	14	1.5	35	4.3	6.3	0.6	25	35
JBS_BH541D	BH541D	3.9-4	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	0.2	0.3	-	0.7	1.8	1.7	2.6	-	0.6	-	1.6	0.2	3.5	0.4	0.7	0.2	2.6	3.5
JBS_BH541D	BH541D	4.9-5	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	0.6	0.3	-	1.2	2.4	2.8	3.9	-	1.4	-	2.3	0.3	5.3	0.8	1.5	0.2	3.6	5.3
JBS_BH541D	BH541D	5.9-6	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.4	1.1	1.2	1.9	-	0.7	-	1	0.2	1.9	0.2	0.7	0.2	1.2	1.9
JBS_BH541D	BH541D	6.9-7	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	10	31	-	33	43	45	55	-	15	-	37	4.3	92	33	17	200	79	85
JBS_BH541D	BH541D	7.9-8	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	7.1	14	-	19	42	40	52	-	17	-	35	5.2	96	8	21	9.4	49	86
JBS_BH541D	BH541D	8.9-9	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	18	23	-	52	77	80	100	-	31	-	65	8.8	160	28	36	19	150	150
JBS_BH541D	BH541D	9.9-10	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	22	140	-	110	97	84	110	-	37	-	80	11	240	140	37	1100	380	210
JBS_BH542	BH542	11.9-12	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	0.7	0.2	-	0.8	1.1	1	1.5	-	0.3	-	1	0.1	2.8	0.6	0.4	1.2	2.8	2.7
JBS_BH542	BH542	12.9-13	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	3	2.6	-	5.3	9.3	8.4	12	-	2.4	-	7.4	0.8	20	3.9	2.9	2.5	18	19
JBS_BH542	BH542	13.9-14	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	13	22	-	34	37	31	41	-	11	-	29	3.5	87	42	13	230	120	76
JBS_BH542	BH542	14.5-14.6	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	17	94	-	75	63	52	70	-	11	-	51	4.3	160	100	15	690	270	130
JBS_BH542	BH542	2.9-3	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	2.7	0.4	-	2.7	2.9	2.4	3.5	-	0.8	-	2.4	0.2	9.1	2.5	1	1.1	9.9	8.1
JBS_BH542	BH542	3.9-4	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	1	0.4	-	1.4	2.5	2.1	3.1	-	0.7	-	2.1	0.2	6.1	1	0.8	0.6	5.5	5.8
JBS_BH542	BH542	4.9-5	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	0.9	0.2	-	1.1	1.5	1.3	1.9	-	0.4	-	1.3	0.1	4.2	0.9	0.5	0.6	3.9	3.8
JBS_BH542	BH542	5.9-6	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	0.8	0.3	-	1.1	1.7	1.4	2.2	-	0.5	-	1.4	0.1	4.5	0.8	0.5	0.7	3.8	4.2
JBS_BH543	BH543	16-16.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.2	0.7	0.78	1.1	-	0.3	-	0.5	<0.1	1.4	<0.1	0.4	0.2	0.6	1.6
JBS_BH543	BH543	2-2.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.1	0.3	0.27	0.4	-	0.1	-	0.2	<0.1	0.6	<0.1	0.1	<0.1	0.5	0.6
JBS_BH543	BH543	3-3.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.1	0.3	0.53	0.7	-	0.2	-	0.3	<0.1	0.6	<0.1	0.2	<0.1	0.3	0.8
JBS_BH543	BH543	4-4.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.1	0.3	0.4	0.5	-	0.2	-	0.2	<0.1	0.5	<0.1	0.2	<0.1	0.3	0.7

							PAHs																				
					Ammonia as N	CPAH (TEF)	PAH (TOTAL)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								0.5	0.01	0.01	0.01	0.01	0.5	0.01	0.01	0.01	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Tar Containing Material (TCM) Criteria							**2000**									**150**											
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**																							
JBS_BH543	BH543	5-5.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.2	0.26	0.3	-	0.1	-	0.2	<0.1	0.4	<0.1	0.1	<0.1	0.3	0.5
JBS_BH543	BH543	6-6.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.1	0.16	0.2	-	<0.1	-	0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.2	0.3
JBS_BH543	BH543	8-8.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.5	0.8	0.83	1.1	-	0.3	-	0.7	<0.1	1.7	0.3	0.3	0.2	1.7	1.8
JBS_BH543	BH543	9-9.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.1	0.3	0.44	0.6	-	0.2	-	0.2	<0.1	0.6	<0.1	0.2	<0.1	0.4	0.8
JBS_BH544D	BH544D	11.9-12	ORWN - Public Domain Blocks 4&5	16/05/2012	-	-	-	-	-	-	0.2	0.3	-	0.6	2.2	3.8	5	-	1.7	-	2.4	0.4	4.1	0.1	1.7	0.1	1.1	7.7
JBS_BH544D	BH544D	14.9-15	ORWN - Public Domain Blocks 4&5	16/05/2012	-	-	-	-	-	-	0.1	0.6	-	0.7	2	2.5	3.3	-	1.1	-	1.7	0.3	3.9	0.3	1.1	0.4	1.8	4.7
JBS_BH544D	BH544D	2.9-3	ORWN - Public Domain Blocks 4&5	16/05/2012	-	-	-	-	-	-	0.3	0.3	-	0.9	2.6	4.3	5.6	-	2	-	2.4	0.4	5.3	0.2	2	0.1	1.9	7.2
JBS_BH544D	BH544D	3.9-4	ORWN - Public Domain Blocks 4&5	16/05/2012	-	-	-	-	-	-	0.4	0.4	-	1.4	3.5	5.4	7.2	-	2.4	-	3.8	0.5	7.5	0.3	2.5	0.2	3.5	9
JBS_BH544D	BH544D	4.9-5	ORWN - Public Domain Blocks 4&5	16/05/2012	-	-	-	-	-	-	0.4	0.3	-	1.4	3.4	5.2	6.8	-	2.2	-	3.6	0.5	7.6	0.3	2.3	0.2	2.9	9.2
JBS_BH544D	BH544D	5.9-6	ORWN - Public Domain Blocks 4&5	16/05/2012	-	-	-	-	-	-	0.3	0.4	-	0.9	3	4.9	6.6	-	2.2	-	3.2	0.6	6.2	0.2	2.2	0.3	2.1	8
JBS_BH545	BH545	13.8-13.9	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	0.07	<0.2	-	<0.1	-	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	0.2
JBS_BH545	BH545	2.9-3	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	<0.1	0.9	-	1.1	2.8	2.8	3.8	-	1.1	-	2.4	0.3	5.8	0.2	1.2	0.2	2.8	6.1
JBS_BH545	BH545	3.9-4	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	<0.1	0.1	-	0.2	0.3	0.4	0.5	-	0.2	-	0.3	<0.1	0.8	0.1	0.2	<0.1	0.7	0.8
JBS_BH546	BH546	2	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	0.1	0.8	-	1.2	4.6	6	8	-	2.7	-	4.1	0.6	8.7	0.2	2.7	0.2	3.4	8.5
JBS_BH546	BH546	3	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.1	0.4	0.5	0.7	-	0.2	-	0.3	<0.1	0.8	<0.1	0.2	<0.1	0.3	0.7
JBS_BH546	BH546	4	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.3	1.1	1.5	2	-	0.6	-	1	0.1	2.1	<0.1	0.6	<0.1	0.9	2.4
JBS_BH546	BH546	5	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.2	0.7	0.89	1.2	-	0.3	-	0.7	<0.1	1.4	<0.1	0.4	<0.1	0.6	1.6
JBS_BH546	BH546	6	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	<0.1	0.1	-	0.2	0.6	0.78	1.1	-	0.3	-	0.6	<0.1	1.2	<0.1	0.3	<0.1	0.5	1.3
JBS_BH547	BH547	2	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	2.4	17	-	23	67	62	97	-	21	-	64	5.7	150	8.7	24	9.8	140	140
JBS_BH547	BH547	3	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	1.3	6.9	-	8.9	19	19	31	-	7.8	-	19	2.4	38	4	9.2	5.7	34	36
JBS_BH547	BH547	7	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.4	0.8	1	1.4	-	0.4	-	0.7	<0.1	1.8	0.1	0.5	0.1	1.2	2.2
JBS_BH547	BH547	8	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.2	0.6	0.8	1.1	-	0.3	-	0.6	<0.1	1.4	0.1	0.4	<0.1	0.8	1.7
JBS_BH547	BH547	9	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	0.1	0.1	-	0.4	0.8	1.1	1.4	-	0.5	-	0.8	<0.1	2.3	0.1	0.5	<0.1	1.5	2.5
JBS_BH547	BH547	12	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	0.09	<0.2	-	<0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	0.1	0.2
JBS_BH547	BH547	13	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	3.1	4.6	-	6	5.8	5.5	7.4	-	1.6	-	4.7	0.5	13	7.2	2	35	18	12
JBS_BH548	BH548	2.9-3	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	<0.1	0.3	-	0.5	1.2	1.3	1.8	-	0.7	-	1.1	0.1	2.7	0.2	0.7	0.1	1.6	2.7
JBS_BH548	BH548	3.9-4	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	<0.1	0.3	-	0.4	1	1	1.4	-	0.4	-	0.9	<0.1	2.3	0.2	0.5	0.1	1.4	2.3
JBS_BH548	BH548	4.9-5	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.4	0.8	0.84	1.2	-	0.4	-	0.7	<0.1	2	0.2	0.4	0.2	1.4	1.9
JBS_BH548	BH548	5.9-6	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.4	0.8	0.9	1.3	-	0.4	-	0.8	<0.1	1.9	0.2	0.5	<0.1	1.3	1.9
JBS_BH549	BH549	11.4-11.5	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.2	0.19	0.3	-	0.1	-	0.2	<0.1	0.3	<0.1	0.1	<0.1	0.2	0.4
JBS_BH549	BH549	2.9-3	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	<0.1	0.1	-	0.3	1.6	1.6	2.4	-	0.8	-	1.5	0.2	2.9	<0.1	0.9	<0.1	1.8	3
JBS_BH549	BH549	4.9-5	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.2	0.5	0.68	0.9	-	0.4	-	0.5	<0.1	0.9	<0.1	0.4	0.1	0.6	1
JBS_BH549	BH549	5.9-6	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	<0.1	0.2	-	0.3	0.9	1.1	1.5	-	0.5	-	0.8	<0.1	1.8	0.1	0.6	0.2	1.3	1.8
JBS_BH549	BH549	6.9-7	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	0.2	0.2	-	0.6	1.2	1.3	1.8	-	0.6	-	1.1	<0.1	2.9	0.3	0.7	0.4	2.5	2.8
JBS_BH549	BH549	7.9-8	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	0.3	0.2	-	0.7	1.2	1.3	1.8	-	0.6	-	1.2	<0.1	3.1	0.5	0.6	0.4	2.9	3
JBS_BH549	BH549	8.9-9	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	0.3	0.1	-	0.6	1	1.1	1.5	-	0.5	-	1	<0.1	2.5	0.4	0.5	0.4	2.3	2.5
JBS_BH550	BH550	12.9-13	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	0.7	3.8	-	3.1	2.6	2.1	2.9	-	0.7	-	2.1	0.2	6.3	4.2	0.7	27	10	5.7
JBS_BH550	BH550	13.9-14	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	0.3	1.3	-	1.2	1	0.78	1.1	-	0.2	-	0.8	<0.1	2.4	1.6	0.3	9.7	4	2.2
JBS_BH550	BH550	14.9-15	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	<0.1	0.1	-	0.2	<0.1	0.06	<0.2	-	<0.1	-	<0.1	<0.1	0.3	0.2	<0.1	0.8	0.6	0.3
JBS_BH550	BH550	2.9-3	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	<0.1	0.1	-	0.2	0.9	0.9	1.3	-	0.4	-	0.8	<0.1	1.6	<0.1	0.4	<0.1	0.7	1.7
JBS_BH550	BH550	3.9-4	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.1	0.3	0.32	0.5	-	0.1	-	0.3	<0.1	0.6	<0.1	0.1	<0.1	0.4	0.6
JBS_BH550	BH550	4.9-5	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.2	0.6	0.54	0.7	-	0.2	-	0.5	<0.1	0.9	<0.1	0.2	<0.1	0.5	1
JBS_BH550	BH550	5.9-6	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.1	0.3	0.34	0.5	-	0.2	-	0.3	<0.1	0.7	<0.1	0.2	<0.1	0.4	0.7
JBS_BH551	BH551	2.9-3	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	0.2	0.19	0.3	-	<0.1	-	0.2	<0.1	0.4	<0.1	<0.1	<0.1	0.3	0.4
JBS_BH551	BH551	3.9-4	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.1	0.2	0.25	0.4	-	0.1	-	0.3	<0.1	0.6	<0.1	0.1	<0.1	0.5	0.6
JBS_BH551	BH551	4.9-5	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.1	0.2	0.22	0.3	-	0.1	-	0.2	<0.1	0.5	<0.1	0.1	<0.1	0.4	0.5
JBS_BH551	BH551	5.9-6	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	<0.1	0.1	-	0.1	0.4	0.39	0.6	-	0.2	-	0.4	<0.1	0.9	<0.1	0.2	<0.1	0.6	0.8
JBS_BH551	BH551	8.9-9	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	<0.1	<0.1	0.06	<0.2	-	<0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1
JBS_BH552	BH552	10.4-10.5	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	<0.1	<0.1	-	0.2	0.4	0.47	0.7	-	0.2	-	0.4	<0.1	0.9	0.1	0.2	<0.1	0.6	0.9

							PAHs																				
					Ammonia as N	CPAH (TEF)	PAH (TOTAL)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								0.5	0.01	0.01	0.01	0.01	0.5	0.01	0.01	0.01	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Tar Containing Material (TCM) Criteria							**2000**									**150**											
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**																							
JBS_BH552	BH552	2.9-3	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	0.3	1.7	-	1.8	4	3.7	5.2	-	1.5	-	3.8	0.2	9.7	1.1	1.7	0.2	11	9.8
JBS_BH552	BH552	4.9-5	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	0.2	<0.1	-	0.4	0.6	0.6	0.9	-	0.2	-	0.6	<0.1	1.7	0.2	0.3	<0.1	1.5	1.6
JBS_BH552	BH552	5.9-6	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	0.1	0.8	-	1.5	3.2	2.8	4.2	-	1.2	-	2.8	0.2	7.8	0.5	1.3	0.2	7	7.2
AECOM_BH56	BH56_11.5-11.7	11.5-11.7	ORWN - Public Domain Blocks 4&5	4/03/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM_BH56	BH56_13.0-13.2	13-13.2	ORWN - Public Domain Blocks 4&5	5/03/2010	-	0.125	7.8	-	-	-	<0.5	<0.5	-	<0.5	0.6	<0.5	-	0.6	<0.5	<0.5	0.5	<0.5	1.5	<0.5	<0.5	1.3	1.8	1.5
AECOM_BH56	BH56_14.5-15.0	14.5-15	ORWN - Public Domain Blocks 4&5	5/03/2010	-	<1.11	2.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	0.9	0.6
AECOM_BH56	BH56_17.5-17.8	17.5-17.8	ORWN - Public Domain Blocks 4&5	5/03/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH56	BH56_2.5-2.7	2.5-2.7	ORWN - Public Domain Blocks 4&5	4/03/2010	-	0.11	3.6	-	-	-	<0.5	<0.5	-	<0.5	0.5	<0.5	-	0.6	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	0.6	1
AECOM_BH56	BH56_20.5-20.9	20.5-20.9	ORWN - Public Domain Blocks 4&5	5/03/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH56	BH56_21.4-21.6	21.4-21.6	ORWN - Public Domain Blocks 4&5	5/03/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH56	BH56_7.0-7.2	7-7.2	ORWN - Public Domain Blocks 4&5	4/03/2010	-	3.855	95.9	<0.5	1.8	<0.5	2.7	<0.5	<0.5	7.5	4.8	3.2	4	-	1.3	-	4.2	<0.5	19.8	3.4	1.2	4.6	25.2	18
AECOM_BH57	BH57_11.5-11.7	11.5-11.7	Block 4	25/02/2010	-	<1.21	1.3	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	0.7
AECOM_BH57	BH57_4.0-4.2	4-4.2	Block 4	25/02/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM_BH57	BH57_7.0-7.2	7-7.2	Block 4	25/02/2010	-	10.25	127.1	-	-	-	<0.5	2.7	-	7.3	10.5	6.8	-	10	2.9	3.2	8.1	0.7	26.6	1.5	2.7	0.5	20.9	22.7
AECOM_BH60	BH60_13.0-13.4	13-13.4	ORWN - Public Domain Blocks 4&5	1/03/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM_BH60	BH60_16.0-16.4	16-16.4	ORWN - Public Domain Blocks 4&5	1/03/2010	-	18.833	653.8	-	0.8	-	6.3	44.2	-	32.6	22.2	12.3	-	17.4	4.4	6.4	16.9	1.3	56.8	38.6	4.2	256	88.3	45.9
AECOM_BH60	BH60_17.5-17.7	17.5-17.7	ORWN - Public Domain Blocks 4&5	2/03/2010	-	10.654	322.6	-	<0.5	-	3.7	19.5	-	17.9	13.1	6.9	-	9.9	2.4	4.1	9	0.7	33.4	22.3	2.3	101	50.7	25.7
AECOM_BH60	BH60_2.5-2.9	2.5-2.9	ORWN - Public Domain Blocks 4&5	1/03/2010	-	6.863	82.4	-	<0.5	-	0.5	3.5	-	4.4	6.9	4.3	-	7.2	2.3	2.7	5	0.6	13.5	2.3	2.1	1.1	12.3	13.7
AECOM_BH60	BH60_20.5-20.9	20.5-20.9	ORWN - Public Domain Blocks 4&5	2/03/2010	-	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH60	BH60_7.0-7.2	7-7.2	ORWN - Public Domain Blocks 4&5	1/03/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM_BH63	BH63_11.5-11.9	11.5-11.9	Outside Investigation Area	1/03/2010	-	2.092	81.3	-	-	-	1	4.6	-	4.5	2.9	1.5	-	1.7	<0.5	1.1	2.2	<0.5	7.7	5.3	<0.5	28.9	13.3	6.6
AECOM_BH63	BH63_13.0-13.3	13-13.3	Outside Investigation Area	1/03/2010	-	<1.21	9.2	-	-	-	<0.5	0.7	-	0.7	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	0.7	<0.5	2.9	2	1
AECOM_BH63	BH63_17.7-17.9	17.7-17.9	Outside Investigation Area	1/03/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM_BH63	BH63_2.5-2.7	2.5-2.7	Outside Investigation Area	26/02/2010	-	0.658	6.2	-	-	-	<0.5	<0.5	-	<0.5	0.7	0.5	-	0.8	<0.5	<0.5	0.8	<0.5	1.5	<0.5	<0.5	<0.5	<0.5	1.9
AECOM_BH63	BH63_20.5-20.9	20.5-20.9	Outside Investigation Area	2/03/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH69	BH69_10.0-10.2	10-10.2	Block 5	26/02/2010	-	1.738	72.2	<0.5	<0.5	<0.5	1.6	5.9	<0.5	4.7	3.1	1.4	2	-	<0.5	-	2.8	<0.5	11.3	4.6	<0.5	<0.5	24.4	12.4
AECOM_BH69	BH69_4.0-4.2	4-4.2	Block 5	26/02/2010	-	1.941	15.3	-	<0.5	-	<0.5	<0.5	-	0.6	1.5	1.4	-	1.9	0.9	1.1	1.2	<0.5	2	<0.5	0.7	<0.5	1.4	2.6
AECOM_BH70	BH70_11.5-11.7	11.5-11.7	Block 5	8/03/2010	-	0.006	2.6	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	0.6	<0.5	1	<0.5	<0.5	<0.5	<0.5	1
AECOM_BH70	BH70_16.0-16.2	16-16.2	Block 5	8/03/2010	-	245.604	**7676.8**	<2.5	776	<2.5	62	473	<2.5	325	256	**194**	235	-	72.4	-	204	17	615	402	62.4	3440	1000	554
AECOM_BH70	BH70_2.5-2.7	2.5-2.7	Block 5	8/03/2010	-	<1.11	4.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	4.3	<0.5	<0.5
AECOM_BH70	BH70_4.0-4.2	4-4.2	Block 5	8/03/2010	-	<1.21	<8	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH70	BH70_5.5-5.7	5.5-5.7	Block 5	8/03/2010	-	19.164	193.8	-	<0.8	-	3.2	1	-	8	16.2	12.6	-	18.8	12.1	7.8	11.3	1.3	35.2	2.3	7.5	2.3	21.1	33.1
AECOM_BH71	BH71_10.0-10.2	10-10.2	Outside Investigation Area	4/03/2010	-	0.776	6.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	0.7	<1	-	<0.5	-	0.6	<0.5	1.3	<0.5	<0.5	0.7	1.4	1.3
AECOM_BH71	BH71_13.0-13.2	13-13.2	Outside Investigation Area	4/03/2010	-	3.877	44.4	-	<0.5	-	<0.5	1.3	-	2	4.2	2.7	-	4.6	1.3	1.4	3.4	<0.5	8.3	0.7	1.1	<0.5	5.5	7.9
AECOM_BH71	BH71_15.0-15.2	15-15.2	Outside Investigation Area	4/03/2010	-	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH71	BH71_19.0-19.2	19-19.2	Outside Investigation Area	4/03/2010	-	<1.21	<8	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH71	BH71_2.5-2.7	2.5-2.7	Outside Investigation Area	4/03/2010	-	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH71	BH71_7.0-7.2	7-7.2	Outside Investigation Area	4/03/2010	-	0.656	6.3	-	<0.5	-	<0.5	<0.5	-	<0.5	0.7	0.5	-	0.8	<0.5	<0.5	0.6	<0.5	1.4	<0.5	<0.5	<0.5	1	1.3
AECOM_BH72	BH72_13.0-13.2	13-13.2	ORWN - Public Domain Blocks 4&5	3/03/2010	-	19.535	236.8	-	<0.5	-	4.9	8.7	-	11.3	22.1	12.8	-	17.4	5.6	8.4	14.9	1.3	44.9	5.1	4.4	4.2	28.7	42.1
AECOM_BH72	BH72_16.0-16.2	16-16.2	ORWN - Public Domain Blocks 4&5	4/03/2010	-	10.223	195.5	-	<0.5	-	2.1	7.3	-	15	13.1	6.7	-	9.3	2.7	3.6	8.6	0.6	27	13	2.1	16.4	43.9	24.1
AECOM_BH72	BH72_19.0-19.2	19-19.2	ORWN - Public Domain Blocks 4&5	4/03/2010	-	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH72	BH72_2.5-2.7	2.5-2.7	ORWN - Public Domain Blocks 4&5	3/03/2010	-	5.386	55.7	-	<0.5	-	<0.5	0.9	-	2	5.4	3.8	-	6.3	2.2	1.8	4.4	<0.5	9.7	0.5	1.7	1.4	6.5	9.1
AECOM_BH72	BH72_20.5-20.7	20.5-20.7	ORWN - Public Domain Blocks 4&5	4/03/2010	-	<1.21	<8	-	<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH72	BH72_5.5-5.7	5.5-5.7	ORWN - Public Domain Blocks 4&5	3/03/2010	-	1.847	22.3	<0.5	0.9	<0.5	<0.5	<0.5	<0.5	1.6	2.3	1.6	2	-	<0.5	-	1.7	<0.5	4.2	1	<0.5	0.6	5.3	4

					PAHs																								
					Ammonia as N	CPAH (TEF)	PAH (TOTAL)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL								0.5	0.01	0.01	0.01	0.01	0.5	0.01	0.01	0.01	0.2	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Tar Containing Material (TCM) Criteria							**2000**									**150**													
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**																									
AECOM_BH73	BH73_11.5-11.7	11.5-11.7	Outside Investigation Area	2/03/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM_BH73	BH73_16.0-16.2	16-16.2	Outside Investigation Area	2/03/2010	-	2.348	86.5	-	-	-	0.8	4.5	-	3.9	2.6	1.7	-	2.1	0.7	0.9	2.1	<0.5	6.8	5.2	0.6	37.1	11.7	5.8
AECOM_BH73	BH73_17.5-17.7	17.5-17.7	Outside Investigation Area	2/03/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM_BH73	BH73_19.0-19.2	19-19.2	Outside Investigation Area	2/03/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH73	BH73_20.5-20.7	20.5-20.7	Outside Investigation Area	2/03/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM_BH73	BH73_7.0-7.2	7-7.2	Outside Investigation Area	2/03/2010	-	0.626	5.2	-	-	-	<0.5	<0.5	-	<0.5	0.6	0.5	-	0.6	<0.5	<0.5	0.6	<0.5	1	<0.5	<0.5	<0.5	0.6	1.3
AECOM_BH74	BH74_10.0-10.5	10-10.5	Outside Investigation Area	3/03/2010	-	<1.11	3.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	1.1	1.4
AECOM_BH74	BH74_16.0-16.5	16-16.5	Outside Investigation Area	3/03/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH74	BH74_5.5-5.7	5.5-5.7	Outside Investigation Area	3/03/2010	-	2.511	35.6	-	-	-	<0.5	1	-	1.9	2.8	1.8	-	2.6	0.7	0.7	2.4	<0.5	6.7	<0.5	0.7	0.9	7.1	6.3
AECOM_BH74	BH74_8.5-8.8	8.5-8.8	Outside Investigation Area	3/03/2010	-	0.867	8.6	-	-	-	<0.5	<0.5	-	<0.5	0.8	0.7	-	0.8	<0.5	<0.5	0.7	<0.5	1.2	<0.5	<0.5	<0.5	1.3	3.1
AECOM_BH75	BH75_16.0-16.2	16-16.2	Outside Investigation Area	26/02/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH75	BH75_4.0-4.2	4-4.2	Outside Investigation Area	25/02/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM_BH75	BH75_8.5-8.7	8.5-8.7	Outside Investigation Area	25/02/2010	-	<1.21	<8	-	-	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

		TPH						BTEX							Inorganics
		TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Sum of BTEX	Total Xylene (ESDAT)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonias N
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			50	100	100	10	50	0.2	0.5	0.1	0.2	0.2	0.2	0.2	1
Tar Containing Material (TCM) Criteria															
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**											
AECOM_BH01	BH01_17.65-17.75	17.65-17.75	ORWN - Proposed Southern Cove	12/03/2009	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH01	BH01_25.0-25.1	25-25.1	ORWN - Proposed Southern Cove	12/10/2009	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH01	BH01_4.0-4.1	4-4.1	ORWN - Proposed Southern Cove	12/02/2009	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH01	BH01_7.0-7.1	7-7.1	ORWN - Proposed Southern Cove	12/02/2009	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH021	BH021 16.0-16.5	16-16.5	ORWN - Public Domain Blocks 4&5	9/05/2006	1590	510	1210	380	32	2100	-	-	-	-	-	-	-	-
BH025	BH025_8.5-9.0	8.5-9	Outside Investigation Area	10/05/2006	<200	<50	<100	<100	<2	<250	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH035	BH035_4.0-4.5	4-4.5	Block 4 - Proposed Southern Cove	18/05/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH042	BH042_6.0-6.5	6-6.5	Block 5	23/05/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH044	BH044_2.3-2.7	2.3-2.7	Block 5	23/05/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH044	BH044_4.0-4.5	4-4.5	Block 5	23/05/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH045	BH045_3.0-3.45	3-3.45	Block 5	24/05/2006	880	<50	420	460	<2	880	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH053	BH053-3.0-3.25	3-3.25	ORWN - Public Domain Blocks 4&5	29/05/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH055	BH055-3.3-3.5	3.3-3.5	Block 4	30/05/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH063	BH063-2.8-3.0	2.8-3	ORWN - Public Domain Blocks 4&5	1/06/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH068	BH068-3.0-3.45	3-3.45	Block 4	1/06/2006	130	<50	<100	130	<2	130	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH068	BH068-9.5-10.0	9.5-10	Block 4	1/06/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH077	BH077_3.0-3.45	3-3.45	Block 5	6/06/2006	1700	260	1210	490	<2	1960	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH078	BH078_3.0-3.45	3-3.45	Block 5	6/06/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH116	BH116 3.0_3.45	3-3.45	ORWN - Proposed Southern Cove	27/06/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH128	BH128_2.0-20.5	20-20.5	Outside Investigation Area	3/07/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH129	BH129_12.5-1.3	12.5-13	Outside Investigation Area	3/07/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH136	BH136 3.0_3.45	3-3.45	Block 5	6/07/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH136	BH136 8.0_8.5	8-8.5	Block 5	6/07/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH137	BH137 3.0_3.45	3-3.45	Block 4	6/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH143	BH143 3.0_3.45	3-3.45	ORWN - Proposed Southern Cove	10/07/2006	<200	<50	<100	<100	<2	<250	-	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	-
BH191	BH191/16.5	16.5	ORWN - Public Domain Blocks 4&5	14/04/2008	990	170	680	310	14	1160	-	7.8	2.2	0.6	5.1	5.7	2.1	-
BH191	BH191/18.2	18.2	ORWN - Public Domain Blocks 4&5	14/04/2008	<200	<50	<100	<100	<10	<250	-	<1	0.3	<0.5	<0.5	<0.5	<0.5	-
BH191	BH191/3.7	3.7	ORWN - Public Domain Blocks 4&5	27/03/2008	1080	120	700	380	<10	1200	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH191	BH191/5.6	5.6	ORWN - Public Domain Blocks 4&5	11/04/2008	<200	<50	<100	<100	<10	<250	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH212	BH212/12.2	12.2	ORWN - Public Domain Blocks 4&5	28/03/2008	<200	<50	<100	<100	<10	<250	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH212	BH212/26.0	26	ORWN - Public Domain Blocks 4&5	31/03/2008	<200	<50	<100	<100	<10	<250	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH212	BH212/4.8	4.8	ORWN - Public Domain Blocks 4&5	25/03/2008	<200	<50	<100	<100	<10	<250	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH213	BH213/10.5	10.5	Outside Investigation Area	14/04/2008	<200	<50	<100	<100	<10	<250	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH213	BH213/18.5	18.5	Outside Investigation Area	17/04/2008	130	<50	130	<100	<10	130	-	<1	<0.2	<0.5	0.5	<0.5	<0.5	-
BH213	BH213/3.6	3.6	Outside Investigation Area	14/04/2008	<200	<50	<100	<100	<10	<250	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH37	BH37_15.8-16.0	15.8-16	Block 4 - Proposed Southern Cove	18/02/2010	<200	<50	<100	<100	53	<50	-	19.1	0.6	2.6	5.7	12.2	6.9	-
AECOM_BH37	BH37_20.4-20.5	20.4-20.5	Block 4 - Proposed Southern Cove	18/02/2010	-	-	-	-	-	-	-	15.7	3.1	2.9	12	10.2	5.5	-
AECOM_BH37	BH37_22.2-AUGER	22.2	Block 4 - Proposed Southern Cove	18/02/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM_BH37	BH37_5.5-5.7	5.5-5.7	Block 4 - Proposed Southern Cove	18/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH37	BH37_8.3-8.5	8.3-8.5	Block 4 - Proposed Southern Cove	18/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH38	BH38_11.5-11.7	11.5-11.7	ORWN - Proposed Southern Cove	19/02/2010	-	-	-	-	-	-	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH38	BH38_14.5-14.7	14.5-14.7	ORWN - Proposed Southern Cove	19/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH38	BH38_20.5-20.7	20.5-20.7	ORWN - Proposed Southern Cove	19/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH38	BH38_8.5-8.7	8.5-8.7	ORWN - Proposed Southern Cove	19/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH39	BH39-11.5-11.7	11.5-11.7	ORWN - Proposed Southern Cove	24/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH39	BH39-16.0-16.2	16-16.2	ORWN - Proposed Southern Cove	24/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH39	BH39-20.5-20.7	20.5-20.7	ORWN - Proposed Southern Cove	24/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH39	BH39-4.0-4.2	4-4.2	ORWN - Proposed Southern Cove	24/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-

		TPH						BTEX							Inorganics
		TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Sum of BTEX	Total Xylene (ESDAT)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonias N
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			50	100	100	10	50	0.2	0.5	0.1	0.2	0.2	0.2	0.2	1
Tar Containing Material (TCM) Criteria															
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**											
AECOM_BH40	BH40_16.5-16.7	16.5-16.7	ORWN - Proposed Southern Cove	18/02/2010	-	-	-	-	-	-	-	22.8	5.4	1.3	14	17.2	5.6	-
AECOM_BH40	BH40_17.8-18.0	17.8-18	ORWN - Proposed Southern Cove	18/02/2010	-	-	-	-	-	-	-	3.4	0.8	<0.5	1.5	2.4	1	-
AECOM_BH40	BH40_19.0-19.4	19-19.4	ORWN - Proposed Southern Cove	18/02/2010	<200	<50	<100	<100	<10	<50	-	<1	0.6	<0.5	0.6	<0.5	<0.5	-
AECOM_BH40	BH40_7.0-7.2	7-7.2	ORWN - Proposed Southern Cove	18/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH400	BH400_12.0-12.4	12-12.4	Block 5	14/02/2011	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH400	BH400_13.2-13.4	13.2-13.4	Block 5	14/02/2011	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH400	BH400_14.0-14.2	14-14.2	Block 5	14/02/2011	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH400	BH400_15-15.4	15-15.4	Block 5	14/02/2011	-	<50	-	-	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<20
BH400	BH400_16.0-16.4	16-16.4	Block 5	14/02/2011	6410	3000	5600	810	331	9410	-	116.1	40.3	11.2	99.4	78.2	37.9	-
BH400	BH400_6.0-6.4	6-6.4	Block 5	11/02/2011	<200	<50	<100	<100	<10	<50	-	<1	0.3	<0.5	<0.5	<0.5	<0.5	-
BH400	BH400_9.0-9.4	9-9.4	Block 5	14/02/2011	570	<50	370	200	<10	570	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH401	BH401_10-10.4	10-10.4	Block 5	10/02/2011	-	<50	-	-	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<20
BH401	BH401_11-11.4	11-11.4	Block 5	10/02/2011	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH401	BH401_13-13.4	13-13.4	Block 5	10/02/2011	140	<50	140	<100	<10	140	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH401	BH401_14-14.2	14-14.2	Block 5	10/02/2011	2900	<50	1720	1180	<10	2900	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH401	BH401_14-17.4	17-17.4	Block 5	10/02/2011	<200	<50	<100	<100	<10	<50	-	<1	0.2	<0.5	<0.5	<0.5	<0.5	-
BH401	BH401_19.2-19.4	19.2-19.4	Block 5	11/02/2011	1180	470	970	210	22	1650	-	10.1	1.4	0.7	5.9	7.2	2.9	-
BH401	BH401_20-20.15	20-20.15	Block 5	11/02/2011	-	<50	-	-	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<20
BH401	BH401_3.0-3.4	3-3.4	Block 5	10/02/2011	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH401	BH401_5.0-5.4	5-5.4	Block 5	10/02/2011	250	<50	130	120	<10	250	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH402	BH402_11.0-11.2	11-11.2	Block 5	9/02/2011	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH402	BH402_14.0-14.5	14-14.5	Block 5	9/02/2011	2220	690	1560	660	66	2910	-	27.8	6.2	1.5	15.7	20.4	7.4	-
BH402	BH402_15-15.5	15-15.5	Block 5	9/02/2011	-	740	-	-	67	740	-	29	3.7	2	8	19	10	<20
BH402	BH402_16-16.3	16-16.3	Block 5	10/02/2011	-	150	-	-	35	150	-	14.9	0.8	1	6.4	10	4.9	<20
BH402	BH402_17.0-17.4	17-17.4	Block 5	10/02/2011	6330	3060	4860	1470	470	9390	-	174.1	63.4	9	127	128	46.1	-
BH402	BH402_19.1-19.4	19.1-19.4	Block 5	10/02/2011	250	180	250	<100	15	430	-	3.6	2.9	<0.5	3.3	2.6	1	-
BH402	BH402_9.0-9.3	9-9.3	Block 5	9/02/2011	860	<50	650	210	<10	860	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH403	BH403_10-10.4	10-10.4	Block 5	9/02/2011	-	12,300	-	-	930	12,300	-	411.3	83.7	20.6	202	318	93.3	<20
BH403	BH403_12-12.4	12-12.4	Block 5	9/02/2011	14,660	7080	11,200	3460	651	21,700 - 21,740	-	179.2	124	10.2	145	131	48.2	-
BH403	BH403_15-15.4	15-15.4	Block 5	9/02/2011	-	9340	-	-	95	9340	-	50	7	2.4	29.8	38.4	11.6	<20
BH403	BH403_16-16.4	16-16.4	Block 5	9/02/2011	12,640	5540	9740	2900	434	18,180 - 18,200	-	157.3	60	8.7	117	116	41.3	-
BH403	BH403_17-17.3	17-17.3	Block 5	9/02/2011	4270	1800	3290	980	13	6070	-	4.4	1.5	<0.5	2.9	3.3	1.1	-
BH403	BH403_2.0-2.4	2-2.4	Block 5	9/02/2011	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH403	BH403_4.0-4.4	4-4.4	Block 5	9/02/2011	3100	220	1340	1760	<10	3320	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH403	BH403_8.0-8.4	8-8.4	Block 5	9/02/2011	12,470	1300	8870	3600	31	13,770 - 13,800	-	10.2	4.2	4.3	5	6.6	3.6	-
BH404	BH404_12-12.4	12-12.4	Block 4	8/02/2011	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH404	BH404_14-14.4	14-14.4	Block 4	8/02/2011	2060	<50	1280	780	125	2060	-	35.1	11.5	14.5	6.6	26.5	8.6	-
BH404	BH404_15-15.4	15-15.4	Block 4	8/02/2011	<200	130	<100	<100	<10	130	-	1	1.2	<0.5	1.3	1	<0.5	-
BH404	BH404_4.0-4.4	4-4.4	Block 4	8/02/2011	380	<50	230	150	<10	380	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH404	BH404_7.0-7.4	7-7.4	Block 4	8/02/2011	7060	650	5240	1820	<10	7710	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH406	BH406_10.0-10.3	10-10.3	Block 4	8/02/2011	150	<50	150	<100	<10	150	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH406	BH406_14.0-14.4	14-14.4	Block 4	8/02/2011	1320	90	920	400	30	1410	-	6.7	3.8	2.6	1.6	4.4	2.3	-
BH406	BH406_15.0-15.4	15-15.4	Block 4	8/02/2011	3490	1340	2720	770	190	4830	-	50	15.1	3.2	31	36.9	13.1	-
BH406	BH406_16.0-16.5	16-16.5	Block 4	9/02/2011	3900	1940	3000	900	861	5840	-	171.8	85	10.9	140	126	45.8	-
BH406	BH406_4.0-4.2	4-4.2	Block 4	8/02/2011	290	<50	110	180	<10	290	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH406	BH406_7.0-7.2	7-7.2	Block 4	8/02/2011	140	<50	140	<100	<10	140	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH407	BH407_12.0-12.18	12-12.18	Block 4 - Proposed Southern Cove	14/02/2011	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH407	BH407_14.0-14.5	14-14.5	Block 4 - Proposed Southern Cove	14/02/2011	<200	<50	<100	<100	<10	<50	-	<1	0.2	<0.5	<0.5	<0.5	<0.5	-
BH407	BH407_15.1-15.45	15.1-15.45	Block 4 - Proposed Southern Cove	14/02/2011	-	<50	-	-	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	<20

				TPH						BTEX							Inorganics
				TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Sum of BTEX	Total Xylene (ESDAT)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonias N
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					50	100	100	10	50	0.2	0.5	0.1	0.2	0.2	0.2	0.2	1
Tar Containing Material (TCM) Criteria																	
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**													
BH407	BH407_16.3-16.5	16.3-16.5	Block 4 - Proposed Southern Cove	14/02/2011	<200	<50	<100	<100	<10	<50	-	<1	0.4	<0.5	<0.5	<0.5	<0.5	-
BH407	BH407_17.4-17.6	17.4-17.6	Block 4 - Proposed Southern Cove	14/02/2011	<200	<50	<100	<100	<10	<50	-	<1	0.4	<0.5	<0.5	<0.5	<0.5	-
BH407	BH407_18.0-18.3	18-18.3	Block 4 - Proposed Southern Cove	14/02/2011	<200	<50	<100	<100	<10	<50	-	<1	1.2	<0.5	1.1	<0.5	<0.5	-
BH407	BH407_8.0-8.1	8-8.1	Block 4 - Proposed Southern Cove	14/02/2011	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH41	BH41_14.5-14.7	14.5-14.7	Block 4 - Proposed Southern Cove	8/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH41	BH41_16.0-16.2	16-16.2	Block 4 - Proposed Southern Cove	8/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH41	BH41_17.5-17.7	17.5-17.7	Block 4 - Proposed Southern Cove	8/03/2010	<200	<50	<100	<100	<10	<50	-	<1	0.8	<0.5	1	<0.5	<0.5	-
AECOM_BH41	BH41_4.0-4.4	4-4.4	Block 4 - Proposed Southern Cove	4/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH41	BH41_8.5-8.9	8.5-8.9	Block 4 - Proposed Southern Cove	4/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH410	BH410_17.0-17.5	17-17.5	ORWN - Public Domain Blocks 4&5	11/05/2011	1820	<50	1160	660	<10	1820	-	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH410	BH410_2.0-2.2	2-2.2	ORWN - Public Domain Blocks 4&5	10/05/2011	<200	<50	<100	<100	<10	<50	-	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH410	BH410_23.0-23.2	23-23.2	ORWN - Public Domain Blocks 4&5	11/05/2011	<200	<50	<100	<100	<10	<50	-	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH410	BH410_26.0-26.2	26-26.2	ORWN - Public Domain Blocks 4&5	12/05/2011	<200	<50	<100	<100	<10	<50	-	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH410	BH410_32.0-32.2	32-32.2	ORWN - Public Domain Blocks 4&5	12/05/2011	<200	<50	<100	<100	22	<50	-	<0.5	<0.2	<0.5	16.4	<0.5	<0.5	-
BH410	BH410_7.0-7.2	7-7.2	ORWN - Public Domain Blocks 4&5	10/05/2011	1130	<50	840	290	<10	1130	-	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH411	BH411_10.0-10.1	10-10.1	ORWN - Public Domain Blocks 4&5	12/04/2011	<200	<50	<100	<100	-	<50	-	-	-	-	-	-	-	<1
BH411	BH411_15.0-15.1	15-15.1	ORWN - Public Domain Blocks 4&5	12/04/2011	1310	<50	930	380	<10	1310	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH411	BH411_18.0-18.1	18-18.1	ORWN - Public Domain Blocks 4&5	12/04/2011	1950	<50	1130	820	<10	1950	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH411	BH411_19.0-19.1	19-19.1	ORWN - Public Domain Blocks 4&5	12/04/2011	<200	<50	<100	<100	-	<50	-	-	-	-	-	-	-	8
BH411	BH411_2.0-2.1	2-2.1	ORWN - Public Domain Blocks 4&5	12/04/2011	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH411	BH411_23.0-23.1	23-23.1	ORWN - Public Domain Blocks 4&5	12/04/2011	<200	<50	<100	<100	-	<50	-	-	-	-	-	-	-	<1
BH411	BH411_26.0-26.1	26-26.1	ORWN - Public Domain Blocks 4&5	12/04/2011	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH411	BH411_3.1-3.2	3.1-3.2	ORWN - Public Domain Blocks 4&5	12/04/2011	<200	<50	<100	<100	-	<50	-	-	-	-	-	-	-	<1
BH411	BH411_4.0-4.1	4-4.1	ORWN - Public Domain Blocks 4&5	12/04/2011	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	-
BH411	BH411_8.0-8.1	8-8.1	ORWN - Public Domain Blocks 4&5	12/04/2011	<200	<50	<100	<100	<10	<50	<0.2	<0.5	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH46	BH46-14.5-14.7	14.5-14.7	ORWN - Proposed Southern Cove	23/02/2010	760	200	560	200	<10	960	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH46	BH46-19.0-19.2	19-19.2	ORWN - Proposed Southern Cove	23/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH46	BH46-20.5-20.7	20.5-20.7	ORWN - Proposed Southern Cove	23/02/2010	<200	<50	<100	<100	<10	<50	-	<1	0.4	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH46	BH46-23.5-23.7	23.5-23.7	ORWN - Proposed Southern Cove	23/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH46	BH46-7.0-7.2	7-7.2	ORWN - Proposed Southern Cove	23/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH47	BH47-13.0-13.2	13-13.2	ORWN - Public Domain Blocks 4&5	22/02/2010	860	<50	480	380	<10	860	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH47	BH47-4.0-4.2	4-4.2	ORWN - Public Domain Blocks 4&5	22/02/2010	1750	<50	850	900	<10	1750	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH47	BH47-8.5-8.7	8.5-8.7	ORWN - Public Domain Blocks 4&5	22/02/2010	880	<50	500	380	<10	880	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH48	BH48-14.5-14.7	14.5-14.7	Block 4	23/02/2010	4650	1750	3610	1040	90	6400	-	27.1	8.9	1.6	20.8	20.1	7	-
AECOM_BH48	BH48-17.0-17.2	17-17.2	Block 4	23/02/2010	110	60	110	<100	<10	170	-	0.8	0.2	<0.5	0.8	0.8	<0.5	-
AECOM_BH48	BH48-8.5-8.7	8.5-8.7	Block 4	23/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
JBS_BH517	BH517	2	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH517	BH517	3	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH517	BH517	4	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH517	BH517	5	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH517	BH517	6	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH517	BH517	7	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH517	BH517	8	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH517	BH517	9	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH517	BH517	13	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH518	BH518	2.9-3	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH518	BH518	3.9-4	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH518	BH518	4.9-5	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH518	BH518	5.9-6	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-

		TPH						BTEX							Inorganics
		TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Sum of BTEX	Total Xylene (ESDAT)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonias N
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			50	100	100	10	50	0.2	0.5	0.1	0.2	0.2	0.2	0.2	1
Tar Containing Material (TCM) Criteria															
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**											
JBS_BH529D	BH529D	2	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH529D	BH529D	3	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH529D	BH529D	4	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH529D	BH529D	5	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH529D	BH529D	6	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH529D	BH529D	7	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH529D	BH529D	8	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH529D	BH529D	9	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH529D	BH529D	15	Block 5 (Non-DECC)	14/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH539	BH539	10.9-11	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH539	BH539	11.9-12	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH539	BH539	12.9-13	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH539	BH539	2.9-3	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH539	BH539	3.9-4	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH539	BH539	4.9-5	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH539	BH539	5.9-6	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH539	BH539	6.9-7	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH539	BH539	7.9-8	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH539	BH539	8.9-9	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH539	BH539	9.9-10	Block 5 (Non-DECC)	18/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH540D	BH540D	12.9-13	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH540D	BH540D	2.9-3	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH540D	BH540D	3.9-4	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH540D	BH540D	4.9-5	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH540D	BH540D	5.9-6	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH540D	BH540D	6.9-7	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH540D	BH540D	7.9-8	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH540D	BH540D	8.9-9	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH540D	BH540D	9.9-10	Block 5 (Non-DECC)	17/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH541D	BH541D	2.9-3	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH541D	BH541D	3.9-4	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH541D	BH541D	4.9-5	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH541D	BH541D	5.9-6	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH541D	BH541D	6.9-7	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH541D	BH541D	7.9-8	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH541D	BH541D	8.9-9	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	3	2	2	1	2	1	-
JBS_BH541D	BH541D	9.9-10	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	87	64	8	69	62	25	-
JBS_BH542	BH542	11.9-12	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH542	BH542	12.9-13	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH542	BH542	13.9-14	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	27	16	7	17	19	8	-
JBS_BH542	BH542	14.5-14.6	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	87	41	9	62	63	24	-
JBS_BH542	BH542	2.9-3	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH542	BH542	3.9-4	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH542	BH542	4.9-5	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH542	BH542	5.9-6	Block 5 (Non-DECC)	19/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH543	BH543	16-16.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH543	BH543	2-2.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH543	BH543	3-3.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH543	BH543	4-4.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table T15
Offsite (west) - Soil Analytical Results – Saturated
Barangaroo

					TPH						BTEX							Inorganics
					TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Sum of BTEX	Total Xylene (ESDAT)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonias N
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL						50	100	100	10	50	0.2	0.5	0.1	0.2	0.2	0.2	0.2	1
Tar Containing Material (TCM) Criteria																		
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**														
JBS_BH543	BH543	5-5.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH543	BH543	6-6.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH543	BH543	8-8.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH543	BH543	9-9.1	Block 5 (Non-DECC)	15/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH544D	BH544D	11.9-12	ORWN - Public Domain Blocks 4&5	16/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH544D	BH544D	14.9-15	ORWN - Public Domain Blocks 4&5	16/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH544D	BH544D	2.9-3	ORWN - Public Domain Blocks 4&5	16/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH544D	BH544D	3.9-4	ORWN - Public Domain Blocks 4&5	16/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH544D	BH544D	4.9-5	ORWN - Public Domain Blocks 4&5	16/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH544D	BH544D	5.9-6	ORWN - Public Domain Blocks 4&5	16/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH545	BH545	13.8-13.9	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH545	BH545	2.9-3	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH545	BH545	3.9-4	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH546	BH546	2	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH546	BH546	3	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH546	BH546	4	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH546	BH546	5	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH546	BH546	6	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH547	BH547	2	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH547	BH547	3	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	<3	0.3	<1	0.5	<2	<1	-
JBS_BH547	BH547	7	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH547	BH547	8	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH547	BH547	9	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH547	BH547	12	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH547	BH547	13	Block 5 (Non-DECC)	23/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH548	BH548	2.9-3	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH548	BH548	3.9-4	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH548	BH548	4.9-5	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH548	BH548	5.9-6	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH549	BH549	11.4-11.5	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH549	BH549	2.9-3	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH549	BH549	4.9-5	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH549	BH549	5.9-6	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH549	BH549	6.9-7	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH549	BH549	7.9-8	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH549	BH549	8.9-9	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH550	BH550	12.9-13	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	<3	0.7	<1	1	<2	<1	-
JBS_BH550	BH550	13.9-14	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	<3	0.5	<1	0.9	<2	<1	-
JBS_BH550	BH550	14.9-15	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	<3	0.2	<1	<0.5	<2	<1	-
JBS_BH550	BH550	2.9-3	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH550	BH550	3.9-4	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH550	BH550	4.9-5	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH550	BH550	5.9-6	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH551	BH551	2.9-3	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH551	BH551	3.9-4	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH551	BH551	4.9-5	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH551	BH551	5.9-6	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH551	BH551	8.9-9	Block 5 (Non-DECC)	24/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH552	BH552	10.4-10.5	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-	-

		TPH						BTEX							Inorganics
		TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Sum of BTEX	Total Xylene (ESDAT)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonias N
		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL			50	100	100	10	50	0.2	0.5	0.1	0.2	0.2	0.2	0.2	1
Tar Containing Material (TCM) Criteria															
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**											
JBS_BH552	BH552	2.9-3	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH552	BH552	4.9-5	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
JBS_BH552	BH552	5.9-6	Block 5 (Non-DECC)	25/05/2012	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM_BH56	BH56_11.5-11.7	11.5-11.7	ORWN - Public Domain Blocks 4&5	4/03/2010	330	<50	200	130	<10	330	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH56	BH56_13.0-13.2	13-13.2	ORWN - Public Domain Blocks 4&5	5/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH56	BH56_14.5-15.0	14.5-15	ORWN - Public Domain Blocks 4&5	5/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH56	BH56_17.5-17.8	17.5-17.8	ORWN - Public Domain Blocks 4&5	5/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH56	BH56_2.5-2.7	2.5-2.7	ORWN - Public Domain Blocks 4&5	4/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH56	BH56_20.5-20.9	20.5-20.9	ORWN - Public Domain Blocks 4&5	5/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH56	BH56_21.4-21.6	21.4-21.6	ORWN - Public Domain Blocks 4&5	5/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH56	BH56_7.0-7.2	7-7.2	ORWN - Public Domain Blocks 4&5	4/03/2010	1630	70	1090	540	<10	1700	-	<1	0.3	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH57	BH57_11.5-11.7	11.5-11.7	Block 4	25/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH57	BH57_4.0-4.2	4-4.2	Block 4	25/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH57	BH57_7.0-7.2	7-7.2	Block 4	25/02/2010	610	<50	410	200	<10	610	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH60	BH60_13.0-13.4	13-13.4	ORWN - Public Domain Blocks 4&5	1/03/2010	440	<50	230	210	<10	440	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH60	BH60_16.0-16.4	16-16.4	ORWN - Public Domain Blocks 4&5	1/03/2010	2280	760	1660	620	84	3040	-	18.2	5.8	1	15.5	13.4	4.8	-
AECOM_BH60	BH60_17.5-17.7	17.5-17.7	ORWN - Public Domain Blocks 4&5	2/03/2010	160	60	160	<100	12	220	-	3.3	0.6	<0.5	1.9	2.4	0.9	-
AECOM_BH60	BH60_2.5-2.9	2.5-2.9	ORWN - Public Domain Blocks 4&5	1/03/2010	1110	<50	430	680	<10	1110	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH60	BH60_20.5-20.9	20.5-20.9	ORWN - Public Domain Blocks 4&5	2/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH60	BH60_7.0-7.2	7-7.2	ORWN - Public Domain Blocks 4&5	1/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH63	BH63_11.5-11.9	11.5-11.9	Outside Investigation Area	1/03/2010	200	<50	200	<100	<10	200	-	3.1	0.2	<0.5	<0.5	1.7	1.4	-
AECOM_BH63	BH63_13.0-13.3	13-13.3	Outside Investigation Area	1/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH63	BH63_17.7-17.9	17.7-17.9	Outside Investigation Area	1/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH63	BH63_2.5-2.7	2.5-2.7	Outside Investigation Area	26/02/2010	1430	<50	800	630	<10	1430	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH63	BH63_20.5-20.9	20.5-20.9	Outside Investigation Area	2/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH69	BH69_10.0-10.2	10-10.2	Block 5	26/02/2010	420	<50	420	<100	<10	420	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH69	BH69_4.0-4.2	4-4.2	Block 5	26/02/2010	590	<50	320	270	<10	590	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH70	BH70_11.5-11.7	11.5-11.7	Block 5	8/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH70	BH70_16.0-16.2	16-16.2	Block 5	8/03/2010	38,740	19,400	29,500	9240	2640	58,100 - 58,140	-	660	300	40.1	346	481	179	-
AECOM_BH70	BH70_2.5-2.7	2.5-2.7	Block 5	8/03/2010	1830	<50	580	1250	14	1830	-	2.9	0.6	1.4	<0.5	1.2	1.7	-
AECOM_BH70	BH70_4.0-4.2	4-4.2	Block 5	8/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH70	BH70_5.5-5.7	5.5-5.7	Block 5	8/03/2010	4220	<50	1640	2580	<10	4220	-	<1	0.3	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH71	BH71_10.0-10.2	10-10.2	Outside Investigation Area	4/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH71	BH71_13.0-13.2	13-13.2	Outside Investigation Area	4/03/2010	110	<50	110	<100	<10	110	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH71	BH71_15.0-15.2	15-15.2	Outside Investigation Area	4/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH71	BH71_19.0-19.2	19-19.2	Outside Investigation Area	4/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH71	BH71_2.5-2.7	2.5-2.7	Outside Investigation Area	4/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH71	BH71_7.0-7.2	7-7.2	Outside Investigation Area	4/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH72	BH72_13.0-13.2	13-13.2	ORWN - Public Domain Blocks 4&5	3/03/2010	2600	<50	1660	940	<10	2600	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH72	BH72_16.0-16.2	16-16.2	ORWN - Public Domain Blocks 4&5	4/03/2010	740	<50	520	220	<10	740	-	0.6	<0.2	<0.5	<0.5	0.6	<0.5	-
AECOM_BH72	BH72_19.0-19.2	19-19.2	ORWN - Public Domain Blocks 4&5	4/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH72	BH72_2.5-2.7	2.5-2.7	ORWN - Public Domain Blocks 4&5	3/03/2010	290	<50	160	130	<10	290	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH72	BH72_20.5-20.7	20.5-20.7	ORWN - Public Domain Blocks 4&5	4/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH72	BH72_5.5-5.7	5.5-5.7	ORWN - Public Domain Blocks 4&5	3/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-

				TPH						BTEX							Inorganics
				TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Sum of BTEX	Total Xylene (ESDAT)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonias N
				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL					50	100	100	10	50	0.2	0.5	0.1	0.2	0.2	0.2	0.2	1
Tar Containing Material (TCM) Criteria																	
Location	**Field ID**	**Sample Depth**	**Monitoring Zone**	**Sample Date**													
AECOM_BH73	BH73_11.5-11.7	11.5-11.7	Outside Investigation Area	2/03/2010	110	<50	<100	110	<10	110	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH73	BH73_16.0-16.2	16-16.2	Outside Investigation Area	2/03/2010	200	120	200	<100	<10	320	-	0.7	0.6	<0.5	<0.5	0.7	<0.5	-
AECOM_BH73	BH73_17.5-17.7	17.5-17.7	Outside Investigation Area	2/03/2010	<200	<50	<100	<100	34	<50	-	11.8	0.7	0.7	4.9	8.5	3.3	-
AECOM_BH73	BH73_19.0-19.2	19-19.2	Outside Investigation Area	2/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH73	BH73_20.5-20.7	20.5-20.7	Outside Investigation Area	2/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH73	BH73_7.0-7.2	7-7.2	Outside Investigation Area	2/03/2010	280	<50	130	150	<10	280	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH74	BH74_10.0-10.5	10-10.5	Outside Investigation Area	3/03/2010	230	<50	130	100	<10	230	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH74	BH74_16.0-16.5	16-16.5	Outside Investigation Area	3/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH74	BH74_5.5-5.7	5.5-5.7	Outside Investigation Area	3/03/2010	200	<50	200	<100	<10	200	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH74	BH74_8.5-8.8	8.5-8.8	Outside Investigation Area	3/03/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH75	BH75_16.0-16.2	16-16.2	Outside Investigation Area	26/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-
AECOM_BH75	BH75_4.0-4.2	4-4.2	Outside Investigation Area	25/02/2010	<200	<50	<100	<100	<10	<50	-	-	-	-	-	-	-	-
AECOM_BH75	BH75_8.5-8.7	8.5-8.7	Outside Investigation Area	25/02/2010	<200	<50	<100	<100	<10	<50	-	<1	<0.2	<0.5	<0.5	<0.5	<0.5	-

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
BOLD = Sample classified as TCM based on PAH (>2000 mg/kg) and Benzo(a)pyrene (>150 mg/kg) results

						PAHs																								
						CPAH (TEF)	PAH (TOTAL)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene
						ug/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL								0.5	0.1	0.1	0.1	0.1	0.5	0.1	0.1	0.05	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.1
MWQC									2.1		5.8	5.8		0.01	0.1	0.1		0.1	0.1	0.1	0.1	0.1	1	3	0.1	70		0.6	0.025
GW SSTC (Human Health)						1000						47,000														1300			

Well	Location	Area	Screened Lithology	Sample Date	Area																									
Wells screened within fill material																														
IT04M	IT04M	ORWN - Public Domain Blocks 4&5	Fill	19/05/2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT05M	IT05M	ORWN - Public Domain Blocks 4&5	Fill	19/05/2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT05S	IT05S	ORWN - Public Domain Blocks 4&5	Fill	19/05/2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT1_MID	AECOM_IT1	ORWN - Public Domain Blocks 4&5	Fill	24/03/2010	8	122	<1	4	<1	6	10	2	6	7	7	12	-	3	-	7	<1	13	11	2	16	134	20	14
IT1_SHALLOW	AECOM_IT1	ORWN - Public Domain Blocks 4&5	Fill	25/03/2010	<1.998	<12.6	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	**<0.9**	**<0.9**	**<0.9**	<2	-	**<0.9**	-	**<0.9**	**<0.9**	<0.9	<0.9	**<0.9**	<0.9	<0.9	**<0.9**	**<0.9**
IT2_MID	AECOM_IT2	ORWN - Public Domain Blocks 4&5	Fill	24/03/2010	<2.22	70	<1	7	<1	6	2	<1	2	**<1**	**<1**	<2	-	**<1**	-	**<1**	**<1**	2	5	**<1**	41	70	10	2
IT2_SHALLOW	AECOM_IT2	ORWN - Public Domain Blocks 4&5	Fill	24/03/2010	<2.22	2	<1	<1	<1	1	<1	<1	**<1**	**<1**	**<1**	<2	-	**<1**	-	**<1**	**<1**	1	<1	**<1**	<1	2	**<1**	**<1**
MW02	BH009	Outside Investigation Area	Fill	14/07/2006	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW02	BH009	Outside Investigation Area	Fill	17/07/2006	0.7	8.1	-	-	-	<1	<1	-	**<1**	**<1**	0.7	-	**<1**	**<1**	**<1**	**<1**	**<1**	2.5	<1	**<1**	<1	-	2.9	2
MW02	BH009	Outside Investigation Area	Fill	14/08/2007	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW02	BH009	Outside Investigation Area	Fill	6/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW02	BH009	Outside Investigation Area	Fill	31/07/2008	-	<5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
MW03	BH010	Outside Investigation Area	Fill	19/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW03	BH010	Outside Investigation Area	Fill	5/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW03	BH010	Outside Investigation Area	Fill	31/07/2008	-	<5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
MW04	BH011	Outside Investigation Area	Fill	14/07/2006	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW04	BH011	Outside Investigation Area	Fill	25/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW04	BH011	Outside Investigation Area	Fill	13/08/2007	0.9	6.4	-	-	-	<1	<1	-	**<1**	**<1**	0.9	-	**<1**	**<1**	**<1**	**<1**	**<1**	2.2	<1	**<1**	<1	-	1.3	2
MW04	BH011	Outside Investigation Area	Fill	6/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW04	BH011	Outside Investigation Area	Fill	31/07/2008	-	<5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
MW05	BH031	Outside Investigation Area	Fill	18/07/2006	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW05	BH031	Outside Investigation Area	Fill	16/08/2007	<1.92	7.7	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	7.7	-	**<1**	**<1**
MW05	BH031	Outside Investigation Area	Fill	9/05/2008	<0.192	<1.55	-	<0.1	<0.1	<0.1	<0.1	-	**<0.1**	<0.1	<0.05	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW05	BH031	Outside Investigation Area	Fill	31/07/2008	-	<5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
MW06	BH031	Outside Investigation Area	Fill	18/07/2006	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW06	BH031	Outside Investigation Area	Fill	16/08/2007	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW06	BH033	Outside Investigation Area	Fill	8/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW06	BH033	Outside Investigation Area	Fill	31/07/2008	-	<5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
MW07	BH036	Outside Investigation Area	Fill	17/07/2006	1.781	12.2	-	-	-	<1	<1	-	**<1**	1.2	1.5	-	1.5	**<1**	**<1**	1.1	**<1**	2.7	<1	<1	<1	-	1.2	3
MW07	BH036	Outside Investigation Area	Fill	15/08/2007	3.497	27.2	-	-	-	<1	<1	-	**<1**	2.2	2.7	-	2.7	1.6	1.3	2.1	**<1**	5.4	<1	1.4	<1	-	1.7	6.1
MW07	BH036	Outside Investigation Area	Fill	6/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	**<1**	**<1**
MW08	BH046	Outside Investigation Area	Fill	25/07/2006	38.74	446.6	-	-	-	11.7	10.8	-	18.4	25.6	25.8	-	21.9	11.6	18.3	24.4	4.9	64.5	14	11	72.1	-	52.4	59.2
MW08	BH046	Outside Investigation Area	Fill	14/08/2006	3.498	127.7	-	-	-	8.5	4.1	-	7.1	2.9	2.7	-	1.9	1.2	1.7	2.6	**<1**	9.8	7.5	1.1	51.2	-	16.7	8.7
MW08	BH046	Outside Investigation Area	Fill	16/08/2007	3.918	98.1	-	-	-	4.6	2	-	4.9	2.6	3.1	-	2.2	1.6	1.6	2.2	**<1**	6	2.9	1.4	49.5	-	7.4	6.1
MW08	BH046	Outside Investigation Area	Fill	7/05/2008	0.6	63.6	-	-	-	6.1	1.3	-	3.1	**<1**	0.6	-	**<1**	**<1**	**<1**	**<1**	**<1**	2.8	4.2	**<1**	37.6	-	5.5	2.4
MW08	BH046	Outside Investigation Area	Fill	16/03/2010	<1.11	23	<0.5	2	<0.5	2	<0.5	<0.5	1	**<0.5**	**<0.5**	<1	-	**<0.5**	-	**<0.5**	**<0.5**	1	2	<0.5	13	23	3	1
MW08	BH046	Outside Investigation Area	Fill	28/02/2011	<1.92	17.2	-	-	-	2.1	<1	-	1.9	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	2.2	<1	7.9	-	3.1	**<1**
MW08 FILTRATE	BH046	Outside Investigation Area	Fill	28/02/2011	<0.192	11.1	-	0.3	<0.1	0.7	0.3	-	0.4	<0.1	<0.05	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	9.7	-	<0.1	**<0.1**
MW11	BH053	ORWN - Public Domain Blocks 4&5	Fill	14/08/2007	<1.92	3.9	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	1.7	<1	**<1**	<1	-	**<1**	2.2
MW11	BH053	ORWN - Public Domain Blocks 4&5	Fill	14/07/2006	<1.92	10	-	-	-	<1	1.5	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	2.2	1.6	**<1**	2.8	-	**<1**	1.9
MW11	BH053	ORWN - Public Domain Blocks 4&5	Fill	17/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12	BH057	Outside Investigation Area	Fill	14/07/2006	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW12	BH057	Outside Investigation Area	Fill	19/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12	BH057	Outside Investigation Area	Fill	14/08/2007	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW12	BH057	Outside Investigation Area	Fill	13/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW13	BH061	Outside Investigation Area	Fill	14/07/2006	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW13	BH061	Outside Investigation Area	Fill	19/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

						PAHs																								
						CPAH (TEF)	PAH (TOTAL)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene
						ug/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL								0.5	0.1	0.1	0.1	0.1	0.5	0.1	0.1	0.05	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.1
MWQC									2.1		5.8	5.8		0.01	0.1	0.1		0.1	0.1	0.1	0.1	0.1	1	3	0.1	70		0.6	0.025
GW SSTC (Human Health)						1000						47,000														1300			
Well	**Location**	**Area**	**Screened Lithology**	**Sample Date**	**Area**																									
MW13	BH061	Outside Investigation Area	Fill	14/08/2007	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW13	BH061	Outside Investigation Area	Fill	13/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW13	BH061	Outside Investigation Area	Fill	28/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW14	BH076	ORWN - Public Domain Blocks 4&5	Fill	17/07/2006	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW14	BH076	ORWN - Public Domain Blocks 4&5	Fill	14/08/2007	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW14	BH076	ORWN - Public Domain Blocks 4&5	Fill	7/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW14	BH076	ORWN - Public Domain Blocks 4&5	Fill	16/03/2010	<4.44	<28	<2	<2	<2	<2	<2	<2	**<2**	**<2**	**<2**	<4	-	**<2**	-	**<2**	**<2**	**<2**	<2	**<2**	<2	<2	**<2**	**<2**
MW19	BH106A	Outside Investigation Area	Fill	18/07/2006	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW19	BH106A	Outside Investigation Area	Fill	16/08/2007	<1.92	6.6	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	6.6	-	**<1**	**<1**
MW19	BH106A	Outside Investigation Area	Fill	9/05/2008	<0.192	<1.55	-	<0.1	<0.1	<0.1	<0.1	-	**<0.1**	<0.1	<0.05	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW212	BH212	ORWN - Public Domain Blocks 4&5	Fill	8/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW212	BH212	ORWN - Public Domain Blocks 4&5	Fill	12/05/2008	<0.192	<1.55	-	<0.1	<0.1	<0.1	<0.1	-	**<0.1**	<0.1	<0.05	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW213	BH213	Outside Investigation Area	Fill	8/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW213	BH213	Outside Investigation Area	Fill	16/03/2010	<4.44	<28	<2	<2	<2	<2	<2	<2	**<2**	**<2**	**<2**	<4	-	**<2**	-	**<2**	**<2**	**<2**	<2	**<2**	<2	<2	**<2**	**<2**
MW213	BH213	Outside Investigation Area	Fill	25/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW214	BH214	Outside Investigation Area	Fill	8/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW214	BH214	Outside Investigation Area	Fill	12/05/2008	<0.192	0.1	-	<0.1	<0.1	<0.1	<0.1	-	**<0.1**	<0.1	<0.05	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	0.1	**<0.1**
MW214	BH214	Outside Investigation Area	Fill	25/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW215	BH215	Outside Investigation Area	Fill	8/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW215	BH215	Outside Investigation Area	Fill	12/05/2008	<0.192	<1.55	-	<0.1	<0.1	<0.1	<0.1	-	**<0.1**	<0.1	<0.05	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW22	BH116	ORWN - Proposed Southern Cove	Fill	17/07/2006	<1.92	14.9	-	-	-	1.2	1.1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	1.4	**<1**	9.9	-	1.3	**<1**
MW22	BH116	ORWN - Proposed Southern Cove	Fill	7/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW22	BH116	ORWN - Proposed Southern Cove	Fill	15/03/2010	<4.44	<28	<2	<2	<2	<2	<2	<2	**<2**	**<2**	**<2**	<4	-	**<2**	-	**<2**	**<2**	**<2**	<2	**<2**	<2	<2	**<2**	**<2**
MW24	BH129	Outside Investigation Area	Fill	25/07/2006	3.251	45	-	-	-	<1	<1	-	4.2	2.5	2.4	-	2.6	1.4	1.8	2.7	**<1**	9	<1	1.2	3.8	-	6.6	6.8
MW24	BH129	Outside Investigation Area	Fill	15/08/2007	<1.92	7.6	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	7.6	-	**<1**	**<1**
MW24	BH129	Outside Investigation Area	Fill	6/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW24	BH129	Outside Investigation Area	Fill	16/03/2010	<1.11	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**<0.5**	**<0.5**	**<0.5**	<1	-	**<0.5**	-	**<0.5**	**<0.5**	<0.5	<0.5	**<0.5**	<0.5	<0.5	<0.5	**<0.5**
MW24	BH129	Outside Investigation Area	Fill	25/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW25	BH153	Outside Investigation Area	Fill	25/07/2006	2.143	20.7	-	-	-	<1	<1	-	2.4	1.3	1.5	-	2.3	**<1**	2.7	1.3	**<1**	3.3	<1	**<1**	<1	-	2.5	3.4
MW25	BH153	Outside Investigation Area	Fill	13/08/2007	3.904	31.6	-	-	-	<1	<1	-	1.1	2.4	3	-	2.8	2	1.6	2.4	**<1**	5.5	<1	1.8	<1	-	2.5	6.5
MW25	BH153	Outside Investigation Area	Fill	12/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW501	JBS_BH501	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	0.1	**<0.1**
MW502	JBS_BH502	Outside Investigation Area	Fill	28/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	-	0.1	0.1
MW506D	JBS_BH506D	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW506S	JBS_BH506S	Outside Investigation Area	Fill	28/05/2012	-	-	-	-	-	0.3	0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.3	0.3	<0.1	1.3	-	0.5	0.3
MW507	JBS_BH507	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	0.3	-	0.2	0.1
MW514	JBS_BH514	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	0.3	0.1	-	0.7	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.5	0.5	<0.1	0.9	-	1.2	0.4
MW515	JBS_BH515	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	0.4	0.1	-	0.2	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.3	0.3	<0.1	1	-	0.8	0.3
MW516	JBS_BH516	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	0.9	<0.1	-	0.2	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.5	0.5	<0.1	0.4	-	1	0.5
MW518	JBS_BH518	Block 5 (Non-DECC)	Fill	28/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	0.1	-	0.2	0.1
MW525D	JBS_BH525D	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	0.3	0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	-	<0.1	0.1
MW525S	JBS_BH525S	Outside Investigation Area	Fill	28/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	0.1	**<0.1**
MW526	JBS_BH526	Outside Investigation Area	Fill	25/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW527	JBS_BH527	Outside Investigation Area	Fill	25/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.2	0.1	<0.1	<0.1	-	0.1	0.1
MW529D	JBS_BH529D	Block 5 (Non-DECC)	Fill	24/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	-	<0.1	0.1
MW529S	JBS_BH529S	Outside Investigation Area	Fill	25/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW539	JBS_BH539	Block 5 (Non-DECC)	Fill	25/05/2012	-	-	-	-	-	8.7	1.4	-	1.8	0.2	0.1	<0.2	-	<0.1	-	0.2	<0.1	2	5.2	<0.1	69	-	7	1.6
MW540D	JBS_BH540D	Block 5 (Non-DECC)	Fill	25/05/2012	-	-	-	-	-	1.5	1	-	0.4	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.4	1.4	<0.1	16	-	2	0.3
MW540S	JBS_BH540S	Block 5 (Non-DECC)	Fill	25/05/2012	-	-	-	-	-	13	0.5	-	2.1	0.1	<0.1	<0.2	-	<0.1	-	0.1	<0.1	1.9	6.6	<0.1	73	-	9	1.3

						PAHs																						
						CPAH (TEF)	PAH (TOTAL)	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	PAHs (Sum of total)	Phenanthrene	Pyrene
						ug/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL								0.5	0.1	0.1	0.1	0.1	0.5	0.1	0.1	0.05	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.1	0.1
MWQC									2.1		5.8	5.8		0.01	0.1	0.1		0.1	0.1	0.1	0.1	0.1	1	3	0.1	70		0.6	0.025
GW SSTC (Human Health)						1000						47,000														1300			
Well	**Location**	**Area**	**Screened Lithology**	**Sample Date**	**Area**																								
MW541D	JBS_BH541D	Block 5 (Non-DECC)	Fill	25/05/2012	-	-	-	-	-	34	97	-	56	50	50	61	-	17	-	40	3.9	120	81	18	1900	-	170	120
MW541S	JBS_BH541S	Block 5 (Non-DECC)	Fill	28/05/2012	-	-	-	-	-	1.1	1.2	-	0.5	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.4	1.6	<0.1	3.4	-	2.3	0.4
MW542	JBS_BH542	Block 5 (Non-DECC)	Fill	28/05/2012	-	-	-	-	-	4.7	0.5	-	0.8	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.7	3.6	<0.1	20	-	4.4	0.5
MW543	JBS_BH543	Block 5 (Non-DECC)	Fill	24/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW544D	JBS_BH544D	ORWN - Public Domain Blocks 4&5	Fill	24/05/2012	-	-	-	-	-	<0.1	<0.1	-	0.1	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	0.1	<0.1	<0.1	0.6	-	0.2	0.1
MW544S	JBS_BH544S	ORWN - Public Domain Blocks 4&5	Fill	25/05/2012	-	-	-	-	-	<0.1	<0.1	-	**<0.1**	<0.1	<0.1	<0.2	-	<0.1	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	**<0.1**
MW74	AECOM_BH74	Outside Investigation Area	Fill	18/03/2010	0.1	18	<0.9	1	<0.9	1	<0.9	<0.9	1	1	**<0.9**	<2	-	**<0.9**	-	**<0.9**	**<0.9**	3	1	**<0.9**	4	18	4	3
Wells screened within marine sediments																												
MW01	BH008A	Outside Investigation Area	Fill + 0.1 m into Sandstone	14/07/2006	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW01	BH008A	Outside Investigation Area	Fill + 0.1 m into Sandstone	25/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MW01	BH008A	Outside Investigation Area	Fill + 0.1 m into Sandstone	5/05/2008	<1.92	<15.5	-	-	-	<1	<1	-	**<1**	**<1**	**<0.5**	-	**<1**	**<1**	**<1**	**<1**	**<1**	<1	<1	**<1**	<1	-	**<1**	**<1**
MW01	BH008A	Outside Investigation Area	Fill + 0.1 m into Sandstone	31/07/2008	-	<5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<5	-	-	-
MW179	BH179	Outside Investigation Area	Fill + Marine Sediments	6/05/2008	0.7	3.4	-	-	-	<1	<1	-	**<1**	**<1**	0.7	-	**<1**	**<1**	**<1**	**<1**	**<1**	1.4	<1	**<1**	<1	-	**<1**	1.3
MW60	AECOM_BH60	ORWN - Public Domain Blocks 4&5	Fill + Marine Sediments	18/03/2010	<1.998	1558	<0.9	71	<0.9	5	20	<0.9	2	**<0.9**	**<0.9**	<2	-	**<0.9**	-	**<0.9**	**<0.9**	3	14	**<0.9**	1500	1560	12	2
MW40	AECOM_BH40	ORWN - Proposed Southern Cove	Fill + Marine Sediments + SS	20/03/2010	<1.998	297	<0.9	36	<0.9	4	16	<0.9	3	**<0.9**	**<0.9**	<2	-	**<0.9**	-	**<0.9**	**<0.9**	2	12	**<0.9**	244	297	14	2
MW69	AECOM_BH69	Block 5	Fill + Sandstone	19/03/2010	7.52	2444	<2	326	<2	35	158	5	28	14	6	6	-	**<2**	-	12	**<2**	34	64	**<2**	1920	2450	126	47
MW69	AECOM_BH69	Block 5	Fill + Sandstone	25/02/2011	<12.1	320	-	-	-	11.7	37.2	-	8.9	**<5**	**<5**	-	**<5**	**<5**	**<5**	**<5**	**<5**	7.4	5.7	**<5**	202	-	32	15.1
MW 69 FILTRATE	AECOM_BH69	Block 5	Fill + 0.1 m into Sandstone	25/02/2011	<0.192	5	-	<0.1	<0.1	<0.1	<0.1	-	**<0.1**	<0.1	<0.05	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	5	-	<0.1	**<0.1**
IT04D	IT04D	ORWN - Public Domain Blocks 4&5	Marine Sediments	19/05/2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT05D	IT05D	ORWN - Public Domain Blocks 4&5	Marine Sediments	19/05/2011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IT1_DEEP	AECOM_IT1	ORWN - Public Domain Blocks 4&5	Marine Sediments	24/03/2010	19.41	354	<10	**<10**	<10	**<10**	12	<10	10	21	17	39	-	10	-	21	**<10**	33	10	**<10**	153	393	29	38
IT2_DEEP	AECOM_IT2	ORWN - Public Domain Blocks 4&5	Marine Sediments	24/03/2010	<2.22	165	<1	4	<1	1	2	<1	**<1**	**<1**	**<1**	<2	-	**<1**	-	**<1**	**<1**	<1	1	**<1**	159	165	2	**<1**
MW401	BH401	Block 5	Marine Sediments	24/02/2011	<11.858	249.2	-	-	-	10.5	12.8	-	**<4.9**	**<4.9**	**<4.9**	-	**<4.9**	**<4.9**	**<4.9**	**<4.9**	**<4.9**	**<4.9**	9.4	**<4.9**	195	-	16.3	5.2
MW401 FILTRATE	BH401	Block 5	Marine Sediments	24/02/2011	<0.192	49.9	-	2.1	<0.1	1.2	1	-	**<0.1**	<0.1	<0.05	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	47.7	-	<0.1	**<0.1**
MW56	AECOM_BH56	ORWN - Public Domain Blocks 4&5	Marine Sediments	17/03/2010	<1.698	<12.3	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	**<0.9**	**<0.9**	**<0.6**	<2	-	**<0.9**	-	**<0.9**	**<0.9**	<0.9	<0.9	**<0.9**	<0.9	<0.9	**<0.9**	**<0.9**

Notes
µg/L - micrograms per litre
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC $^{VMP:}$ Site Specific Target Criteria for the VMP Area
Shading denotes concentration greater than SSTC criteria
Shading denotes concentraiton greater than MWQC criteria
Bold denotes laboratory EQL greater than MWQC criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic, **TPH C10-C36 aliphatic and aromatic (note TPH in table not speciated)

					TPH						BTEX					Inorganics	
					TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonia	Ammonia as N
					mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
EQL						50	100	50	20	50	1	1	1	10	1	0.005	0.01
MWQC						40			110		700	80	180	75		0.91	
GW SSTC (Human Health)						17,000	220,000	250,000			2100					150	
Well	**Location**	**Area**	**Screened Lithology**	**Sample Date**													
Wells screened within fill material																	
IT04M	IT04M	ORWN - Public Domain Blocks 4&5	Fill	19/05/2011	-	-	-	-	-	-	-	-	-	-	-	-	1.24
IT05M	IT05M	ORWN - Public Domain Blocks 4&5	Fill	19/05/2011	-	-	-	-	-	-	-	-	-	-	-	-	<0.1
IT05S	IT05S	ORWN - Public Domain Blocks 4&5	Fill	19/05/2011	-	-	-	-	-	-	-	-	-	-	-	-	<0.1
IT1_MID	AECOM_IT1	ORWN - Public Domain Blocks 4&5	Fill	24/03/2010	1.35	100	900	450	<20	1450	<1	<2	<5	<2	<2	-	<0.1
IT1_SHALLOW	AECOM_IT1	ORWN - Public Domain Blocks 4&5	Fill	25/03/2010	<0.15	**<50**	<100	<50	<20	<50	<1	<2	<5	<2	<2	-	<0.1
IT2_MID	AECOM_IT2	ORWN - Public Domain Blocks 4&5	Fill	24/03/2010	3.9	210	3580	320	30	4110	3	<2	<5	<2	<2	-	9.26
IT2_SHALLOW	AECOM_IT2	ORWN - Public Domain Blocks 4&5	Fill	24/03/2010	0.33	**<50**	240	90	40	330	2	<2	20	<2	<2	-	<0.1
MW02	BH009	Outside Investigation Area	Fill	14/07/2006	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	-
MW02	BH009	Outside Investigation Area	Fill	17/07/2006	0.57	**<50**	200	370	<20	570	<1	<2	<2	<2	<2	-	-
MW02	BH009	Outside Investigation Area	Fill	14/08/2007	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	1
MW02	BH009	Outside Investigation Area	Fill	6/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	<0.015
MW02	BH009	Outside Investigation Area	Fill	31/07/2008	<0.15	**<50**	<100	<50	<20	<200	<5	<5	<5	<5	<5	-	-
MW03	BH010	Outside Investigation Area	Fill	19/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-
MW03	BH010	Outside Investigation Area	Fill	5/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	0.13
MW03	BH010	Outside Investigation Area	Fill	31/07/2008	<0.15	**<50**	<100	<50	<20	<200	<5	<5	<5	<5	<5	-	-
MW04	BH011	Outside Investigation Area	Fill	14/07/2006	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	-
MW04	BH011	Outside Investigation Area	Fill	25/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-
MW04	BH011	Outside Investigation Area	Fill	13/08/2007	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	<0.1
MW04	BH011	Outside Investigation Area	Fill	6/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	0.119
MW04	BH011	Outside Investigation Area	Fill	31/07/2008	<0.15	**<50**	<100	<50	<20	<200	<5	<5	<5	<5	<5	-	-
MW05	BH031	Outside Investigation Area	Fill	18/07/2006	0.17	**<50**	100	70	<20	170	<1	<2	<2	<2	<2	-	-
MW05	BH031	Outside Investigation Area	Fill	16/08/2007	<0.15	**<50**	<100	<50	<20	<200	1	<2	<2	<2	<2	-	<0.01
MW05	BH031	Outside Investigation Area	Fill	9/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	<0.015
MW05	BH031	Outside Investigation Area	Fill	31/07/2008	<0.15	**<50**	<100	<50	<20	<200	<5	<5	<5	<5	<5	-	-
MW06	BH031	Outside Investigation Area	Fill	18/07/2006	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	-
MW06	BH031	Outside Investigation Area	Fill	16/08/2007	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	2	<2	-	<0.01
MW06	BH033	Outside Investigation Area	Fill	8/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	0.214
MW06	BH033	Outside Investigation Area	Fill	31/07/2008	<0.15	**<50**	<100	<50	<20	<200	<5	<5	<5	<5	<5	-	-
MW07	BH036	Outside Investigation Area	Fill	17/07/2006	0.08	**<50**	<100	80	<20	80	<1	<2	<2	<2	<2	-	-
MW07	BH036	Outside Investigation Area	Fill	15/08/2007	0.46	**<50**	300	160	<20	460	<1	<2	<2	<2	<2	-	<0.1
MW07	BH036	Outside Investigation Area	Fill	6/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	0.581
MW08	BH046	Outside Investigation Area	Fill	25/07/2006	8.98	1060	6400	2580	120	10,040	25	10	17	14	10	-	-
MW08	BH046	Outside Investigation Area	Fill	14/08/2006	4.34	1180	4000	340	60	5520	8	4	6	5	5	-	-
MW08	BH046	Outside Investigation Area	Fill	16/08/2007	9.96	1490	8300	1660	<20	11,450	4	3	<2	4	3	-	16.3
MW08	BH046	Outside Investigation Area	Fill	7/05/2008	5.26	1070	4300	960	<20	6330	2	3	<5	2	2	-	12.4
MW08	BH046	Outside Investigation Area	Fill	16/03/2010	3.54	950	3190	350	20	4490	7	<2	<5	<2	2	-	-
MW08	BH046	Outside Investigation Area	Fill	28/02/2011	2.27	560	2110	160	<20	2830	6	2	<5	2	2	-	-
MW08 FILTRATE	BH046	Outside Investigation Area	Fill	28/02/2011	-	-	-	-	-	-	-	-	-	-	-	-	-
MW11	BH053	ORWN - Public Domain Blocks 4&5	Fill	14/08/2007	0.84	50	700	140	<20	890	<1	<2	<2	<2	<2	-	6.05
MW11	BH053	ORWN - Public Domain Blocks 4&5	Fill	14/07/2006	0.2	**<50**	200	<50	<20	200	<1	<2	<2	<2	<2	-	-
MW11	BH053	ORWN - Public Domain Blocks 4&5	Fill	17/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12	BH057	Outside Investigation Area	Fill	14/07/2006	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	-
MW12	BH057	Outside Investigation Area	Fill	19/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-
MW12	BH057	Outside Investigation Area	Fill	14/08/2007	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	0.907
MW12	BH057	Outside Investigation Area	Fill	13/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	0.017
MW13	BH061	Outside Investigation Area	Fill	14/07/2006	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	-
MW13	BH061	Outside Investigation Area	Fill	19/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-

					TPH						BTEX					Inorganics	
					TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonia	Ammonia as N
					mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
EQL						50	100	50	20	50	1	1	1	10	1	0.005	0.01
MWQC						40			110		700	80	180	75		0.91	
GW SSTC (Human Health)						17,000	220,000	250,000			2100					150	
Well	**Location**	**Area**	**Screened Lithology**	**Sample Date**													
MW13	BH061	Outside Investigation Area	Fill	14/08/2007	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	0.839
MW13	BH061	Outside Investigation Area	Fill	13/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	<0.015
MW13	BH061	Outside Investigation Area	Fill	28/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	-	-
MW14	BH076	ORWN - Public Domain Blocks 4&5	Fill	17/07/2006	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	-
MW14	BH076	ORWN - Public Domain Blocks 4&5	Fill	14/08/2007	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	1.07
MW14	BH076	ORWN - Public Domain Blocks 4&5	Fill	7/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	0.144
MW14	BH076	ORWN - Public Domain Blocks 4&5	Fill	16/03/2010	<0.15	**<50**	<100	<50	<20	<50	<1	<2	<5	<2	<2	-	-
MW19	BH106A	Outside Investigation Area	Fill	18/07/2006	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	-
MW19	BH106A	Outside Investigation Area	Fill	16/08/2007	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	<0.1
MW19	BH106A	Outside Investigation Area	Fill	9/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	<0.015
MW212	BH212	ORWN - Public Domain Blocks 4&5	Fill	8/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	<0.015
MW212	BH212	ORWN - Public Domain Blocks 4&5	Fill	12/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-
MW213	BH213	Outside Investigation Area	Fill	8/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	<0.015
MW213	BH213	Outside Investigation Area	Fill	16/03/2010	<0.15	**<50**	<100	<50	<20	<50	<1	<2	<5	<2	<2	-	-
MW213	BH213	Outside Investigation Area	Fill	25/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	<0.005	-
MW214	BH214	Outside Investigation Area	Fill	8/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	0.057
MW214	BH214	Outside Investigation Area	Fill	12/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-
MW214	BH214	Outside Investigation Area	Fill	25/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	0.068	-
MW215	BH215	Outside Investigation Area	Fill	8/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	0.078
MW215	BH215	Outside Investigation Area	Fill	12/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-
MW22	BH116	ORWN - Proposed Southern Cove	Fill	17/07/2006	0.4	90	400	<50	30	490	5	<2	4	2	<2	-	-
MW22	BH116	ORWN - Proposed Southern Cove	Fill	7/05/2008	0.2	100	200	<50	30	300	2	<2	<5	<2	<2	-	1.24
MW22	BH116	ORWN - Proposed Southern Cove	Fill	15/03/2010	<0.15	**<50**	<100	<50	<20	<50	<1	<2	<5	<2	<2	-	2.7
MW24	BH129	Outside Investigation Area	Fill	25/07/2006	0.74	**<50**	300	440	<20	740	<1	<2	<2	<2	<2	-	-
MW24	BH129	Outside Investigation Area	Fill	15/08/2007	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	<0.1
MW24	BH129	Outside Investigation Area	Fill	6/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	0.138
MW24	BH129	Outside Investigation Area	Fill	16/03/2010	<0.15	**<50**	<100	<50	<20	<50	<1	<2	<5	<2	<2	-	-
MW24	BH129	Outside Investigation Area	Fill	25/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	<0.005	-
MW25	BH153	Outside Investigation Area	Fill	25/07/2006	0.18	**<50**	100	80	<20	180	<1	<2	<2	<2	<2	-	-
MW25	BH153	Outside Investigation Area	Fill	13/08/2007	0.6	**<50**	400	200	<20	600	<1	<2	<2	<2	<2	-	3.61
MW25	BH153	Outside Investigation Area	Fill	12/05/2008	0.1	**<50**	100	<50	<20	100	3	<2	<5	<2	<2	-	4.32
MW501	JBS_BH501	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	1.1	-
MW502	JBS_BH502	Outside Investigation Area	Fill	28/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	-	-
MW506D	JBS_BH506D	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	5.7	-
MW506S	JBS_BH506S	Outside Investigation Area	Fill	28/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	0.54	-
MW507	JBS_BH507	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	1.5	-
MW514	JBS_BH514	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	6.7	-
MW515	JBS_BH515	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	6.8	-
MW516	JBS_BH516	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	0.056	-
MW518	JBS_BH518	Block 5 (Non-DECC)	Fill	28/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	0.72	-
MW525D	JBS_BH525D	Outside Investigation Area	Fill	24/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	0.02	-
MW525S	JBS_BH525S	Outside Investigation Area	Fill	28/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	-	-
MW526	JBS_BH526	Outside Investigation Area	Fill	25/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	0.008	-
MW527	JBS_BH527	Outside Investigation Area	Fill	25/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	0.04	-
MW529D	JBS_BH529D	Block 5 (Non-DECC)	Fill	24/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	0.27	-
MW529S	JBS_BH529S	Outside Investigation Area	Fill	25/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	0.13	-
MW539	JBS_BH539	Block 5 (Non-DECC)	Fill	25/05/2012	-	-	-	-	-	-	41	2	9	6	4	15	-
MW540D	JBS_BH540D	Block 5 (Non-DECC)	Fill	25/05/2012	-	-	-	-	-	-	5	<1	4	2	1	18	-
MW540S	JBS_BH540S	Block 5 (Non-DECC)	Fill	25/05/2012	-	-	-	-	-	-	38	2	1	3	2	15	-

					TPH						BTEX					Inorganics	
					TPH C15-C36	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH C6 - C9	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Ammonia	Ammonia as N
					mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L
EQL						50	100	50	20	50	1	1	1	10	1	0.005	0.01
MWQC						40			110		700	80	180	75		0.91	
GW SSTC (Human Health)						17,000	220,000	250,000			2100					150	
Well	**Location**	**Area**	**Screened Lithology**	**Sample Date**													
MW541D	JBS_BH541D	Block 5 (Non-DECC)	Fill	25/05/2012	-	-	-	-	-	-	4300	78	1900	520	240	42	-
MW541S	JBS_BH541S	Block 5 (Non-DECC)	Fill	28/05/2012	-	-	-	-	-	-	4	<1	2	<2	<1	-	-
MW542	JBS_BH542	Block 5 (Non-DECC)	Fill	28/05/2012	-	-	-	-	-	-	3	<1	<1	<2	<1	-	-
MW543	JBS_BH543	Block 5 (Non-DECC)	Fill	24/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	0.03	-
MW544D	JBS_BH544D	ORWN - Public Domain Blocks 4&5	Fill	24/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	0.54	-
MW544S	JBS_BH544S	ORWN - Public Domain Blocks 4&5	Fill	25/05/2012	-	-	-	-	-	-	<1	<1	<1	<2	<1	0.03	-
MW74	AECOM_BH74	Outside Investigation Area	Fill	18/03/2010	0.42	**<50**	280	140	<20	420	<1	<2	<5	<2	<2	-	-
Wells screened within marine sediments																	
MW01	BH008A	Outside Investigation Area	Fill + 0.1 m into Sandstone	14/07/2006	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<2	<2	<2	-	-
MW01	BH008A	Outside Investigation Area	Fill + 0.1 m into Sandstone	25/07/2006	-	-	-	-	-	-	-	-	-	-	-	-	-
MW01	BH008A	Outside Investigation Area	Fill + 0.1 m into Sandstone	5/05/2008	<0.15	**<50**	<100	<50	<20	<200	<1	<2	<5	<2	<2	-	0.204
MW01	BH008A	Outside Investigation Area	Fill + 0.1 m into Sandstone	31/07/2008	<0.15	**<50**	<100	<50	<20	<200	<5	<5	<5	<5	<5	-	-
MW179	BH179	Outside Investigation Area	Fill + Marine Sediments	6/05/2008	1.02	**<50**	200	820	<20	1020	<1	<2	<5	<2	<2	-	0.218
MW60	AECOM_BH60	ORWN - Public Domain Blocks 4&5	Fill + Marine Sediments	18/03/2010	2.75	18,500	2630	120	4360	21,250	1380	34	969	313	148	-	-
MW40	AECOM_BH40	ORWN - Proposed Southern Cove	Fill + Marine Sediments + SS	20/03/2010	-	-	-	-	-	-	52	2	46	26	12	-	9.7
MW69	AECOM_BH69	Block 5	Fill + Sandstone	19/03/2010	4.26	7200	3900	360	3400	11,460	868	77	804	240	144	-	90.4
MW69	AECOM_BH69	Block 5	Fill + Sandstone	25/02/2011	0.33	530	330	<50	210	860	52	16	9	13	13	-	-
MW 69 FILTRATE	AECOM_BH69	Block 5	Fill + 0.1 m into Sandstone	25/02/2011	-	-	-	-	-	-	-	-	-	-	-	-	-
IT04D	IT04D	ORWN - Public Domain Blocks 4&5	Marine Sediments	19/05/2011	-	-	-	-	-	-	-	-	-	-	-	-	1.21
IT05D	IT05D	ORWN - Public Domain Blocks 4&5	Marine Sediments	19/05/2011	-	-	-	-	-	-	-	-	-	-	-	-	2.47
IT1_DEEP	AECOM_IT1	ORWN - Public Domain Blocks 4&5	Marine Sediments	24/03/2010	4	1350	3050	950	210	5350	113	4	22	22	10	-	1.38
IT2_DEEP	AECOM_IT2	ORWN - Public Domain Blocks 4&5	Marine Sediments	24/03/2010	2.99	1860	2790	200	350	4850	265	7	65	32	18	-	5.99
MW401	BH401	Block 5	Marine Sediments	24/02/2011	1.07	790	1070	<50	350	1860	127	<5	108	27	15	-	-
MW401 FILTRATE	BH401	Block 5	Marine Sediments	24/02/2011	-	-	-	-	-	-	-	-	-	-	-	-	-
MW56	AECOM_BH56	ORWN - Public Domain Blocks 4&5	Marine Sediments	17/03/2010	0.92	440	920	<50	1460	1360	378	20	473	189	66	-	-

Notes
µg/L - micrograms per litre
EQL = Estimated Quantitation Limit
< denotes result less than EQL
SSTC $^{VMP-}$ Site Specific Target Criteria for the VMP Area
Shading denotes concentration greater than SSTC criteria
Shading denotes concentraiton greater than MWQC criteria
Bold denotes laboratory EQL greater than MWQC criteria
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TEF - Toxicity Equivalent Factor
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
* TPH C6-C9 aliphatic, **TPH C10-C36 aliphatic and aromatic (note TPH in table not speciated)

Chemical Group																	TPH					BTEX										
Chemical Name	Arsenic	Barium	Beryllium	Cadmium	Chromium	Chromium (hexavalent)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Vanadium	Zinc	TPH C6 - C9	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Total Xylene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	1	5	1	0.1	1	0.5	1	2	10	2	5	0.05	1	5	5	2	50	100	100	50	0.2	0.2	0.2	0.15	0.5	0.5	0.5	0.5	0.5	0.5	1
AECOM_BH33	BH33_0.75-0.85	Fill	PDA - Block 4	<5			<1	8			264		6		<0.1	10		50	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1						
AECOM_BH33	BH33_5.0-5.2	Fill	PDA - Block 4	6			<1	10			12		36		<0.1	12		77	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH33	BH33_8.0-8.2	Natural Sandstone	PDA - Block 4	<5			<1	9			10		37		<0.1	7		40	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1						
AECOM_BH34	BH34_1.8-2.2	Fill	PDA - Block 4	<5	80	<1	<1	16	<0.5	5	6		15	252	<0.1	6	18	33	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH34	QC240		PDA - Block 4	<5	70	<1	<1	12	<0.5	4	6	14,000	12	253	<0.1	5	18	24	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH34	QC241		PDA - Block 4	2	47	<1	<0.1	25	<1	5	4	16,300	16	316	<0.05	6	22	33	<10	<50	<100	<100	<250 - 0	<0.2	<0.5	<0.5	<1.5 - 0	<0.5	<0.5		<0.5	<0.5	<0.5	<1
AECOM_BH34	BH34_3.8-4.0	Fill	PDA - Block 4	<5	40	<1	<1	9		4	<5		9	160	<0.1	4	14	17																
AECOM_BH34	BH34_6.0-6.2	Fill	PDA - Block 4	<5	40	<1	<1	11		6	6		11	285	<0.1	8	17	40	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH34	BH34_11.0-11.2	Natural Sandstone	PDA - Block 4	<5	30	<1	<1	9		4	<5		11	219	<0.1	5	13	27	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH35	BH35_0.9-1.0	Fill	PDA - Block 4	7	70	1	<1	9		10	9		40	457	<0.1	13	19	89																
AECOM_BH35	BH35_4.9-5.0	Fill	PDA - Block 4	<5	110	<1	<1	10		5	<5		13	268	<0.1	6	17	27	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH35	BH35_6.4-6.5	Fill	PDA - Block 4	<5	90	<1	<1	10		5	<5		12	308	<0.1	7	18	28																
AECOM_BH35	BH35_9.9-10.0	Fill	PDA - Block 4	<5	20	<1	<1	9	<0.5	4	<5	13,200	12	154	<0.1	6	19	37	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH36	BH36-0.07-0.1	Fill	VMP & PDA - Block 3	<5	20	<1	<1	2		12	256		6	753	<0.1	7	119	51																
AECOM_BH36	BH36_1.0-1.2	Fill	VMP & PDA - Block 3	<5	10	<1	<1	8		<2	<5		17	43	<0.1	<2	12	14	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH36	BH36_4.0-4.4	Fill	VMP & PDA - Block 3	<5	30	<1	<1	7		<2	<5		9	73	<0.1	2	12	17	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM_BH36	BH36_8.5-8.9	Fill	VMP & PDA - Block 3	<5	50	<1	<1	9		6	7		13	308	<0.1	10	14	46	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH36	BH36_13-13.4	Fill	VMP & PDA - Block 3	<5	50	<1	<1	8		4	6		13	254	<0.1	5	14	40																
AECOM_BH36	BH36_15-15.05	Natural Sandstone	VMP & PDA - Block 3	<5	40	<1	<1	12	<0.5	<2	<5	12,800	12	43	<0.1	5	20	11	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM_BH37	BH37_0.06-0.1	Fill	Block 4	<5	20	<1	<1	2		12	225		6	768	<0.1	7	125	47																
AECOM_BH37	BH37_2.5-2.7	Fill	Block 4	<5	<10	<1	<1	5		<2	23		9	9	<0.1	<2	8	11																
AECOM_BH37	BH37_5.5-5.7	Fill	Block 4	<5	30	<1	<1	8	<0.5	3	<5	8730	20	125	<0.1	5	15	28	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH37	BH37_8.3-8.5	Fill	Block 4	<5	80	<1	<1	10		6	<5		11	329	<0.1	9	16	46	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH37	QC67		Block 4	<5	70	<1	<1	9	<0.5	7	6	20,000	15	486	<0.1	11	17	46	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH37	QC68		Block 4	3	74	<1	<0.1	8	<1	7	4	22,600	14	418	<0.05	10	13	41	<10	<50	<100	<100	<250 - 0	<0.2	<0.5	<0.5	<1.5 - 0	<0.5	<0.5		<0.5	<0.5	<0.5	<1
AECOM_BH37	BH37_15.8-16.0	Fill	Block 4	<5	20	<1	<1	11	<0.5	<2	<5	1030	10	<5	<0.1	2	9	<5	53	<50	<100	<100	<50	0.6	2.6	5.7	19.1	<0.5	1		0.6	0.5	<0.5	
AECOM_BH37	QC69		Block 4	<5	20	<1	<1	12	<0.5	<2	<5	1120	9	<5	<0.1	2	9	<5	<10	<50	<100	<100	<50	0.4	<0.5	1.2	2.2	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH37	BH37_20.4-20.5	Natural Sandstone	Block 4	<5	<10	<1	<1	2	<0.5	<2	<5	620	6	<5	<0.1	2	10	<5						3.1	2.9	12	15.7	0.6	3.8	<0.5	1.5	1.2	0.8	<1
AECOM_BH37	BH37_22.2-AUGER	Natural Clayey Sand	Block 4	<5	20	<1	<1	7	<0.5	<2	<5	9810	10	11	<0.1	<2	15	6										16.1	112	<0.6	39.9	35	22.8	18
AECOM_BH40	BH40_1.0-1.2	Fill	PDA - Block 4	<5	20	<1	<1	9		3	<5		10	181	<0.1	4	13	20																
AECOM_BH40	BH40_7.0-7.2	Fill	PDA - Block 4	<5	20	<1	<1	7		4	<5		7	180	<0.1	5	9	30	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH40	QC54		PDA - Block 4	<5	20	<1	<1	7		2	<5		7	115	<0.1	3	10	15	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH40	BH40_13.0-13.2	Fill	PDA - Block 4	<5	<10	<1	<1	4		<2	<5		8	77	<0.1	<2	8	36																
AECOM_BH40	BH40_16.5-16.7	Natural Sandy Clay	PDA - Block 4	20	<10	<1	<1	22	<0.5	<2	<5	17,800	6	<5	<0.1	<2	86	<5						5.4	1.3	14	22.8	2.5	13.1	<0.5	10	8.4	6.8	6
AECOM_BH40	BH40_17.8-18.0	Natural Sandy Clay	PDA - Block 4	<5	10	<1	<1	5	<0.5	<2	<5	890	6	<5	<0.1	<2	6	<5						0.8	<0.5	1.5	3.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM_BH40	BH40_19.0-19.4	Natural Sandy Clay	PDA - Block 4	38	20	<1	<1	28	<0.5	<2	<5	24,500	8	9	<0.1	2	116	8	<10	<50	<100	<100	<50	0.6	<0.5	0.6	<1	<0.5	2		2	1.4	0.8	
AECOM_BH41	BH41_0.07-0.1	Fill	Block 4	<5	20	<1	<1	2		13	356		7	852	<0.1	11	127	54																
AECOM_BH41	BH41_1.0-1.4	Fill	Block 4	7	510	1	<1	11	<0.5	13	11	38,400	17	682	<0.1	21	22	94	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH41	BH41_4.0-4.4	Fill	PDA - Block 4	<5	20	<1	<1	7		4	<5		8	215	<0.1	5	10	34	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH41	BH41_8.5-8.9	Fill	Block 4	<5	10	<1	<1	8	<0.5	3	<5	9710	8	169	<0.1	3	12	16	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH41	BH41_14.5-14.7	Fill	Block 4	<5	80	<1	<1	12		3	15		47	203	0.3	5	18	101	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	0.7		0.6	0.9	1.2	
AECOM_BH41	BH41_16.0-16.2	Natural Clayey Sand	Block 4	<5	10	<1	<1	8		<2	<5	2840	7	<5	0.1	2	10	<5	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	1.2		1.4	0.5	<0.5	
AECOM_BH41	BH41_17.5-17.7	Natural Sandstone	Block 4						<0.5										<10	<50	<100	<100	<50	0.8	<0.5	1	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM_BH42	BH42_1.0-1.1	Fill	PDA - Block 4	5	70	<1	<1	11		4	25		142	203	0.2	8	18	89	<10	<50	110	<100	110 - 260	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	2	1.5	
AECOM_BH42	BH42_2.0-2.1	Fill	PDA - Block 4																															
AECOM_BH42	BH42_3.2-3.3	Fill	PDA - Block 4	6	<10	<1	<1	4	<0.5	<2	<5	4550	8	6	<0.1	<2	8	<5	234	4680	13,200	4150	22,000 - 22,030	1	40.8	1.5	123.5	35	250	<1.2	217	157	113	136
AECOM_BH42	BH42_3.5-3.6	Natural Sandstone	PDA - Block 4	10	<10	<1	<1	5		<2	<5		<5	9	<0.1	<2	10	<5	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	0.8		<0.5	<0.5	<0.5	
AECOM_BH44	BH44_1.4-1.5	Fill	PDA - Block 4	<5	100	<1	<1	18		18	50		127	406	0.1	66	31	89																
AECOM_BH44	BH44_1.9-2.0	Fill	PDA - Block 4	5	130	<1	<1	8	<0.5	<2	9	11,300	17	<5	<0.1	<2	32	<5	10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH44	BH44_4.9-5.0	Natural Sandstone	PDA - Block 4	<5	50	<1	<1	11	<0.5	<2	<5	8600	<5	<5	<0.1	<2	10	<5	147	1040	2650	650	4340	2.1	18.1	5.4	46.6	11.3	90	<1.2	41.9	27.6	15.6	18
AECOM_BH45	BH45_0.8-1.0	Fill	PDA - Block 4	<5	70	<1	<1	12		5	<5		18	283	<0.1	6	17	28																
AECOM_BH45	BH45_3.2-3.4	Fill	PDA - Block 4	<5	60	<1	<1	16		5	<5		13	318	<0.1	7	19	29	10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH45	QC230		PDA - Block 4	<5	70	<1	<1	18		5	5		16	321	<0.1	7	16	31	<10	<50	<100	<100	<50					<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH45	BH45_7.2-7.4	Fill	PDA - Block 4	<5	50	1	<1	9	<0.5	5	5	21,800	16	193	<0.1	6	15	51	12	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH45	QC231		PDA - Block 4	<5	60	<1	<1	11	<0.5	4	7	12,700	26	167	<0.1	5	15	36	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH45	QC232		PDA - Block 4	3	33	<1	<0.1	10	<1	7	6	8730	16	424	<0.05	8	14	48	<10	<50	<100	<100	<250 - 0	<0.2	<0.5	<0.5	<1.5 - 0	<0.5	<0.5		<0.5	<0.5	<0.5	<1
AECOM_BH45	BH45_13.2-13.4	Natural Sandstone	PDA - Block 4	<5	40	<1	<1	12		5	<5		13	297	<0.1	6	18	32	<10	<50	<100	<100	<50					<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH48	BH48_0.15-0.16	Fill	Block 4	<5	70	<1	<1	12		29	77		<5	599	<0.1	83	32	41																
AECOM_BH48	BH48-1.0-1.2	Fill	Block 4	<5	130	<1	<1	8		<2	13		259	90	0.3	3	14	201	<10	<50	200	150	350 - 400	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	0.9	0.7	
AECOM_BH48	QC76		Block 4	<5	120	<1	<1	8		<2	9		226	108	0.3	3	11	136	<10	<50	150	160	310 - 360	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	0.8	0.6	
AECOM_BH48	QC77		Block 4	3	76	<1	0.2	7		1	14		256	93	0.9	4	11	175	<10	<50	100	110	210 - 260	<0.2	<0.5	<0.5	<1.5 - 0	<0.5	<0.5		<0.5	0.6	0.5	<1
AECOM_BH48	BH48-8.5-8.7	Fill	Block 4	<5	90	<1	<1	8		2	15		88	111	0.3	6	18	906	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	0.5	<0.5	
AECOM_BH48	BH48-11.5-11.7	Fill	Block 4																														
AECOM_BH48	BH48-14.5-14.7	Natural Sandstone	Block 4	<5	30	<1	<1	4	<0.8	<2	23	4420	12	33	0.3	<2	8	27	90	1750	3610	1040	6400	8.9	1.6	20.8	27.1	12.9	113	<1.2	54	39.2	31	39
AECOM_BH48	QC78		Block 4	<5	10	<1	<1	6	<0.5	<2	<5		6	<5	<0.1	<2	<5	7	424	1980	3490	1020	6490	35	7.6	95.5	132.3	18.2	142	<1.2	98	54.8	43.4	54
AECOM_BH48	BH48-17.0-17.2	Natural Sandstone	Block 4	<5	10	<1	<1	3		<2	<5		5	<5	<0.1	<2	5	<5	<10	60	110	<100	170 - 270	0.2	<0.5	0.8	1.3	<0.5	1.9		2	1.2	0.6	
AECOM_BH49	BH49_1.5-1.7	Fill	PDA - Block 4	<5	70	<1	<1	14		6	56		141	251	0.2	11	18	110	11	80	1460	790	2330	<0.2	<0.5	<0.5	<1	1.1	11		18.1	35.8	22.7	
AECOM_BH49	BH49_4.2-4.4	Fill	PDA - Block 4	<5	50	<1	<1	3		<2	15		30	110	0.7	3	6	6	13	250	1610	1080	2940	<0.2	<0.5	<0.5	<1	4.1	23.8		16	23.2	19.2	
AECOM_BH49	BH49_6.2-6.4	Fill	PDA - Block 4	14	<10	<1	<1	23	<0.5	<2	<5	24,400	7	20	<0.1	2	49	<5	<10	160	450	150	760	1.6	<0.5	1.8	2.8	0.8	2.3	<0.5	1.7	3.1	2.5	3

Chemical Group																	TPH					BTEX										
Chemical Name	Arsenic	Barium	Beryllium	Cadmium	Chromium	Chromium (hexavalent)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Vanadium	Zinc	TPH C6 - C9	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Total Xylene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	1	5	1	0.1	1	0.5	1	2	10	2	5	0.05	1	5	5	2	50	100	100	50	0.2	0.2	0.2	0.15	0.5	0.5	0.5	0.5	0.5	0.5	1
AECOM_BH49	BH49-6.2-6.4	Fill	PDA - Block 4																													
AECOM_BH49	QC223		PDA - Block 4	13	<10	<1	<1	16	<0.5	<2	<5	19,800	<5	10	<0.1	<2	38	<5	11	60	260	<100	320 - 420	2.4	<0.5	2.5	3.6	1	2.9	<0.5	2.8	2.5	1.9	2
AECOM_BH49	QC224		PDA - Block 4	12	14	<1	<0.1	25	<1	3	4	17,000	10	53	0.07	9	31	22	10	130	110	<100	240 - 340	3.3	1.3	3.4	5.8	1	2.2	<0.5	1.4	1.3	1	1
AECOM_BH49	BH49_8.2-8.4	Fill	PDA - Block 4	6	<10	<1	<1	30		<2	<5		14	33	<0.1	<2	44	<5	348	1160	2650	790	4600	49.7	5.2	74.6	84.1	11.2	55.1		43.6	30.9	16.4	
AECOM_BH49	BH49_10.2-10.4	Fill	PDA - Block 4	<5	30	<1	<1	35		<2	<5		8	<5	<0.1	<2	54	<5	56	670	1240	420	2330	5.5	1.4	10.8	14.6	5.3	32.6		25.8	23.1	11.4	
AECOM_BH49	BH49_12.2-12.4	Natural Clayey Sand	PDA - Block 4	<5	<10	<1	<1	19	<0.5	<2	<5	12,200	26	<5	<0.1	<2	9	<5						10.2	2	16.6	28.9	16.5	132	<1.2	59.1	48.4	35.8	45
AECOM_BH50	BH50_0.15-0.25	Fill	PDA - Block 4	<5	30	<1	<1	10		28	80		<5	507	<0.1	91	22	36															
AECOM_BH50	BH50_1.3-1.5	Natural Sandstone	PDA - Block 4	<5	<10	<1	<1	3		<2	<5	2310	<5	<5	<0.1	<2	6	<5	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	0.6	<0.5	
AECOM_BH52	BH52_0.15-0.16	Fill	PDA - Block 4	<5	60	<1	<1	25	<0.5	39	72	60,700	<5	677	<0.1	160	34	48															
AECOM_BH52	BH52_1.0-1.2	Fill	PDA - Block 4	<5	50	<1	<1	8		<2	57		132	69	0.2	4	11	114	78	<50	580	370	950 - 1000	0.2	2.7	3.9	28.9							
AECOM_BH52	BH52_2.2-2.6	Fill	PDA - Block 4	<5	20	<1	<1	18	<0.5	3	14	12,400	35	150	<0.1	8	19	61	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	1		1	2.4	1.6	
AECOM_BH52	QC220		PDA - Block 4	<5	<10	<1	<1	4	<0.5	<2	<5	3740	<5	5	<0.1	<2	14	<5	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH52	QC221		PDA - Block 4	<1	<5	<1	<0.1	4	<1	<1	<2	1030	5	8	<0.05	<1	6	6	<10	<50	<100	<100	<250 - 0	<0.5	<0.5	<0.5	<1.5	<0.5	<0.5		<0.5	<0.5	<0.5	<1
AECOM_BH52	BH52_4.2-4.4	Fill	PDA - Block 4	<5	60	<1	<1	19		<2	190		93	35	0.2	6	24	38	10	<50	6600	2370	8970 - 9020	1.7	1	1.1	2.1	36.1	85.7		115	140	82.2	
AECOM_BH54	BH54_0.6-0.7	Fill	PDA - Block 4	<5	100	<1	<1	10	<0.5	5	30	55,000	630	246	0.2	16	18	231															
AECOM_BH54	BH54_1.0-1.4	Fill	PDA - Block 4	<5	40	<1	<1	12	<0.5	3	28	#######	206	652	<0.1	3	22	20	72	4380	11,700	3560	19,600 - 19,640	2.5	3.5	7.3	35.5	273	1000		1070	912	533	
AECOM_BH54	QC228		PDA - Block 4	<5	40	<1	<1	13	<0.5	<2	21	39,600	158	79	0.1	2	17	21	212	10,300	27,600	8940	46,800 - 46,840	4.3	8	21.5	88.6	144	468		509	467	253	
AECOM_BH54	BH54_2.8-3.0	Natural Sand	PDA - Block 4	<5	10	<1	<1	12		<2	<5		9	8	<0.1	<2	17	<5	13	900	2980	1000	4880	<0.2	0.8	<0.5	4.8	11.1	29.3	<1.2	32.6	27.5	21.7	28
AECOM_BH55	BH55_1.0-1.2	Fill	PDA - Block 4	<5	40	<1	<1	5		<2	<5		20	15	0.4	<2	10	<5	109	11,300	19,400	5550	36,200 - 36,250	7.8	2.8	14	34.9	80.7	473		482	425	252	
AECOM_BH55	BH55_2.2-2.4	Fill	PDA - Block 4	<5	10	<1	<1	5		<2	<5	6640	9	<5	<0.1	<2	8	<5	304	6420	10,600	3740	20,760 - 20,800	22.2	29.6	2.3	100.4	25.3	149	<1.2	119	107	84	102
AECOM_BH55	BH55_2.7-2.9	Fill	PDA - Block 4	<5	20	<1	<1	10		<2	11		30	6	0.1	<2	6	<5	104	9150	14,800	4750	28,700	9.4	8.9	2	40.9	67.1	386		341	294	160	
AECOM_BH57	BH57_4.0-4.2	Fill	Block 4	<5	50	<1	<1	6		<2	12		280	46	0.3	2	14	99	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1							
AECOM_BH57	BH57_7.0-7.2	Fill	Block 4	8	290	<1	<1	18		<2	25	13,300	318	87	0.3	4	36	379	<10	<50	410	200	610 - 660	<0.2	<0.5	<0.5	<1	<0.5	2.7		7.3	10.5	6.8	
AECOM_BH57	BH57_11.5-11.7	Fill	Block 4	<5	40	<1	<1	6		5	96		83	179	0.2	8	36	62	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
AECOM_BH57	BH57_16.5-16.7	Natural Clayey Sand	Block 4	5	10	<1	<1	210		<2	7		10	188	<0.1	5	21	7															
AECOM_BH58	BH58_0.15-0.16	Fill	PDA - Block 4	<5	60	<1	<1	21	<0.5	34	65	55,000	<5	618	<0.1	137	30	46															
AECOM_BH58	BH58_1.0-1.2	Fill	PDA - Block 4	8	60	<1	<1	11		4	30		54	186	0.6	8	25	49	<10	<50	550	460	1010 - 1060	<0.2	<0.5	<0.5	<1	0.6	8.2		8.5	16.2	12.7	
AECOM_BH58	BH58_3.2-3.4	Fill	PDA - Block 4	<5	50	<1	<1	9		6	70		118	160	0.1	12	28	120	<10	80	450	380	910	<0.2	<0.5	<0.5	<1	1.6	1.1		2.2	2.8	2.1	
AECOM_BH58	QC225		PDA - Block 4	6	70	<1	<1	8		3	59		171	130	0.3	6	17	121	<10	<50	520	400	920 - 970	<0.2	<0.5	<0.5	<1	2.4	1.1		3.1	6	3.4	
AECOM_BH58	QC226		PDA - Block 4	4	36	<1	0.2	10		2	27		123	68	0.2	5	16	190	<10	<50	320	270	590 - 640	<0.2	<0.5	<0.5	<1.5 - 0	1.4	1.4		1.8	5.7	5.3	8
AECOM_BH58	BH58_5.2-5.4	Fill	PDA - Block 4	<5	120	<1	<1	13		4	55		386	127	0.2	10	21	261	<10	<50	320	300	620 - 670	<0.2	<0.5	<0.5	<1	1.2	0.9		2	3.3	2.6	
AECOM_BH58	BH58_8.6-8.8	Fill	PDA - Block 4	7	160	<1	<1	12	<0.5	3	145	13,600	585	122	0.7	8	16	380	<10	<50	640	510	1150 - 1200	<0.2	<0.5	<0.5	<1	<0.5	2.1	<0.5	2.2	5.6	5.3	7
AECOM_BH58	BH58_10.2-10.4	Fill	PDA - Block 4	<5	60	<1	<1	9		<2	41		131	59	0.5	4	10	159															
AECOM_BH58	BH58_10.8-11.2	Fill	PDA - Block 4	<5	50	<1	<1	8	<0.5	3	28	10,100	66	133	0.1	5	17	74	<10	<50	420	430	850 - 900	<0.2	<0.5	<0.5	<1	0.8	0.9		1.3	3.3	2.2	
AECOM_BH59	BH59_0.15-0.16	Fill	PDA - Block 4	<5	20	<1	<1	7	<0.5	26	111	43,200	<5	502	<0.1	70	28	37															
AECOM_BH59	BH59_1.0-1.1	Fill	PDA - Block 4	6	50	<1	<1	30		3	27		112	83	1.2	11	11	96															
AECOM_BH59	BH59_1.9-2.0	Fill	PDA - Block 4	<5	10	<1	<1	21		<2	<5		10	<5	<0.1	23	12	27	<10	980	2290	860	4130	<0.2	<0.5	<0.5	<1	10.3	58.8		60.3	45.9	26.5	
AECOM_BH59	BH59_3.4-3.5	Fill	PDA - Block 4	14	<10	<1	<1	5	<0.5	<2	<5	15,000	<5	106	<0.1	<2	9	<5	459	9120	19,200	6140	34,460 - 34,500	82.4	88.3	32.5	154.2	104	404	<1.2	368	271	189	232
AECOM_BH59	BH59-3.4-3.5	Fill	PDA - Block 4																														
AECOM_BH59	BH59_4.2-4.3	Fill	PDA - Block 4	<5	<10	<1	<1	6		<2	<5		<5	<5	<0.1	<2	10	<5	14	140	380	130	650	3.4	<0.5	2.9	3.3	1.4	9.1		8.3	6.2	3.4	
BH019	BH019 0.3-0.5	Fill	PDA - Block 4	<5			<1	11			23		42		<0.1	21		43															
BH019	BH019 1.5-1.95	Fill	PDA - Block 4	<5			<1	15			8		13		<0.1	<2		<5	50	100	<100	<100	300					<0.5	<0.5		1	<0.5	<0.5	
BH019	BH019 2.5-3.0	Fill	PDA - Block 4	<5			<1	8			37		117		<0.1	<2		6	354	2180	3840	1060	7080					24.3	82		79.3	70.3	58.2	
BH019	BH019 3.0-3.45	Fill	PDA - Block 4	<5			<1	8			21		51		<0.1	5		9	210	3160	5450	1870	10,480					31.6	120		114	103	86.3	
BH020	BH020 0.3-0.5	Fill	PDA - Block 4	<5			<1	12			42		178		0.2	22		121	<2	<50	460	350	860					0.6	1.6		2.5	6.2	6.8	
BH020	BH021 0.3-0.5	Fill	PDA - Block 4	<5			<1	10			17		48		<0.1	12		40	<2	<50	130	100	280					<0.5	0.9		0.9	2.2	2.3	
BH020	BH020 1.5-2.1	Fill	PDA - Block 4	<5			<1	8			32		106		<0.1	10		98	<2	<50	280	340	670					<0.5	1.3		1.6	3.9	4.4	
BH020	D0905-1	Fill	PDA - Block 4	<5			<1	8			29		106		0.1	8		84	<2	<50	240	290	580					<0.5	1.3		1.7	3.4	4	
BH020	BH020 3.0-3.25	Fill	PDA - Block 4	<5			<1	8			28		183		0.2	6		90															
BH020	D0905-2	Fill	PDA - Block 4	4			0.2	12			71		250		0.38	7		160															
BH035	BH035_0.3-0.5	Fill	Block 4	<5			<1	2			212		7		<0.1	6		48	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4							
BH035	BH035_1.5-1.95	Fill	Block 4	<5			<1	11			9		20		<0.1	5		31															
BH035	D1805-1	Fill	Block 4	<5			<1	12			19		27		<0.1	5		38	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4							
BH035	BH035_4.0-4.5	Fill	Block 4	<5			<1	16			10		18		<0.1	33		38	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4							
BH035	D1805-2	Fill	Block 4	<5			<1	15			10		18		<0.1	6		34															
BH055	BH055-0.8-1.0	Fill	Public Domain Blocks	<5			<1	7			<5		25		<0.1	<2		26	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4							
BH055	D3005-1	Fill	Public Domain Blocks	2			<0.1	6			3		28		<0.05	2		26	<10	<50	<100	<100	<250 - 0	<0.2	<0.5	<0.5	<1.5 - 0							
BH055	BH055-1.8-2.0	Fill	Public Domain Blocks	<5			<1	5			5		34		<0.1	2		18	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	0.8	0.9	
BH055	D3005-2	Fill	Public Domain Blocks	<5			<1	8			8		38		<0.1	4		28	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4							
BH055	BH055-3.3-3.5	Fill	Public Domain Blocks	<5			<1	7			5		16		<0.1	9		15	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH063	BH063-1.5-1.65	Fill	Public Domain Blocks	<5			<1	8			6		46		<0.1	3		30	<2	<50	420	400	870	<0.2	<0.2	<0.2	<0.4	1.1	1.1		3.2	8.1	8.8	
BH063	BH063-2.8-3.0	Fill	Public Domain Blocks	<5			<1	5			13		149		<0.1	<2		64	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	1	1	
BH065	BH065-0.3-0.5	Fill	PDA - Block 4	<5			<1	16			39		144		0.1	24		110	<2	<50	180	350	580	<0.2	<0.2	<0.2	<0.4	<0.5	1.1		1.2	3	3.1	
BH065	D0106-1	Fill	PDA - Block 4	<5 - 2			<1 - 0.2	10 - 11			38 - 74		144 - 190		0.16	22 - 24		124 - 160	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	0.6	0.6	
BH065	BH065-1.5-1.95	Fill	PDA - Block 4	<5			<1	12			32		144		0.2	11		103	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		0.6	1.1	0.9	
BH065	BH065-3.0-3.45	Fill	PDA - Block 4	5			<1	12			61		210		0.3	9		169	3	90	1040	720	1850	<0.2	<0.2	<0.2	0.8	7	1.4		9.7	9.5	7.7	
BH065	D0106-2	Fill	PDA - Block 4	<5 - 6			0.3	10 - 19			33 - 55		128 - 320		0.5	4 - 29		86 - 250	2	140	1350	880	2370	<0.2	<0.2	<0.2	0.5	6.0 - 6.9	0.9 - 5.7		7.1 - 28.6	9.4 - 33.6	7.8- 26.2	12
BH068	BH068-0.3-0.5	Fill	Block 4	<5			<1	12			36		47		0.1	43		47	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	1.4	1.2	
BH068	BH068-3.0-3.45	Fill	Block 4	<5			<1	8			38		217		0.6	5		138	<2	<50	<100	130	280	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	

Chemical Group																	TPH					BTEX										
Chemical Name	Arsenic	Barium	Beryllium	Cadmium	Chromium	Chromium (hexavalent)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Vanadium	Zinc	TPH C6 - C9	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Total Xylene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	1	5	1	0.1	1	0.5	1	2	10	2	5	0.05	1	5	5	2	50	100	100	50	0.2	0.2	0.2	0.15	0.5	0.5	0.5	0.5	0.5	0.5	1
Location	Field ID	Matrix	Area																													
BH068	BH068-9.5-10.0	Fill	Block 4	<5			<1	7			<5		116		<0.1	<2		29	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH070	BH070_0.3-0.5	Fill	PDA - Block 4	<5			<1	7			16		87		<0.1	5		63	<2	<50	600	210	860	<0.2	<0.2	<0.2	<0.4	<0.5	0.5		0.6	1.3	1.4	
BH070	D0206-1	Fill	PDA - Block 4	<5 - 2			<0.1	6 - 8			14 - 18		91 - 110		0.18	5		63 - 78	<2	<50	480	320	850	<0.2	<0.2	<0.2	<0.4	<0.5	0.6 - 0.8		0.8 - 1.1	2.9 - 2.9	2.8	4
BH070	BH070_1.5-1.95	Fill	PDA - Block 4	5			<1	11			26		320		0.5	3		169	<2	<50	230	340	620	<0.2	<0.2	<0.2	<0.4	<0.5	0.7		1.2	2.5	2.5	
BH071	BH071_1.5-1.95	Fill	PDA - Block 4	<5			<1	10			18		55		<0.1	5		43	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH071	BH071_3.0-3.45	Fill	PDA - Block 4	<5			<1	10			21		20		<0.1	7		42	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH072	BH072_0.3-0.5	Fill	PDA - Block 4	<5			<1	2			226		7		<0.1	5		50	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH072	BH072_3.0-3.45	Fill	PDA - Block 4	<5			<1	11			168		23		<0.1	7		54	<2	<50	120	<100	270	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH072	BH072_9.5-10.0	Fill	PDA - Block 4	<5			<1	16			12		16		<0.1	7		34	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH073	BH073_1.5-1.95	Fill	PDA - Block 4	<5			<1	13			29		130		0.1	25		38	<2	<50	560	270	880	<0.2	<0.2	<0.2	<0.4	20.6	87.8		77.3	107	100	
BH073	BH073_2.0-2.4	Fill	PDA - Block 4	<5			<1	35			11		59		<0.1	<2		6	8	260	1340	260	1860	<0.2	2.1	<0.2	5.5	4.4	24.4		18.7	19	15.3	
BH075	BH075_0.3-0.5	Fill	PDA - Block 4	<5			<1	14			52		83		0.2	54		80	<2	<50	570	440	1060	<0.2	<0.2	<0.2	<0.4	0.5	8.4		7.9	19.4	19	
BH075	D0606-1	Fill	PDA - Block 4	<5 - 1			<0.1	8 - 9			5 - 6		16 - 19		<0.05	5 - 8		33 - 40	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	0.8 - 1.3		0.5 - 1	1.7 - 3.3	1.6 - 3.2	5
BH075	BH075_3.0-3.45	Fill	PDA - Block 4	<5			<1	36			11		31		<0.1	11		83	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	0.9	0.8	
BH087	BH087 1.5-1.95	Fill	PDA - Block 4	<5			<1	9			<5		14		<0.1	<2		<5	20	2230	5820	1520	9570	0.7	1.2	0.8	10.5	21.6	177		136	114	78.5	
BH087	BH087 3.0-3.45	Fill	PDA - Block 4	<5			<1	12			17		128		<0.1	<2		13	271	4560	7310	1670	13,540	15	47.5	24.9	118.5	24.4	158		120	97.4	79.6	
BH087	BH087 7.0-7.5	Fill	PDA - Block 4	<5			<1	15			<5		13		<0.1	<2		<5	442	4360	6720	1550	12,630	82.7	24.3	149	173.1	23.7	135		104	64.5	49	
BH089	BH089 0.3-0.5	Fill	PDA - Block 4	<5			<1	12			29		19		<0.1	26		43	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH089	BH089 1.5-1.95	Fill	PDA - Block 4	<5			<1	44			51		269		0.2	14		165	<2	70	440	170	680	<0.2	<0.2	<0.2	<0.4	<0.5	2.5		2.3	3.7	3.3	
BH089	BH089 3.0-3.45	Fill	PDA - Block 4	<5			<1	28			16		198		0.3	5		100	<2	<50	170	<100	320	<0.2	<0.2	<0.2	<0.4	<0.5	2.3		3.4	6.2	5.6	
BH090	BH090 1.5-1.95	Fill	PDA - Block 4	<5			<1	13			14		602		0.2	5		281	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	0.6	0.7	
BH090	D0906-2	Fill	PDA - Block 4	3			0.3	17			17		749		0.3	6		300	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		0.5	1.7	1.6	2
BH090	BH090 3.0-3.45	Fill	PDA - Block 4	<5			<1	20			33		480		0.2	34		401	<2	<50	140	<100	290	<0.2	<0.2	<0.2	<0.4	<0.5	1		2	3.5	3.3	
BH109	BH109 0.3_0.5	Fill	PDA - Block 4	<5			<1	3			225		12		<0.1	6		53	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH109	BH109 3.0_3.45	Fill	PDA - Block 4	<5			<1	41			20		14		<0.1	8		34	<2	<50	<100	130	280	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH109	BH109 9.5_10.0	Fill	PDA - Block 4	<5			<1	23			6		17		<0.1	7		40	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH113	BH113 1.5_1.95	Fill	PDA - Block 4	<5			<1	10			<5		9		<0.1	4		21	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH113	BH113 3.0_3.45	Fill	PDA - Block 4	5			<1	33			12		17		<0.1	8		52	<2	70	540	470	1080	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		0.6	0.9	0.7	
BH114	BH114 0.3_0.5	Fill	PDA - Block 4	<5			<1	4			198		15		<0.1	5		54	<2	<50	130	210	390	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	1.2	1.7	
BH114	BH114 3.0_3.45	Fill	PDA - Block 4	6			<1	37			12		15		<0.1	7		47	<2	60	620	360	1040	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH115	BH115 0.8_1.0	Fill	PDA - Block 4	<5			<1	14			28		358		5.2	8		236	<2	<50	560	340	950	<0.2	<0.2	<0.2	<0.4							
BH115	D2806_1	Fill	PDA - Block 4	<5			<1	11			30		356		9.1	6		242	<2	120	1470	1120	2710	<0.2	<0.2	<0.2	<0.4							
BH115	BH115 1.5_1.95	Fill	PDA - Block 4	<5			<1	11			26		330		1.2	4		279	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	0.8	0.7	
BH115	D2806_2	Fill	PDA - Block 4	<5			<1	13			19		365		1.4	5		273	<2	<50	280	160	490	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		0.5	1.2	1.1	
BH115	BH115 3.0_3.45	Fill	PDA - Block 4	<5			<1	11			21		278		2.7	6		180	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	0.7	0.6	
BH119	BH119 1.6_2.05	Fill	PDA - Block 4	<5			<1	32			36		634		0.2	7		283	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	0.6	0.8	
BH119	BH119 7.5_8.0	Fill	PDA - Block 4	10			1	27			115		361		2.1	10		389	1140	6750	13,000	4690	24,440	82.4	63	118	251.8	53.5	273		236	152	149	
BH119	BH119 9.5_10.0	Fill	PDA - Block 4	<5			<1	13			<5		20		<0.1	<2		13	1060	5320	7940	2110	15,370	97.8	14.7	124	205	39.7	240		163	88.9	80	
BH132	BH132_1.5-1.95	Fill	PDA - Block 4	33			<1	42			34		12,100		<0.1	11		45	<2	<50	500	390	940	0.5	<0.2	<0.2	<0.4	0.9	3.5		5.4	19.5	17.1	
BH132	BH132_8.0-8.5	Natural Clayey Sand	PDA - Block 4																1050	1870	3040	1190	6100	140	44.7	232	345	18.4	148		57	45	28	
BH133	BH133_0.3-0.5	Fill	PDA - Block 4																<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	1		0.9	2.2	2.1	
BH133	BH133 1.5_1.95	Fill	PDA - Block 4	11			<1	14			21		40		<0.1	<2		45	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH135	BH135A-0.4-0.6	Fill	PDA - Block 4	6			<1	10			57		30		<0.1	11		79	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH135	BH135A-1.6-2.05	Fill	PDA - Block 4																															
BH135	D1207-01	Fill	PDA - Block 4																															
BH135	BH135A-3.0-3.45	Fill	PDA - Block 4	<5			<1	9			6		16		<0.1	4		28										<0.5	<0.5		<0.5	<0.5	<0.5	
BH135	D1207-02	Fill	PDA - Block 4	<5			<1	12			23		15		<0.1	23		102															
BH137	BH137 1.5_1.95	Fill	Block 4	<5			<1	5			18		169		4.1	3		96	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	0.5	
BH137	BH137 3.0_3.45	Fill	Block 4	<5			<1	8			99		89		0.2	6		45										<0.5	<0.5		<0.5	<0.5	<0.5	
BH137	BH137 12.5_13.0	Fill	Block 4	<5			<1	12			10		69		0.6	5		41															
BH141	BH141 1.5_1.95	Fill	PDA - Block 4	<5			<1	25			16		17		<0.1	16		55	<2	70	1600	590	2260	<0.2	<0.2	<0.2	<0.4	1.8	11.8		14.6	28.2	24.6	
BH141	BH141 3.0_3.45	Fill	PDA - Block 4	<5			<1	5			9		99		<0.1	<2		<5	325	1800	4490	1430	7720	41.8	49.1	17.3	146.8	127	600		499	429	344	
BH142	BH142 1.5_1.95	Fill	Block 4	<5			<1	8			5		10		<0.1	4		22	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH142	BH142 9.5_10.0	Fill	Block 4	<5			<1	17			<5		7		<0.1	5		24															
BH143	BH143 1.5_1.95	Fill	Block 4	<5			<1	8			11		6		<0.1	4		18															
BH143	BH143 3.0_3.45	Fill	Block 4	<5			<1	10			6		14		<0.1	8		43	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH146	BH146-1.5-1.95	Fill	PDA - Block 4	<5			<1	9			14		5		<0.1	<2		10	2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH146	BH146-3.0-3.33	Fill	PDA - Block 4	<5			<1	9			12		31		0.3	<2		14										8.8	58.8		35.4	89.7	67.3	
BH146	BH146-4.1-4.6	Fill	PDA - Block 4	<5			<1	18			<5		7		<0.1	2		<5	222	3020	3750	860	7630	15.2	13.9	25.3	87	16	78.8		58.6	43.5	32.9	
BH156	BH156_0.4-0.5	Fill	PDA - Block 4																<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH156	D1408-4	Fill	PDA - Block 4																<10	<50	<100	<100	<250 - 0	<0.2	<0.5	<0.5	<1.5 - 0	<0.5	<0.5		<0.5	<0.5	<0.5	<1
BH156	BH156_0.9-1.0	Fill	PDA - Block 4																<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH156	D1408-5	Fill	PDA - Block 4																<10	<50	<100	<100	<250 - 0	<0.2	<0.5	<0.5	<1.5 - 0	<0.5	<0.5		<0.5	<0.5	<0.5	<1
BH159	BH159_0.25-0.35	Fill	PDA - Block 4																<2	<50	270	960	1280	<0.2	<0.2	<0.2	0.5	<0.5	<0.5		<0.5	<0.5	<0.5	
BH159	D1408-8	Fill	PDA - Block 4																<10	<50	<100	280	280 - 430	<0.2	<0.5	<0.5	<1.5 - 0	<0.5	<0.5		<0.5	<0.5	<0.5	<1
BH160	D1408-11	Fill	PDA - Block 4																<2					<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH160	BH160_0.3-0.4	Fill	PDA - Block 4																<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	
BH160	D1408-11	Fill	PDA - Block 4																<10	<50	<100	<100	<250 - 0	<0.2	<0.5	<0.5	<1.5 - 0	<0.5	<0.5		<0.5	<0.5	<0.5	<1
BH161	BH161_0.3-0.4	Fill	PDA - Block 4																<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.4	<0.5	<0.5		<0.5	<0.5	<0.5	

Chemical Group																	TPH					BTEX										
Chemical Name	Arsenic	Barium	Beryllium	Cadmium	Chromium	Chromium (hexavalent)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Vanadium	Zinc	TPH C6 - C9	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Total Xylene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	1	5	1	0.1	1	0.5	1	2	10	2	5	0.05	1	5	5	2	50	100	100	50	0.2	0.2	0.2	0.15	0.5	0.5	0.5	0.5	0.5	0.5	1
Location	Field ID	Matrix	Area																												
BH161	D1408-12	Fill	PDA - Block 4														<10	<50	<100	<100	<250 - 0	<0.2	<0.5	<0.5	<1.5 - 0	<0.5	<0.5		<0.5	<0.5	<0.5	<1
BH200	BH200_0 - 1.6	Fill	PDA - Block 4																												
BH200	BH200/1.0	Fill	PDA - Block 4	9			<1	38			70		937		1	28		75	<10	520	10,200	4730	15,450	1.6	<0.5	2.2	2.8	5.2	54.8		75.7	158	113	
BH200	BH200_2 - 2.2	Fill	PDA - Block 4																													
BH200	BH200/2.5	Fill	PDA - Block 4	<5			<1	17			19		101		0.3	4		27	<10	110	1060	500	1670	<0.2	<0.5	<0.5	<1	1	6.7		9.9	16.9	12.4	
BH200	BH200/6.53	Natural Sandstone	PDA - Block 4	<5			<1	<2			<5		10		0.5	<2		<5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH202	BH202/2.3	Fill	PDA - Block 4	8			<1	13			146		579		0.4	12		369	<10	<50	240	270	560	<0.2	<0.5	<0.5	<1	<0.5	1		1.6	6.5	6.5	
BH202	BH202/4.7	Fill	PDA - Block 4	6			<1	6			142		93		0.1	8		80	<10	<50	280	340	670	<0.2	<0.5	<0.5	<1	1.1	0.8		2	4	3.6	
BH202	BH202/6.8	Natural Sandstone	PDA - Block 4	<5			<1	8			20		28		<0.1	<2		35	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH203	BH203/1.9	Fill	PDA - Block 4	11			<1	10			402		790		1.2	37		372	<10	<50	330	360	740	<0.2	<0.5	<0.5	<1	<0.5	1.4		2.2	5	5.1	
BH203	BH203/7.3	Fill	PDA - Block 4	<5			<1	9			51		53		0.1	10		86	<10	<50	560	450	1060	<0.2	<0.5	<0.5	<1	<0.5	0.8		1.3	2.9	2.6	
BH204	BH204/1.0	Fill	PDA - Block 4	<5			<1	6			14		44		<0.1	<2		6	20	2890	9620	3070	15,580	0.6	3.5	1.4	8.6	45.2	194		187	128	78.6	
BH204D	BH204D/1.5	Fill	PDA - Block 4	<5			<1	48			8		172		4.6	40		146	226	54,200	72,400	20,600	147,200	61	7	69.2	94.1	222	605		1200	823	652	
BH204D	BH204D_2 - 3.2	Fill	PDA - Block 4																													
BH204D	BH204D/3.0	Fill	PDA - Block 4	<5			<1	6			6		19		0.6	<2		7	289	11,600	19,400	6340	37,340	36.8	34.9	49.3	151.9	85.6	234		283	255	195	
BH204D	BH204D_3.5 - 3.7	Fill	PDA - Block 4																													
BH204D	BH204D/4.0	Fill	PDA - Block 4	<5			<1	11			8		38		0.4	3		14	215	12,600	22,400	7020	42,020	44.3	15.1	53	99.5	73.4	336		338	299	224	
BH205	BH205/7.8	Natural Sandy Clay	PDA - Block 4	<5			<1	26			<5		31		<0.1	3		7	<10	<50	<100	<100	<250	1.4	<0.5	0.7	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH205	D01_270308	Natural Sandy Clay	PDA - Block 4	6			<0.1	29			<2		4		0.09	2		8	<10	<50	130	<100	280	2	<0.5	1	<1.5 - 0	<0.5	<0.5		<0.5	<0.5	<0.5	<1
BH205	BH205_4.8 - 11.7	Fill	PDA - Block 4																													
BH205	BH205/9.3	Natural Clayey Sand	PDA - Block 4	<5			<1	9			<5		<5		<0.1	<2		<5	138	1500	2710	640	4850	7.5	5.4	34.7	64.3	11	57.6		30.7	25.2	15.5	
BH205	BH205/13.0	Natural Sandstone	PDA - Block 4	<5			<1	21			15		24		<0.1	<2		9	13	<50	<100	<100	<250	2.5	<0.5	3.3	4	1.2	3.8		3.9	2.9	1.9	
BH205	BH205/13.8	Natural Sandstone	PDA - Block 4	<5			<1	5			<5		19		<0.1	<2		16	<10	<50	<100	<100	<250	0.7	<0.5	0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH205	D01_010408	Natural Sandstone	PDA - Block 4	<5			<1	7			<5		22		<0.1	<2		25	<10	<50	<100	<100	<250	0.8	<0.5	0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH205	BH205/19.2	Natural Sandstone	PDA - Block 4	<5			<1	8			<5		<5		<0.1	<2		<5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	1	<0.5	0.7		<0.5	<0.5	<0.5	
BH205	BH205/22.2	Natural Sandstone	PDA - Block 4	<5			<1	15			<5		7		<0.1	<2		14	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH206	BH206/0.5	Fill	PDA - Block 4	<5			<1	8			135		18		0.1	12		64	<10	<50	310	180	540	<0.2	<0.5	<0.5	<1	<0.5	4.2		3.9	8.4	7.8	
BH206	BH206/1.8	Fill	PDA - Block 4	<5			<1	13			31		38		<0.1	12		152	<10	<50	190	340	580	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH206	BH206/4.6	Fill	PDA - Block 4	<5			<1	11			38		30		0.1	5		108	<10	<50	230	230	510	<0.2	<0.5	<0.5	<1	<0.5	0.6		0.7	1.7	1.2	
BH206	BH206/7.1	Natural Clayey Sand	PDA - Block 4	<5			<1	12			<5		8		0.6	<2		12	15	200	350	<100	650	<0.2	1	<0.5	4.9	1.4	10		5.6	4.1	2.1	
BH206	BH206/10.7	Natural Sandstone	PDA - Block 4	<5			<1	<2			<5		33		<0.1	<2		<5	<10	<50	110	<100	260	<0.2	<0.5	<0.5	<1	<0.5	1.9		1.6	1.2	0.7	
BH207	BH207/7.45	Fill	PDA - Block 4	<5			<1	9			7		15		0.2	8		49	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH207	BH207/12.0	Fill	PDA - Block 4	8			<1	23			37		257		2.1	6		209	<10	<50	430	340	820	<0.2	<0.5	<0.5	<1	<0.5	2.2		1.9	4.4	4.8	
BH207	BH207/13.1	Fill	PDA - Block 4	<5			<1	4			<5		31		<0.1	<2		263	<10	<50	140	<100	290	<0.2	<0.5	<0.5	<1	<0.5	2.4		2	1.8	1.2	
BH207	BH207/15.0	Natural Sandstone	PDA - Block 4	<5			<1	15			<5		<5		<0.1	4		25	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH208	BH208/2.25	Fill	PDA - Block 4	<5			<1	29			8		6		<0.1	12		62	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH208	BH208/9.5	Fill	PDA - Block 4	<5			<1	8			<5		8		<0.1	6		38	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH208	BH208/13.5	Natural Sandy Clay	PDA - Block 4	23			1	54			156		392		2.4	13		551	<10	80	3320	2520	5920	<0.2	<0.5	<0.5	<1	<0.5	1.8		3.2	9.4	9.3	
BH209	BH209/2.3	Fill	PDA - Block 4	<5			<1	11			21		29		<0.1	9		55	<10	<50	880	580	1510	<0.2	<0.5	0.5	<1	0.7	7.5		4.8	10.8	16.5	
BH209	BH209/4.5	Natural Clay	PDA - Block 4	7			<1	8			16		18		<0.1	9		25	227	1190	1950	460	3600	15.5	37.2	4.3	86	5.9	33.8		19.1	17.7	11.2	
BH209	BH209/6.1	Natural Sandstone	PDA - Block 4	<5			<1	11			<5		<5		<0.1	<2		<5	929	2280	2350	430	5060	88.2	34.8	213	259.8	6.8	54.9		22.3	15.4	9.1	
BH209	BH209/9.4	Natural Sandstone	PDA - Block 4	<5			<1	3			<5		<5		<0.1	<2		<5	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH210	BH210/1.5	Fill	PDA - Block 4	<5			<1	12			<5		12		<0.1	5		23	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH210	BH210/15.9	Natural Sandstone	PDA - Block 4	<5			<1	7			<5		7		<0.1	2		20	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH211	BH211/14.0	Fill	PDA - Block 4	<5			<1	6			<5		8		<0.1	5		28	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH211	BH211/15.5	Natural Clayey Sand	PDA - Block 4	11			<1	13			<5		5		<0.1	<2		<5	19	<50	<100	<100	<250	3.4	0.6	5.5	5.1	<0.5	1.9		1.4	0.8	<0.5	
BH211	BH211/16.05-16.15	Natural Sandstone	PDA - Block 4	<5			<1	21			<5		7		<0.1	2		12	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH404	BH404_0.4-0.5	Fill	Block 4	<5			<1	12			30		179		0.2	25		109	<10	<50	280	210	490 - 540	<0.2	<0.5	<0.5	<1	<0.5	3		3.7	6.4	6.2	
BH404	BH404_4.0-4.4	Fill	Block 4	<5			<1	6			10		89		0.2	<2		43	<10	<50	230	150	380 - 430	<0.2	<0.5	<0.5	<1	<0.5	1.6		2.5	3.5	3	
BH404	BH404_7.0-7.4	Fill	Block 4	<5			<1	13			124		78		<0.1	15		44	<10	650	5240	1820	7710	<0.2	<0.5	<0.5	<1	47.6	<4		93.3	75.2	52.7	
BH404	BH404_12-12.4	Fill	Block 4	5			<1	7			78		92		0.7	6		119	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH404	BH404_14-14.4	Fill	Block 4	28			2	53			228		804		5	18		665	125	<50	1280	780	2060 - 2110	11.5	14.5	6.6	35.1	10.6	11.6		13.9	21.9	11.6	
BH404	QC653		Block 4	21			1	29			132		334		2.6	12		508	87	<50	1160	720	1880 - 1930	9.8	9.8	7.1	25.1	7.8	9.2		11.8	16.6	10.2	
BH404	BH404_15-15.4	Fill	Block 4	<5			<1	10			<5		61		<0.1	<2		<5	<10	130	<100	<100	130 - 330	1.2	<0.5	1.3	1.5	<0.5	<0.5		<0.5	<0.5	<0.5	
BH405	BH405_4.0-4.3	Fill	PDA - Block 4	<5			<1	7			41		74		<0.1	4		52	<10	<50	400	620	1020 - 1070	<0.2	<0.5	<0.5	<1	<0.5	0.9		1.2	5	5.9	
BH405	BH405_7.0-7.3	Fill	PDA - Block 4	<5			<1	11			<5		30		<0.1	5		33	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH405	BH405_13.0-13.2	Natural Sand	PDA - Block 4	<5			<1	<2			<5		10		<0.1	<2		10	<10	510	1760	560	2830	0.7	0.6	0.6	4.3	11.2	45.2		40.9	30.2	21.6	
BH405	BH405_14.0-14.4	Natural Sandy Clay	PDA - Block 4	<5			<1	4			<5		20		<0.1	<2		<5	156	3390	7020	2010	12,400 - 12,420	5.9	4	33	76.6	44.9	221		182	130	86.2	
BH405	QC609		PDA - Block 4	<5			<1	9			<5		20		<0.1	<2		7	10	3020	5950	1700	10,670 - 10,700	0.6	<0.5	2.7	5.4	43.2	213		168	129	84.8	
BH406	BH406_4.0-4.2	Fill	Block 4	7			<1	20			51		161		0.1	7		143	<10	<50	110	180	290 - 340	<0.2	<0.5	<0.5	<1	<0.5	<0.5		0.6	1.2	1.7	
BH406	BH406_7.0-7.2	Fill	Block 4	<5			<1	55			94		<5		<0.1	32		38	<10	<50	140	<100	140 - 290	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	1.1	0.9	
BH406	BH406_10.0-10.3	Fill	Block 4	<5			<1	5			55		27		<0.1	3		29	<10	<50	150	<100	150 - 300	<0.2	<0.5	<0.5	<1	0.9	<0.5		1	1.3	1.1	
BH406	BH406_14.0-14.4	Fill	Block 4	11			<1	20			163		250		1.4	13		214	30	90	920	400	1410	3.8	2.6	1.6	6.7	31.3	33.5		68.2	77.5	50.8	
BH406	BH406_15.0-15.4	Natural Silty Clay	Block 4	<5			<1	5			<5		7		<0.1	<2		<5	190	1340	2720	770	4830	15.1	3.2	31	50	10	65.3		50.3	39.8	24.2	
BH406	QC602		Block 4	<5			<1	5			<5		6		<0.1	<2		<5	505	850	2020	640	3510	35.8	6.8	68.6	105.4	6.2	33.2		32.3	25.5	15.8	
BH406	QC603		Block 4	<2			<0.5	5.5			<5		6.4		<0.1	<5		5.6	73	940	2500	960	4400	11	2.4	24	35.7 - 36	11	50		52	43	33	46
BH406	BH406_16.0-16.5	Natural Silty Sand	Block 4	10			<1	9			<5		7		<0.1	<2		<5	861	1940	3000	900	5840	85	10.9	140	171.8	34.3	231		162	114	78.1	
BH407	BH407_8.0-8.1	Fill	Block 4	<5			<1	12			<5		11		<0.1	4		24	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH407	BH407_12.0-12.18	Fill	Block 4	<5			<1	10			<5		6		<0.1	7		15	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	

Chemical Group																	TPH					BTEX											
Chemical Name	Arsenic	Barium	Beryllium	Cadmium	Chromium	Chromium (hexavalent)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Vanadium	Zinc	TPH C6 - C9	TPH C10 - C14	TPH C15-C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Total Xylene	Acenaphthene	Acenaphthylene	Acetophenone	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(b)&(k)fluoranthene	
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
EQL	1	5	1	0.1	1	0.5	1	2	10	2	5	0.05	1	5	5	2	50	100	100	50	0.2	0.2	0.2	0.15	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1	
Location	Field ID	Matrix	Area																														
BH407	BH407_14.0-14.5	Natural Clayey Sand	Block 4	<5			<1	6			<5		6		<0.1	2		<5	<10	<50	<100	<100	<50	0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH407	QC610		Block 4	<5			<1	7			<5		8		<0.1	2		<5	<10	<50	<100	<100	<50	0.3	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH407	QC611		Block 4	<2			<0.5	9.7			<5		7.7		<0.1	<5		<5	<10	<50	<100	<100	<100	<0.5	<0.5	<0.5	<0.15	<0.5	<0.5		<0.5	<0.5	<0.5	<1
BH407	BH407_15.1-15.45	Natural Clayey Sand	Block 4																<10	<50			<50	<0.2	<0.5	<0.5	<1							
BH407	BH407_16.3-16.5	Natural Clayey Sand	Block 4	9			<1	10			<5		5		<0.1	<2		<5	<10	<50	<100	<100	<50	0.4	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH407	BH407_17.4-17.6	Natural Sand	Block 4	<5			<1	2			<5		<5		<0.1	<2		<5	<10	<50	<100	<100	<50	0.4	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH407	BH407_18.0-18.3	Natural Sand	Block 4	<5			<1	11			<5		6		<0.1	<2		<5	<10	<50	<100	<100	<50	1.2	<0.5	1.1	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH408	BH408_2.0-2.4	Fill	PDA - Block 4	<5			<1	8			36		10		<0.1	8		30	<10	<50	190	260	450 - 500	<0.2	<0.5	<0.5	<1	<0.5	2.2		3.5	6.2	6.3	
BH408	BH408_8.0-8.3	Natural Sandy Clay	PDA - Block 4	<5			<1	22			<5		5		<0.1	3		<5	<10	100	350	<100	450 - 550	0.6	0.7	<0.5	1.3	1.8	6.1		6.2	2.6	1.3	
BH408	BH408_9.0-9.4	Natural Clayey Sand	PDA - Block 4	6			<1	20			<5		5		<0.1	<2		<5	24	360	710	150	1220	2.1	4.6	<0.5	8.9	4.2	22.9		12.5	9.7	5.6	
BH408	QC613		PDA - Block 4	8			<1	20			<5		6		<0.1	<2		<5	<10	110	260	<100	370 - 470	0.5	1	<0.5	2.2	1.1	6.6		3.9	2.5	1.4	
BH409	BH409_3.7-4.0	Fill	PDA - Block 4	<5			<1	15			<5		6		<0.1	<2		8	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<1	<0.5	<0.5		<0.5	<0.5	<0.5	
BH409	BH409_5.0-5.3	Natural Sand	PDA - Block 4	22			<1	7			<5		<5		<0.1	3		7	12	150	180	<100	330 - 430	1.8	3.5	<0.5	2.9	5.6	2.8		1.9	0.6	<0.5	
BH409	BH409_6.0-6.4	Natural Sandy Clay	PDA - Block 4																<10	<50			<50	0.3	<0.5	<0.5	<1							
BH409	BH409_7.0-7.3	Natural Clayey Sand	PDA - Block 4	<5			<1	14			<5		6		<0.1	<2		<5	106	<50	<100	<100	<50	2.8	3.5	22.3	26.7	<0.5	0.7		<0.5	<0.5	<0.5	

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
SVOCs - Semi-volatile organic compounds
VOCs - Volatile Organic Compounds
PCBs - Polychlorinated Biphenyls
OCPs - Organochlorine Pesticides
OPPs - Organophosphorus Pesticides
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
* Detected compounds shown only for phenols, OCPs, OPPs, SVOCs and VOCs (all other compounds less than laboratory EQL)

Chemical Group	PAHs													Phenols													
Chemical Name	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	CPAH	PAH (TOTAL)	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	Phenol	Phenolics Total	Cyanide (WAD)	Cyanide (Free)	Cyanide Total	Weak Acid Dissociable (WAD) Cyanide	Sulphate	Total Organic Carbon (TOC)
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
EQL	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5			0.01	0.01	0.01	0.5	0.01	0.01		1	1	1	1	10	0.1
AECOM_BH33	BH33_0.75-0.85	Fill	PDA - Block 4																								
AECOM_BH33	BH33_5.0-5.2	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5			<1		<1		
AECOM_BH33	BH33_8.0-8.2	Natural Sandstone	PDA - Block 4																								
AECOM_BH34	BH34_1.8-2.2	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1	<1		<0.5
AECOM_BH34	QC240		PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1	<1		<0.5
AECOM_BH34	QC241		PDA - Block 4		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<3	7.4	<0.5	<0.5	<0.5	<1	<0.5	<0.5	0	<1		<1			0.2
AECOM_BH34	BH34_3.8-4.0	Fill	PDA - Block 4																								
AECOM_BH34	BH34_6.0-6.2	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH34	BH34_11.0-11.2	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH35	BH35_0.9-1.0	Fill	PDA - Block 4																								
AECOM_BH35	BH35_4.9-5.0	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5		<1		<1			
AECOM_BH35	BH35_6.4-6.5	Fill	PDA - Block 4																								
AECOM_BH35	BH35_9.9-10.0	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5							0.5
AECOM_BH36	BH36-0.07-0.1	Fill	VMP & PDA - Block 3																								
AECOM_BH36	BH36_1.0-1.2	Fill	VMP & PDA - Block 3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH36	BH36_4.0-4.4	Fill	VMP & PDA - Block 3		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<3	<7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				<1	<1		
AECOM_BH36	BH36_8.5-8.9	Fill	VMP & PDA - Block 3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH36	BH36_13-13.4	Fill	VMP & PDA - Block 3																								
AECOM_BH36	BH36_15-15.05	Natural Sandstone	VMP & PDA - Block 3		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	1.7	1	0.7	<3	8.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				<1	<1		<0.5
AECOM_BH37	BH37_0.06-0.1	Fill	Block 4																								
AECOM_BH37	BH37_2.5-2.7	Fill	Block 4																								
AECOM_BH37	BH37_5.5-5.7	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1			
AECOM_BH37	BH37_8.3-8.5	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH37	QC67		Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5			<1	<1			<0.5
AECOM_BH37	QC68		Block 4		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<3	<7	<0.5	<0.5	<0.5	<1	<0.5	<0.5	0		<1	<1			0.12
AECOM_BH37	BH37_15.8-16.0	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	0.9	<0.5	3.3	2.3	1.2	4	14.6	<0.5	<0.5	<0.5	<1	<0.5	<0.5			<1	<1			<0.5
AECOM_BH37	QC69		Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1	0.9	<0.5	<4	8.9	<0.5	<0.5	<0.5	<1	<0.5	<0.5			<1	<1			<0.5
AECOM_BH37	BH37_20.4-20.5	Natural Sandstone	Block 4		<0.5		0.9	<0.5	1.6	1.9	<0.5	31.1	5.9	2.6	4.4	53.4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			<1	<1			<0.5
AECOM_BH37	BH37_22.2-AUGER	Natural Clayey Sand	Block 4		5.5		24.1	2.1	44.6	54.1	4.6	948	159	68.2	94.1	1536	<0.6	<0.6	<0.6	<1.2	<0.6	<0.6				<1			<0.5
AECOM_BH40	BH40_1.0-1.2	Fill	PDA - Block 4																								
AECOM_BH40	BH40_7.0-7.2	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH40	QC54		PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH40	BH40_13.0-13.2	Fill	PDA - Block 4																								
AECOM_BH40	BH40_16.5-16.7	Natural Sandy Clay	PDA - Block 4		2		6	0.6	31.8	12.6	2	137	36.6	19.2	25.8	288.6	5.9	<0.5	<0.5	3	<0.5	<0.5			<1		<1		<0.5
AECOM_BH40	BH40_17.8-18.0	Natural Sandy Clay	PDA - Block 4		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	1.4	0.8	<0.5	<3	8.2	1	<0.5	<0.5	0.6	<0.5	<0.5			<1	<1			<0.5
AECOM_BH40	BH40_19.0-19.4	Natural Sandy Clay	PDA - Block 4	0.9	<0.5	<0.5	1.2	<0.5	3.8	2.7	<0.5	10.5	6.6	3.4	6.3	37.8	3.1	1.3	<0.5	2.7	<0.5	<0.5							
AECOM_BH41	BH41_0.07-0.1	Fill	Block 4																								
AECOM_BH41	BH41_1.0-1.4	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1	<1		0.8
AECOM_BH41	BH41_4.0-4.4	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1	<1		<0.5
AECOM_BH41	BH41_8.5-8.9	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1	<1		<0.5
AECOM_BH41	BH41_14.5-14.7	Fill	Block 4	1.5	0.9	0.7	0.7	<0.5	1.3	<0.5	<0.5	<0.5	0.5	3.2	6.9	14.7	<0.5	<0.5	<0.5	<1	<0.5	<0.5				1	<1		
AECOM_BH41	BH41_16.0-16.2	Natural Clayey Sand	Block 4	<0.5	<0.5	<0.5	0.6	<0.5	1.1	<0.5	<0.5	0.6	3.3	1.7	4.1	14.4	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1	<1		<0.5
AECOM_BH41	BH41_17.5-17.7	Natural Sandstone	Block 4		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.7	<0.5	<3	7.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				<1			<0.5
AECOM_BH42	BH42_1.0-1.1	Fill	PDA - Block 4	2.3	0.8	1	1.7	<0.5	2.9	<0.5	0.6	<0.5	1.2	3.2	10.4	20.2	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH42	BH42_2.0-2.1	Fill	PDA - Block 4																								
AECOM_BH42	BH42_3.2-3.3	Fill	PDA - Block 4		22.9		122	7.9	369	243	23.8	926	660	351	446.6	3497.6	<1.2	3.2	<1.2	<2.5	<1.2	<1.2					<1		2.8
AECOM_BH42	BH42_3.5-3.6	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	0.6	<0.5	1	2.4	0.8	<4	11.4	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH44	BH44_1.4-1.5	Fill	PDA - Block 4																								
AECOM_BH44	BH44_1.9-2.0	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5			<1		<1		0.8
AECOM_BH44	BH44_4.9-5.0	Natural Sandstone	PDA - Block 4		3.2		22.8	<1.2	59.2	54.5	3.4	410	156	67.2	73.8	963.9	<1.2	<1.2	<1.2	<2.5	<1.2	<1.2			<1		<1		<0.5
AECOM_BH45	BH45_0.8-1.0	Fill	PDA - Block 4																								
AECOM_BH45	BH45_3.2-3.4	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.5	<0.5	<4	8	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH45	QC230		PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	1.1	0.8	<4	9.3	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH45	BH45_7.2-7.4	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5			<1		<1		<0.5
AECOM_BH45	QC231		PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5			<1		<1		<0.5
AECOM_BH45	QC232		PDA - Block 4		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<3	<7	<0.5	<0.5	<0.5	<1	<0.5	<0.5	0	<1	<1				0.2
AECOM_BH45	BH45_13.2-13.4	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	1.2	1	<4	9.8	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH48	BH48_0.15-0.16	Fill	Block 4																								
AECOM_BH48	BH48-1.0-1.2	Fill	Block 4	0.9	<0.5	<0.5	0.7	<0.5	1.7	<0.5	<0.5	<0.5	1	1.8	5.2	12.2	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH48	QC76		Block 4	0.8	<0.5	<0.5	0.8	<0.5	1.8	<0.5	<0.5	<0.5	1.8	2	5	13.1	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH48	QC77		Block 4		<0.5		0.5	<0.5	1	<0.5	<0.5	<0.5	0.6	1	3.1	8.2	<0.5	<0.5	<0.5	<1	<0.5	<0.5	0						
AECOM_BH48	BH48-8.5-8.7	Fill	Block 4	0.6	<0.5	<0.5	0.6	<0.5	1.2	<0.5	<0.5	<0.5	0.9	1.4	4.2	10.2	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH48	BH48-11.5-11.7	Fill	Block 4																								
AECOM_BH48	BH48-14.5-14.7	Natural Sandstone	Block 4		8.5		30.8	2.9	124	94.3	8.9	517	215	101	121.3	1352.5	97.6	30.2	<1.2	57.1	<1.2	9.4			<1		<1		<0.5
AECOM_BH48	QC78		Block 4		11.8		41.7	3.9	157	121	12.5	720	267	128	168.1	1819.3	119	39.1	<1.2	98.3	<1.2	11.2			<1		<1		1
AECOM_BH48	BH48-17.0-17.2	Natural Sandstone	Block 4	0.8	<0.5	<0.5	0.9	<0.5	3.1	2.3	<0.5	11	5.2	2.4	5.5	33.9	6.4	4.8	<0.5	10.8	<0.5	2.1							
AECOM_BH49	BH49_1.5-1.7	Fill	PDA - Block 4	37	13.2	11.8	32	3.8	76.7	4.5	11.4	9.7	61.4	77.9	167.7	428.1	0.8	0.8	<0.5	2.1	<0.5	1.9							
AECOM_BH49	BH49_4.2-4.4	Fill	PDA - Block 4	27.6	9.2	13.4	16.2	2.6	38.8	12.5	7.9	64.7	41.7	53.3	119.3	374.2	5.1	6.4	<0.5	13.9	<0.5	15.8							
AECOM_BH49	BH49_6.2-6.4	Fill	PDA - Block 4		0.6		2.4	<0.5	4.4	2.7	0.7	19.5	5.7	3.7	9.8	50.6	1.4	<0.5	<0.5	<0.5	<0.5	<0.5			<1		<1		<0.5

Chemical Group				PAHs													Phenols												
Chemical Name	Location	Field ID	Matrix	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	CPAH	PAH (TOTAL)	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	Phenol	Phenolics Total	Cyanide (WAD)	Cyanide (Free)	Cyanide Total	Weak Acid Dissociable (WAD) Cyanide	Sulphate	Total Organic Carbon (TOC)
Units				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
EQL				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5			0.01	0.01	0.01	0.5	0.01	0.01		1	1	1	1	10	0.1
AECOM_BH49	BH49-6.2-6.4	Fill	PDA - Block 4																										
AECOM_BH49	QC223		PDA - Block 4		<0.5		2	<0.5	5.7	4.2	0.5	29.3	14.2	4.8	7.9	72.8	3.4	1	<0.5	<0.5	<0.5	<0.5			<1		<1		1.6
AECOM_BH49	QC224		PDA - Block 4		<0.5		1.1	<0.5	4.1	2.6	<0.5	50.7 - 51.9	6	2.8	4.9	76.9	6.5	<0.5	<0.5	<1	<0.5	<0.5		<1	<1				2.9
AECOM_BH49	BH49_8.2-8.4	Fill	PDA - Block 4	21.4	6.7	12	22.6	2	83.3	62	6	373	130	70.3	118	946.5	4.5	4.1	<0.5	1.2	<0.5	<0.5							
AECOM_BH49	BH49_10.2-10.4	Fill	PDA - Block 4	14.8	4.7	6.5	15.3	1.1	54.6	33.4	3.8	343	191	46.7	80.7	813.1	9	7.8	<0.5	9.5	<0.5	1.6			<1		<1		
AECOM_BH49	BH49_12.2-12.4	Natural Clayey Sand	PDA - Block 4		8.7		37.8	3.4	161	125	9.8	703	283	137	143.9	1760.5	57.6	14.4	<1.2	25.5	<1.2	2.8			<1		<1		<0.5
AECOM_BH50	BH50_0.15-0.25	Fill	PDA - Block 4																										
AECOM_BH50	BH50_1.3-1.5	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	4.1	8.1	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1	<1		<0.5
AECOM_BH52	BH52_0.15-0.16	Fill	PDA - Block 4																										
AECOM_BH52	BH52_1.0-1.2	Fill	PDA - Block 4																										
AECOM_BH52	BH52_2.2-2.6	Fill	PDA - Block 4	2.4	0.9	1	1.9	<0.5	4.1	<0.5	0.8	<0.5	2.3	3.9	11.5	25.3	<0.5	<0.5	<0.5	<1	<0.5	<0.5			<1		<1		<0.5
AECOM_BH52	QC220		PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5			<1		<1		<0.5
AECOM_BH52	QC221		PDA - Block 4		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<3	<7	<0.5	<0.5	<0.5	<1	<0.5	<0.5	0	<1	<1				<0.1
AECOM_BH52	BH52_4.2-4.4	Fill	PDA - Block 4	93.8	43.2	52.9	109	11.6	306	123	37.6	55.8	412	291	570.3	1994.9	5.7	5.1	<0.5	11.7	<0.5	7.4			<1		<1		
AECOM_BH54	BH54_0.6-0.7	Fill	PDA - Block 4																										
AECOM_BH54	BH54_1.0-1.4	Fill	PDA - Block 4	824	248	324	549	72.5	2130	1290	231	6370	3130	1670	3693.5	20,627	22.8	7	<4	<8	<4	5							1.4
AECOM_BH54	QC228		PDA - Block 4	488	130	117	341	36.6	1780	653	119	3680	2390	851	1951.6	12,427	<4	<4	<4	<8	<4	<4			<1		<1		1.5
AECOM_BH54	BH54_2.8-3.0	Natural Sand	PDA - Block 4		5.8		22.5	2.2	66.1	40.2	6.6	227	131	54.5	86.3	678.1	<1.2	<1.2	<1.2	<2.5	<1.2	<1.2			<1		<1		
AECOM_BH55	BH55_1.0-1.2	Fill	PDA - Block 4	300	123	107	282	23.3	1280	460	95	4510	2030	1220	1607.3	12,143	41.3	28.3	<4	33.2	<4	23.5				127	8		
AECOM_BH55	BH55_2.2-2.4	Fill	PDA - Block 4		17.2		87	5.4	274	151	17.5	1740	463	237	318.1	3476.4	4.2	<1.2	<1.2	<2.5	<1.2	<1.2				249	<1		
AECOM_BH55	BH55_2.7-2.9	Fill	PDA - Block 4	187	65	117	200	14.5	783	440	53.3	4810	1840	677	1090.8	10,435	8.4	<4	<4	<8	<4	<4				22	<1		
AECOM_BH57	BH57_4.0-4.2	Fill	Block 4																										
AECOM_BH57	BH57_7.0-7.2	Fill	Block 4	10	2.9	3.2	8.1	0.7	26.6	1.5	2.7	0.5	20.9	22.7	44.9	127.6	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1			<0.5
AECOM_BH57	BH57_11.5-11.7	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	0.7	<4	8.3	<0.5	<0.5	<0.5	<1	<0.5	<0.5			<1	<1			
AECOM_BH57	BH57_16.5-16.7	Natural Clayey Sand	Block 4																										
AECOM_BH58	BH58_0.15-0.16	Fill	PDA - Block 4																										
AECOM_BH58	BH58_1.0-1.2	Fill	PDA - Block 4	19	9.8	6.9	14	1.8	36.1	1.5	7.2	2.3	23.4	37.6	87.6	205.8	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH58	BH58_3.2-3.4	Fill	PDA - Block 4	3.6	1.4	1	2.5	<0.5	6.6	1.3	1	10.9	5.9	6.8	14.9	51.3	0.6	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH58	QC225		PDA - Block 4	5.1	1.7	2.4	4.1	<0.5	16.5	2	1.2	3.4	11.1	15.5	24.4	79.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5							
AECOM_BH58	QC226		PDA - Block 4		2.9		4.9	0.8	10.1	1.1	2.4	2.5	4.7	12.6	2	7.6	<0.5	<0.5	<0.5	<1	<0.5	<0.5	0						
AECOM_BH58	BH58_5.2-5.4	Fill	PDA - Block 4	3.8	1.7	1.9	3.1	<0.5	7.5	1.3	1.4	1.3	6.2	7.4	18.3	46.1	<0.5	<0.5	<0.5	<1	<0.5	<0.5			<1		<1		
AECOM_BH58	BH58_8.6-8.8	Fill	PDA - Block 4		1.4		4.6	<0.5	7.9	0.7	1.3	1.2	4.6	10.6	18.7	48.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5							1
AECOM_BH58	BH58_10.2-10.4	Fill	PDA - Block 4																										
AECOM_BH58	BH58_10.8-11.2	Fill	PDA - Block 4	3.2	1.3	1.7	2.8	<0.5	7.3	0.7	1	1.2	3.6	8.5	16	40.3	<0.5	<0.5	<0.5	<1	<0.5	<0.5							<0.5
AECOM_BH59	BH59_0.15-0.16	Fill	PDA - Block 4																										
AECOM_BH59	BH59_1.0-1.1	Fill	PDA - Block 4																										
AECOM_BH59	BH59_1.9-2.0	Fill	PDA - Block 4	35.8	13.1	14.3	32.2	3.2	121	68.3	11.8	453	206	104	182.8	1264.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5			<1		<1		
AECOM_BH59	BH59_3.4-3.5	Fill	PDA - Block 4		44.5		214	21.7	669	462	52.2	3560	1400	603	792.4	8362.4	42.5	8.2	<1.2	7	1.3	1.8							1.1
AECOM_BH59	BH59-3.4-3.5	Fill	PDA - Block 4																										
AECOM_BH59	BH59_4.2-4.3	Fill	PDA - Block 4	4.6	1.4	2	4.5	<0.5	14.2	8.8	1.2	46.4	23.5	12.6	23.8	148.1	8.1	5	<0.5	7.2	<0.5	1.6			<1		<1		
BH019	BH019 0.3-0.5	Fill	PDA - Block 4																										
BH019	BH019 1.5-1.95	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	1.4	<0.5	29.3	4.1	1.1	<4	43.2													
BH019	BH019 2.5-3.0	Fill	PDA - Block 4	56.9	22.6	25.5	54.1	6.4	208	110	22.6	700	295	179	316.6	1994.2													
BH019	BH019 3.0-3.45	Fill	PDA - Block 4	85.3	32.2	37.2	77.6	8.8	295	157	32.9	891	407	255	463.3	2733.9													
BH020	BH020 0.3-0.5	Fill	PDA - Block 4	7.7	3.7	2.3	5.4	0.8	14.6	1.2	3.1	0.8	7.8	15.2	36	80.3													
BH020	BH021 0.3-0.5	Fill	PDA - Block 4	2.8	1.2	1.1	1.8	<0.5	4.5	<0.5	1.2	0.8	2.8	4.8	13.1	28.8													
BH020	BH020 1.5-2.1	Fill	PDA - Block 4	5	2.5	1.9	3.6	0.6	8.5	0.7	2.1	0.5	4.7	8.7	24	50.5													
BH020	D0905-1	Fill	PDA - Block 4	4.6	2.8	1.7	3.1	<0.5	7.5	0.6	2.2	0.5	4.3	7.8	22.3	46.5													
BH020	BH020 3.0-3.25	Fill	PDA - Block 4																										
BH020	D0905-2	Fill	PDA - Block 4																										
BH035	BH035_ 0.3-0.5	Fill	Block 4																										
BH035	BH035_ 1.5-1.95	Fill	Block 4																										
BH035	D1805-1	Fill	Block 4																										
BH035	BH035_ 4.0-4.5	Fill	Block 4																										
BH035	D1805-2	Fill	Block 4																										
BH055	BH055-0.8-1.0	Fill	Public Domain Blocks																										
BH055	D3005-1	Fill	Public Domain Blocks																										
BH055	BH055-1.8-2.0	Fill	Public Domain Blocks	1.2	0.8	<0.5	0.8	<0.5	1.5	<0.5	0.6	<0.5	1	1.6	6.1	12.7										<1		240	
BH055	D3005-2	Fill	Public Domain Blocks																						<1		290	
BH055	BH055-3.3-3.5	Fill	Public Domain Blocks	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8													
BH063	BH063-1.5-1.65	Fill	Public Domain Blocks	10.4	6.3	3.6	7.8	1.1	18.3	1.6	4.8	0.7	9.1	18.9	50.9	104.9										3.3		250	
BH063	BH063-2.8-3.0	Fill	Public Domain Blocks	1.1	0.6	<0.5	0.9	<0.5	2.2	<0.5	0.5	<0.5	1.3	2.2	6.1	14.3										<1		210	
BH065	BH065-0.3-0.5	Fill	PDA - Block 4	3.6	2.1	1.3	2.7	<0.5	5.9	<0.5	1.6	<0.5	3.6	6.2	17.9	37.4										2.6		370	
BH065	D0106-1	Fill	PDA - Block 4	0.8	<0.5	<0.5	0.6	<0.5	1.1	<0.5	<0.5	<0.5	0.6	1.2	4.6	10										1.3		370	
BH065	BH065-1.5-1.95	Fill	PDA - Block 4	1.1	0.6	<0.5	0.8	<0.5	2.4	<0.5	<0.5	<0.5	1.9	2.3	6	15.2										<1		420	
BH065	BH065-3.0-3.45	Fill	PDA - Block 4	9.4	4.5	3.5	8.7	0.9	28.3	7.8	3.6	13.9	34.6	25.8	47.8	176.3										12.7		960	
BH065	D0106-2	Fill	PDA - Block 4	33	4.7- 14.6	14.7	8.5 - 27.8	1.2 - 3.2	24 - 103	5.8 - 10.8	4 - 13.3	12 - 17.7	27 - 112	22 - 84.9	35.6 - 166.4	140 - 536										14.6		540	
BH068	BH068-0.3-0.5	Fill	Block 4	1.6	0.7	0.6	1.1	<0.5	2.5	<0.5	0.6	<0.5	1	2.4	7.7	16.1										<1		230	
BH068	BH068-3.0-3.45	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8										<1		1250	

Chemical Group				PAHs													Phenols														
Chemical Name	Location	Field ID	Matrix	Area	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	CPAH	PAH (TOTAL)	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	Phenol	Phenolics Total	Cyanide (WAD)	Cyanide (Free)	Cyanide Total	Weak Acid Dissociable (WAD) Cyanide	Sulphate	Total Organic Carbon (TOC)
Units					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
EQL					0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5			0.01	0.01	0.01	0.5	0.01	0.01		1	1	1	1	10	0.1
BH068	BH068-9.5-10.0	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	0.7	1	<4	9.3											<1		330	
BH070	BH070_0.3-0.5	Fill	PDA - Block 4	1.6	0.7	0.6	1.1	<0.5	3	<0.5	0.6	0.9	2.3	3.1	7.8	19.2											<1		370	
BH070	D0206-1	Fill	PDA - Block 4	3.3	1.5 - 2.1	1.2	2.5 - 2.6	<0.5 - 0.5	5 - 5.7	<0.5	1.3 - 1.7	0.8 - 0.8	3.1 - 3.3	5.3 - 5.8	12.5 - 16.1	29.1 - 34.6											2		390	
BH070	BH070_1.5-1.95	Fill	PDA - Block 4	3.1	1.5	1.2	2.4	<0.5	4.9	<0.5	1.3	<0.5	3.7	5	15	32											<1		730	
BH071	BH071_1.5-1.95	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		190	
BH071	BH071_3.0-3.45	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		320	
BH072	BH072_0.3-0.5	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		<100	
BH072	BH072_3.0-3.45	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		220	
BH072	BH072_9.5-10.0	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		390	
BH073	BH073_1.5-1.95	Fill	PDA - Block 4	99.3	44	33.5	88.7	10.7	252	56.5	41.4	14.8	190	228	524.6	1451.6											8.7		730	
BH073	BH073_2.0-2.4	Fill	PDA - Block 4	15.6	6.3	6.2	14.6	1.5	48.8	20.8	5.7	80.5	58.3	43	84.2	383.1											2.1		190	
BH075	BH075_0.3-0.5	Fill	PDA - Block 4	21.2	11.3	9.4	16.4	2.4	42.7	2.2	9.8	2.8	25.7	43	108.9	242.1											7.6		1120	
BH075	D0606-1	Fill	PDA - Block 4	1.7	0.8 - 2.2	0.6	1.5 - 2.8	<0.5 - 0.6	3.3 - 6.2	<0.5	0.6 - 1.8	<0.5 - 0.5	1.7 - 3.3	3.6 - 6.4	9 - 13.9	20.4 - 33.5											1.3		210	
BH075	BH075_3.0-3.45	Fill	PDA - Block 4	1.1	0.6	0.5	0.7	<0.5	1.8	<0.5	<0.5	<0.5	1	1.9	5.6	12.8											1.5		1300	
BH087	BH087 1.5-1.95	Fill	PDA - Block 4	83.6	34	35.2	69.5	8.6	325	182	31.2	925	496	265	454.6	2982.2											9.8		490	
BH087	BH087 3.0-3.45	Fill	PDA - Block 4	79.6	34	31.9	70.7	8.6	285	160	30.5	1030	439	247	432.3	2895.7											26.7		760	
BH087	BH087 7.0-7.5	Fill	PDA - Block 4	45.7	20	19.9	50	5.3	163	125	17.4	1090	333	173	271.8	2418.5											2.1		120	
BH089	BH089 0.3-0.5	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	0.7	0.7	<4	8.7											<1		280	
BH089	BH089 1.5-1.95	Fill	PDA - Block 4	3.4	1.6	1.7	3.1	<0.5	7.7	2	1.4	9	8.3	7.4	18.7	58.4											2.1		1190	
BH089	BH089 3.0-3.45	Fill	PDA - Block 4	5.9	2.6	2.7	5.4	0.6	13.5	1.1	2.3	0.7	11.5	13	31.3	77.3											<1		1340	
BH090	BH090 1.5-1.95	Fill	PDA - Block 4	0.8	<0.5	<0.5	0.5	<0.5	1.1	<0.5	<0.5	<0.5	0.8	1.1	4.6	10.1											<1		1500	
BH090	D0906-2	Fill	PDA - Block 4	1.6	0.9	0.8	1.4	<0.5	3.2	<0.5	0.7	<0.5	1.7	3.3	9.1	19.8											<1		1180	
BH090	BH090 3.0-3.45	Fill	PDA - Block 4	3.3	1.6	1.7	3.1	<0.5	7.1	<0.5	1.4	<0.5	6.3	7.3	18.4	43.6											<1		1690	
BH109	BH109 0.3_0.5	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		<100	
BH109	BH109 3.0_3.45	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		130	
BH109	BH109 9.5_10.0	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		360	
BH113	BH113 1.5_1.95	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		<100	
BH113	BH113 3.0_3.45	Fill	PDA - Block 4	0.8	<0.5	<0.5	0.8	<0.5	1.8	<0.5	<0.5	<0.5	1.8	1.8	5.2	13.2											1		320	
BH114	BH114 0.3_0.5	Fill	PDA - Block 4	2	1.3	0.9	1.2	<0.5	2.3	<0.5	0.9	<0.5	1	2.5	9.7	18											<1		150	
BH114	BH114 3.0_3.45	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		160	
BH115	BH115 0.8_1.0	Fill	PDA - Block 4																											
BH115	D2806_1	Fill	PDA - Block 4																											
BH115	BH115 1.5_1.95	Fill	PDA - Block 4	0.9	<0.5	<0.5	0.7	<0.5	1.7	<0.5	<0.5	<0.5	1	1.6	5.1	11.9											1.1		1880	
BH115	D2806_2	Fill	PDA - Block 4	1.4	0.7	0.6	1.1	<0.5	2.9	<0.5	0.5	<0.5	1.9	2.6	7.1	17											1		1180	
BH115	BH115 3.0_3.45	Fill	PDA - Block 4	0.8	<0.5	<0.5	0.6	<0.5	1.6	<0.5	<0.5	<0.5	0.8	1.4	4.7	11											<1		1390	
BH119	BH119 1.6_2.05	Fill	PDA - Block 4	0.9	0.6	<0.5	0.6	<0.5	1	<0.5	<0.5	<0.5	0.5	1	5	10											<1		1180	
BH119	BH119 7.5_8.0	Fill	PDA - Block 4	113	59.9	71.3	121	27.4	550	313	57.2	1620	880	497	750.8	5173.3											<1		3780	
BH119	BH119 9.5_10.0	Fill	PDA - Block 4	55.5	23.5	43.5	69.8	9	289	239	26.4	1210	504	244	396.6	3325.3											<1		490	
BH132	BH132_1.5-1.95	Fill	PDA - Block 4	21.9	8.8	9	14.8	2.3	29.5	2	7.1	3.8	16.1	27.5	100.5	189.2											20.5		1150	
BH132	BH132_8.0-8.5	Natural Clayey Sand	PDA - Block 4	27.4	11	11.6	37.5	3	77.6	76.9	8.3	825	228	97.6	171.8	1700.3														
BH133	BH133_0.3-0.5	Fill	PDA - Block 4	2.6	1.4	0.9	1.9	<0.5	4	<0.5	1	1.3	2.7	4	12.6	27.5														
BH133	BH133 1.5_1.95	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		340	
BH135	BH135A-0.4-0.6	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														
BH135	BH135A-1.6-2.05	Fill	PDA - Block 4																									140		
BH135	D1207-01	Fill	PDA - Block 4																									110		
BH135	BH135A-3.0-3.45	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														
BH135	D1207-02	Fill	PDA - Block 4																											
BH137	BH137 1.5_1.95	Fill	Block 4	0.6	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	0.8	4.1	8.7											<1		550	
BH137	BH137 3.0_3.45	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														
BH137	BH137 12.5_13.0	Fill	Block 4																											
BH141	BH141 1.5_1.95	Fill	PDA - Block 4	25.2	12.2	10.6	24.1	2.5	72.2	4.5	9.6	2.3	38.4	67.9	137	350.5											71.7		790	
BH141	BH141 3.0_3.45	Fill	PDA - Block 4	359	149	140	328	35.4	1160	725	124	5840	1820	980	1908.4	13,659														
BH142	BH142 1.5_1.95	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														
BH142	BH142 9.5_10.0	Fill	Block 4																											
BH143	BH143 1.5_1.95	Fill	Block 4																											
BH143	BH143 3.0_3.45	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														
BH146	BH146-1.5-1.95	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											8.6		290	
BH146	BH146-3.0-3.33	Fill	PDA - Block 4	72.8	33	28.9	69	8.5	184	10.9	31.4	28.3	26.6	198	400.6	951.4														
BH146	BH146-4.1-4.6	Fill	PDA - Block 4	37.2	16.2	14.8	34.7	4.1	107	71.6	14.2	454	186	105	197.6	1274.6											1.2		560	
BH156	BH156_0.4-0.5	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		<100	
BH156	D1408-4	Fill	PDA - Block 4		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<3	<7														
BH156	BH156_0.9-1.0	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5								
BH156	D1408-5	Fill	PDA - Block 4		<0.5		<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	0.5	<3	7	<0.5	<0.5	<0.5		<0.5	<0.5	0							
BH159	BH159_0.25-0.35	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8											<1		210	
BH159	D1408-8	Fill	PDA - Block 4		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<3	<7														
BH160	D1408-11	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														
BH160	BH160_0.3-0.4	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5								
BH160	D1408-11	Fill	PDA - Block 4		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<3	<7														
BH161	BH161_0.3-0.4	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														

Chemical Group				PAHs													Phenols													
Chemical Name				Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	CPAH	PAH (TOTAL)	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	Phenol	Phenolics Total	Cyanide (WAD)	Cyanide (Free)	Cyanide Total	Weak Acid Dissociable (WAD) Cyanide	Sulphate	Total Organic Carbon (TOC)
Units				mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
EQL				0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5			0.01	0.01	0.01	0.5	0.01	0.01		1	1	1	1	10	0.1
Location	Field ID	Matrix	Area																											
BH161	D1408-12	Fill	PDA - Block 4		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<3	<7														
BH200	BH200_0 - 1.6	Fill	PDA - Block 4																											
BH200	BH200/1.0	Fill	PDA - Block 4	158	30.4	48.2	128	11.6	320	14.8	34.4	64.4	269	296	681.6	1781.5	<0.5	3.8	<0.5	8.5	<0.5	6.7				200		30,600	
BH200	BH200_2 - 2.2	Fill	PDA - Block 4																											
BH200	BH200/2.5	Fill	PDA - Block 4	18.2	8.3	7.3	14.6	2.2	34.7	5.4	6.9	10.1	32.4	33.1	86.8	220.1	<0.5	<0.5	<0.5	1.3	<0.5	<0.5				44		2160	
BH200	BH200/6.53	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	1.1	<0.5	<0.5	<1	<0.5	<0.5				<1		260	
BH202	BH202/2.3	Fill	PDA - Block 4	6.4	3.9	3	5.5	0.9	11.4	<0.5	3.9	1	3.4	11.6	36.6	67.6	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		660	
BH202	BH202/4.7	Fill	PDA - Block 4	3.5	1.7	1.8	3.1	<0.5	8.9	0.8	1.7	<0.5	4.8	9.8	19.9	48.6	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		440	
BH202	BH202/6.8	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		340	
BH203	BH203/1.9	Fill	PDA - Block 4	5.3	3.4	2.3	4.1	0.9	9.3	<0.5	3.4	<0.5	5.9	9.1	29.5	58.9	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		870	
BH203	BH203/7.3	Fill	PDA - Block 4	2.4	1.2	1.1	2.2	<0.5	5.5	0.6	1.2	0.7	3.4	5.6	14.1	32.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		1740	
BH204	BH204/1.0	Fill	PDA - Block 4	68.8	39.8	59	83.5	9.9	373	295	41.3	1180	673	246	508.9	3702.1	1.5	<0.5	<0.5	<1	<0.5	<0.5				8		430	
BH204D	BH204D/1.5	Fill	PDA - Block 4	587	305	231	631	71.4	1550	1190	247	8410	2700	1510	3547.4	20,934	754	1160	<8	2290	<8	1720				575		5440	
BH204D	BH204D_2 - 3.2	Fill	PDA - Block 4																											
BH204D	BH204D/3.0	Fill	PDA - Block 4	210	38.2	40.4	184	13.3	655	384	40.8	1970	1090	545	976.7	6223.3	<0.5	38.4	<0.5	63.4	<0.5	55.8				76		660	
BH204D	BH204D_3.5 - 3.7	Fill	PDA - Block 4																											
BH204D	BH204D/4.0	Fill	PDA - Block 4	239	42.5	41	212	16.3	777	462	48.3	2930	1290	644	1122.1	7972.5	<0.5	80	<0.5	100	<0.5	84.2				44		710	
BH205	BH205/7.8	Natural Sandy Clay	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	0.5	<0.5	<4	8.2	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		540	
BH205	D01_270308	Natural Sandy Clay	PDA - Block 4		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	5.5	<0.5	<0.5	<3	12	<0.5	0.8	<0.5	<1	<0.5	<0.5	0.8			<1		40	
BH205	BH205_4.8 - 11.7	Fill	PDA - Block 4																											
BH205	BH205/9.3	Natural Clayey Sand	PDA - Block 4	14.3	5.6	6.7	20.8	1.6	42.4	42.9	5	291	117	50.8	94.7	738.1	9.5	2.1	<0.5	2.6	<0.5	<0.5				<1		150	
BH205	BH205/13.0	Natural Sandstone	PDA - Block 4	2.1	0.6	0.8	2	<0.5	7.5	6	0.6	28.8	13.1	6.3	11.4	82	5.2	<0.5	<0.5	5	<0.5	<0.5				<1		1570	
BH205	BH205/13.8	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	1.3	<0.5	<0.5	1.2	<0.5	<0.5				<1		330	
BH205	D01_010408	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	1.4	<0.5	<0.5	1.6	<0.5	<0.5				<1		380	
BH205	BH205/19.2	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.7	1.4	0.7	<4	9.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		150	
BH205	BH205/22.2	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		220	
BH206	BH206/0.5	Fill	PDA - Block 4	7.7	3.6	3.6	7.5	1.1	15.6	0.9	3.4	1.9	11.8	16.8	43.1	98.7	<0.5	<0.5	<0.5	<1	<0.5	<0.5				8		400	
BH206	BH206/1.8	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<4	8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		600	
BH206	BH206/4.6	Fill	PDA - Block 4	1.5	0.7	0.6	1.1	<0.5	4	<0.5	0.6	<0.5	2.4	3.6	7.9	20.7	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		1130	
BH206	BH206/7.1	Natural Clayey Sand	PDA - Block 4	1.9	0.7	0.7	2.5	<0.5	6.7	8.3	0.6	39.8	16.9	8.8	13.1	110.6	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		100	
BH206	BH206/10.7	Natural Sandstone	PDA - Block 4	0.8	<0.5	<0.5	0.9	<0.5	2.1	1.4	<0.5	3.5	5.1	2.5	5.6	24.2	0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		120	
BH207	BH207/7.45	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		290	
BH207	BH207/12.0	Fill	PDA - Block 4	5.2	2.5	1.7	3.6	0.6	8.8	0.7	2.2	1.2	4.3	9.5	25	54.1	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		2980	
BH207	BH207/13.1	Fill	PDA - Block 4	1.3	<0.5	<0.5	1.5	<0.5	3.5	2.4	<0.5	6.1	6.5	4.3	7.8	35.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		200	
BH207	BH207/15.0	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	<0.5	<0.5	<4	8.1	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		<100	
BH208	BH208/2.25	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		17,500	
BH208	BH208/9.5	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		230	
BH208	BH208/13.5	Natural Sandy Clay	PDA - Block 4	11.4	4.9	3	8.9	0.9	20.5	0.7	3.9	0.7	8.4	22.8	51.7	110.3	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		1700	
BH209	BH209/2.3	Fill	PDA - Block 4	19.8	7.7	6.4	8	2.2	20.1	1.9	6.6	2.6	7.6	44.8	78	168	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		710	
BH209	BH209/4.5	Natural Clay	PDA - Block 4	11.4	4.5	2.7	12.9	1.2	28.3	24.8	3.4	203	75.5	41.6	65	497	1	<0.5	<0.5	<1	<0.5	<0.5				4		710	
BH209	BH209/6.1	Natural Sandstone	PDA - Block 4	7	3.2	2.9	11	1	24.6	27	2.2	498	86.5	42.1	51.8	814	14	<0.5	<0.5	<1	<0.5	<0.5				<1		140	
BH209	BH209/9.4	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	1.6	3.5	<0.5	6	<0.5	10				<1		130	
BH210	BH210/1.5	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		270	
BH210	BH210/15.9	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		210	
BH211	BH211/14.0	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		150	
BH211	BH211/15.5	Natural Clayey Sand	PDA - Block 4	<0.5	<0.5	<0.5	0.6	<0.5	1.2	1.2	<0.5	5.2	3.6	1.8	4.4	21.2	0.6	<0.5	<0.5	<1	<0.5	<0.5				<1		860	
BH211	BH211/16.05-16.15	Natural Sandstone	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.5	<0.5	<0.5	<1	<0.5	<0.5				<1		420	
BH404	BH404_0.4-0.5	Fill	Block 4	7	3.2	2.5	5.1	0.8	17.4	1.5	2.9	1.4	8	17	34.1	86.6														
BH404	BH404_4.0-4.4	Fill	Block 4	3.5	1.5	1.2	2.5	<0.5	10	1.1	1	<0.5	6.6	9.5	16.7	49														
BH404	BH404_7.0-7.4	Fill	Block 4	53.5	26	28.4	68.6	5.8	212	62.4	20.9	127	323	219	331.1	1419.4														
BH404	BH404_12-12.4	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<0.5	0.9	<4	8.8														
BH404	BH404_14-14.4	Fill	Block 4	20	5.2	9	15.7	1.4	52.5	15.6	4.6	88	38.8	51	89.4	371.4														
BH404	QC653		Block 4	15.6	4.5	4.5	11.2	1.2	44.7	9.3	4.2	60.6	29	42.6	68	283														
BH404	BH404_15-15.4	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	0.6	<0.5	7.6	0.9	0.5	<4	15.7														
BH405	BH405_4.0-4.3	Fill	PDA - Block 4	8	2.6	2.4	5	<0.5	6.8	<0.5	2.2	<0.5	1.4	17.1	31.6	60.5														
BH405	BH405_7.0-7.3	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.01	<0.01	<0.01		<0.01	<0.01								
BH405	BH405_13.0-13.2	Natural Sand	PDA - Block 4	25.7	7.5	14.3	23.6	2	72.9	46.5	7.6	208	130	63	132.5	750.2														
BH405	BH405_14.0-14.4	Natural Sandy Clay	PDA - Block 4	96.3	49.1	44.5	93	10.3	301	236	42	1040	470	250	551.4	3296.3	4.9	1.5	<0.02		<0.02	<0.02								
BH405	QC609		PDA - Block 4	94.3	47.7	45.1	90.2	10.4	290	208	41.6	1010	456	239	543.1	3170.3														
BH406	BH406_4.0-4.2	Fill	Block 4	2.1	0.9	0.7	0.9	<0.5	2.7	<0.5	0.7	<0.5	1.5	7.2	8.7	22.7														
BH406	BH406_7.0-7.2	Fill	Block 4	0.9	<0.5	<0.5	0.9	<0.5	2.6	<0.5	<0.5	<0.5	1	3	5.8	14.9														
BH406	BH406_10.0-10.3	Fill	Block 4	1.1	0.5	<0.5	1.1	<0.5	3.4	0.6	<0.5	<0.5	3.1	3.3	6.6	19.9														
BH406	BH406_14.0-14.4	Fill	Block 4	49	19.1	22.9	55.4	5.1	200	57.2	17.9	76.7	200	168	297.7	1132.6														
BH406	BH406_15.0-15.4	Natural Silty Clay	Block 4	24.5	9.5	12.2	28.6	<4	94.8	58	8.4	401	153	80.4	151.2	1064														
BH406	QC602		Block 4	15	6.1	4.6	16.8	<4	61.2	30.3	5.2	236	89.6	48.9	93	630.7														
BH406	QC603		Block 4		15		31	3.9	110	62	14	440	160	83	139.9	1107.9														
BH406	BH406_16.0-16.5	Natural Silty Sand	Block 4	92	29.4	26.5	93.7	7.5	323	220	26.6	1170	529	266	467.8	3403.1	326	218	<0.25		<0.25	20.9								
BH407	BH407_8.0-8.1	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														
BH407	BH407_12.0-12.18	Fill	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														

Chemical Group				PAHs													Phenols													
Chemical Name	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	CPAH	PAH (TOTAL)	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	Phenol	Phenolics Total	Cyanide (WAD)	Cyanide (Free)	Cyanide Total	Weak Acid Dissociable (WAD) Cyanide	Sulphate	Total Organic Carbon (TOC)
Units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
EQL	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5			0.01	0.01	0.01	0.5	0.01	0.01		1	1	1	1	10	0.1
Location	Field ID	Matrix	Area																										
BH407	BH407_14.0-14.5	Natural Clayey Sand	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														
BH407	QC610		Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														
BH407	QC611		Block 4		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<3	<7														
BH407	BH407_15.1-15.45	Natural Clayey Sand	Block 4																						<1				
BH407	BH407_16.3-16.5	Natural Clayey Sand	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														
BH407	BH407_17.4-17.6	Natural Sand	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														
BH407	BH407_18.0-18.3	Natural Sand	Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8														
BH408	BH408_2.0-2.4	Fill	PDA - Block 4	7.1	4.5	3.1	5.2	0.7	12.6	<0.5	3.6	<0.5	6.6	12.9	36.7	76	0.03	0.02	<0.01		<0.01	<0.01								
BH408	BH408_8.0-8.3	Natural Sandy Clay	PDA - Block 4	1.1	0.6	<0.5	1.9	<0.5	4.3	7	<0.5	13	9.4	6.9	9	63.7														
BH408	BH408_9.0-9.4	Natural Clayey Sand	PDA - Block 4	4.6	2.6	2.3	7.6	0.6	14.5	16.6	2	89.8	38.8	18.3	35	252.6	<0.05	<0.05	<0.05		<0.05	<0.05								
BH408	QC613		PDA - Block 4	1.1	0.6	0.5	1.9	<0.5	4.2	4.8	<0.5	23.8	11.7	5.2	9	70.3															
BH409	BH409_3.7-4.0	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<4	<8	<0.01	<0.01	<0.01		<0.01	0.01								
BH409	BH409_5.0-5.3	Natural Sand	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	2.2	<0.5	33.8	6.8	1.8	4.1	60.2														
BH409	BH409_6.0-6.4	Natural Sandy Clay	PDA - Block 4																						<1				
BH409	BH409_7.0-7.3	Natural Clayey Sand	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.8	1.1	0.6	<4	11.2	0.04	0.09	<0.01		<0.01	<0.01								

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
SVOCs - Semi-volatile organic compounds
VOCs - Volatile Organic Compounds
PCBs - Polychlorinated Biphenyls
OCPs - Organochlorine Pesticides
OPPs - Organophosphorus Pesticides
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
* Detected compounds shown only for phenols, OCPs, OPPs, SVOCs and VOCs (all other compounds less than laboratory EQL)

Chemical Group		OCPs*		OPPs		SVOCs										VOCs							
Chemical Name	a-BHC	Endosulfan sulphate	Pirimphos-ethyl	Organic Matter	1,2,4,5-tetrachlorobenzene	1,3,5-Trichlorobenzene	1,3,5-Trinitrobenzene	1-naphthylamine	2-Picoline	3,3-Dichlorobenzidine	4-(dimethylamino) azobenzene	4-aminobiphenyl	Azobenzene	Carbazole	Dibenzofuran	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-propylbenzene	p-isopropyltoluene	Styrene
Units	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.05	0.05	0.05	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
AECOM_BH33	BH33_0.75-0.85	Fill	PDA - Block 4																				
AECOM_BH33	BH33_5.0-5.2	Fill	PDA - Block 4																				
AECOM_BH33	BH33_8.0-8.2	Natural Sandstone	PDA - Block 4																				
AECOM_BH34	BH34_1.8-2.2	Fill	PDA - Block 4																				
AECOM_BH34	QC240		PDA - Block 4																				
AECOM_BH34	QC241		PDA - Block 4																				
AECOM_BH34	BH34_3.8-4.0	Fill	PDA - Block 4																				
AECOM_BH34	BH34_6.0-6.2	Fill	PDA - Block 4																				
AECOM_BH34	BH34_11.0-11.2	Natural Sandstone	PDA - Block 4																				
AECOM_BH35	BH35_0.9-1.0	Fill	PDA - Block 4																				
AECOM_BH35	BH35_4.9-5.0	Fill	PDA - Block 4																				
AECOM_BH35	BH35_6.4-6.5	Fill	PDA - Block 4																				
AECOM_BH35	BH35_9.9-10.0	Fill	PDA - Block 4				0.9																
AECOM_BH36	BH36-0.07-0.1	Fill	VMP & PDA - Block 3																				
AECOM_BH36	BH36_1.0-1.2	Fill	VMP & PDA - Block 3																				
AECOM_BH36	BH36_4.0-4.4	Fill	VMP & PDA - Block 3	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH36	BH36_8.5-8.9	Fill	VMP & PDA - Block 3																				
AECOM_BH36	BH36_13-13.4	Fill	VMP & PDA - Block 3																				
AECOM_BH36	BH36_15-15.05	Natural Sandstone	VMP & PDA - Block 3	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH37	BH37_0.06-0.1	Fill	Block 4																				
AECOM_BH37	BH37_2.5-2.7	Fill	Block 4																				
AECOM_BH37	BH37_5.5-5.7	Fill	Block 4																				
AECOM_BH37	BH37_8.3-8.5	Fill	Block 4																				
AECOM_BH37	QC67		Block 4				0.5																
AECOM_BH37	QC68		Block 4																				
AECOM_BH37	BH37_15.8-16.0	Fill	Block 4				<0.5																
AECOM_BH37	QC69		Block 4				0.6																
AECOM_BH37	BH37_20.4-20.5	Natural Sandstone	Block 4	<0.5	<0.5	<0.5	0.6			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	6.8	1.8	<0.5	<0.5	<0.5	6.1
AECOM_BH37	BH37_22.2-AUGER	Natural Clayey Sand	Block 4	<0.6	<0.6	<0.6	0.6	<1.2	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<1	6.8	16.8						
AECOM_BH40	BH40_1.0-1.2	Fill	PDA - Block 4																				
AECOM_BH40	BH40_7.0-7.2	Fill	PDA - Block 4																				
AECOM_BH40	QC54		PDA - Block 4																				
AECOM_BH40	BH40_13.0-13.2	Fill	PDA - Block 4																				
AECOM_BH40	BH40_16.5-16.7	Natural Sandy Clay	PDA - Block 4	<0.5	<0.5	<0.5	0.8			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	5.3	8.9	7.5	3	<0.5	<0.5	<0.5	6.7
AECOM_BH40	BH40_17.8-18.0	Natural Sandy Clay	PDA - Block 4	<0.5	<0.5	<0.5	<0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	1.3	0.6	<0.5	<0.5	<0.5	0.9
AECOM_BH40	BH40_19.0-19.4	Natural Sandy Clay	PDA - Block 4																				
AECOM_BH41	BH41_0.07-0.1	Fill	Block 4																				
AECOM_BH41	BH41_1.0-1.4	Fill	Block 4				1.5																
AECOM_BH41	BH41_4.0-4.4	Fill	Block 4				0.6																
AECOM_BH41	BH41_8.5-8.9	Fill	Block 4				0.8																
AECOM_BH41	BH41_14.5-14.7	Fill	Block 4																				
AECOM_BH41	BH41_16.0-16.2	Natural Clayey Sand	Block 4																				
AECOM_BH41	BH41_17.5-17.7	Natural Sandstone	Block 4	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH42	BH42_1.0-1.1	Fill	PDA - Block 4																				
AECOM_BH42	BH42_2.0-2.1	Fill	PDA - Block 4																				
AECOM_BH42	BH42_3.2-3.3	Fill	PDA - Block 4	<1.2	<1.2	<1.2	4.8	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	1	69.7	103	92.9	31	7.3	4.9	<0.5	<0.5
AECOM_BH42	BH42_3.5-3.6	Natural Sandstone	PDA - Block 4																				
AECOM_BH44	BH44_1.4-1.5	Fill	PDA - Block 4																				
AECOM_BH44	BH44_1.9-2.0	Fill	PDA - Block 4				1.4																
AECOM_BH44	BH44_4.9-5.0	Natural Sandstone	PDA - Block 4	<1.2	<1.2	<1.2	0.8	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1	11.1	21.7	22	8.4	<0.5	0.9	<0.5	11.8
AECOM_BH45	BH45_0.8-1.0	Fill	PDA - Block 4																				
AECOM_BH45	BH45_3.2-3.4	Fill	PDA - Block 4																				
AECOM_BH45	QC230		PDA - Block 4																				
AECOM_BH45	BH45_7.2-7.4	Fill	PDA - Block 4				<0.5																
AECOM_BH45	QC231		PDA - Block 4				0.6																
AECOM_BH45	QC232		PDA - Block 4																				
AECOM_BH45	BH45_13.2-13.4	Natural Sandstone	PDA - Block 4																				
AECOM_BH48	BH48_0.15-0.16	Fill	Block 4																				
AECOM_BH48	BH48-1.0-1.2	Fill	Block 4																				
AECOM_BH48	QC76		Block 4																				
AECOM_BH48	QC77		Block 4																				
AECOM_BH48	BH48-8.5-8.7	Fill	Block 4																				
AECOM_BH48	BH48-11.5-11.7	Fill	Block 4																				
AECOM_BH48	BH48-14.5-14.7	Natural Sandstone	Block 4	<1.2	<1.2	<1.2	<0.5	<2.5	<1.2	<1.2	<1.2	<1.2	1.6	<1.2	<1.2	<1	32.8	49.4	8.7	3.9	<0.5	<0.5	<0.5	9.1
AECOM_BH48	QC78		Block 4	1.3	<1.2	<1.2	1.8	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1	41.2	90.5	40.9	21.1	<0.5	1.2	0.6	43
AECOM_BH48	BH48-17.0-17.2	Natural Sandstone	Block 4																				
AECOM_BH49	BH49_1.5-1.7	Fill	PDA - Block 4																				
AECOM_BH49	BH49_4.2-4.4	Fill	PDA - Block 4																				
AECOM_BH49	BH49_6.2-6.4	Fill	PDA - Block 4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	<1	2	2.1	1	<0.5	<0.5	<0.5	<0.5	<0.5

Chemical Group				OCPs*		OPPs		SVOCs										VOCs								
Chemical Name				a-BHC	Endosulfan sulphate	Pirimphos-ethyl	Organic Matter	1,2,4,5-tetrachlorobenzene	1,3,5-Trichlorobenzene	1,3,5-Trinitrobenzene	1-naphthylamine	2-Picoline	3,3-Dichlorobenzidine	4-(dimethylamino) azobenzene	4-aminobiphenyl	Azobenzene	Carbazole	Dibenzofuran	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-propylbenzene	p-isopropyltoluene	Styrene
Units				mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL				0.05	0.05	0.05	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Location	**Field ID**	**Matrix**	**Area**																					
AECOM_BH49	BH49-6.2-6.4	Fill	PDA - Block 4																					
AECOM_BH49	QC223		PDA - Block 4	<0.5	<0.5	<0.5	2.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	1.8	3.1	1.2	0.6	<0.5	<0.5	<0.5	0.5
AECOM_BH49	QC224		PDA - Block 4	<0.5	<0.5			<0.5			<0.5			<0.5	<0.5	<0.5	1.7	2.7	1.9	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH49	BH49_8.2-8.4	Fill	PDA - Block 4																					
AECOM_BH49	BH49_10.2-10.4	Fill	PDA - Block 4																					
AECOM_BH49	BH49_12.2-12.4	Natural Clayey Sand	PDA - Block 4	<1.2	<1.2	<1.2	0.7			<1.2	1.4	<1.2	<1.2	<1.2	<1.2	<1	32.3	60.8	9.5	3.8	<0.5	<0.5	<0.5	8.7
AECOM_BH50	BH50_0.15-0.25	Fill	PDA - Block 4																					
AECOM_BH50	BH50_1.3-1.5	Natural Sandstone	PDA - Block 4				<0.5																	
AECOM_BH52	BH52_0.15-0.16	Fill	PDA - Block 4																					
AECOM_BH52	BH52_1.0-1.2	Fill	PDA - Block 4																					
AECOM_BH52	BH52_2.2-2.6	Fill	PDA - Block 4				<0.5																	
AECOM_BH52	QC220		PDA - Block 4				0.6												<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH52	QC221		PDA - Block 4																<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH52	BH52_4.2-4.4	Fill	PDA - Block 4																					
AECOM_BH54	BH54_0.6-0.7	Fill	PDA - Block 4																					
AECOM_BH54	BH54_1.0-1.4	Fill	PDA - Block 4				2.4												16.4	5.8	<0.5	<0.5	<0.5	4.8
AECOM_BH54	QC228		PDA - Block 4				2.6																	
AECOM_BH54	BH54_2.8-3.0	Natural Sand	PDA - Block 4	<1.2	<1.2	<1.2		<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1	20	31	2.8	1.2	<0.5	<0.5	<0.5	<0.5
AECOM_BH55	BH55_1.0-1.2	Fill	PDA - Block 4																					
AECOM_BH55	BH55_2.2-2.4	Fill	PDA - Block 4	<1.2	<1.2	<1.2		<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	1.2	<1	67.6	124	76.5	31.2	0.6	1.4	<0.5	6.2
AECOM_BH55	BH55_2.7-2.9	Fill	PDA - Block 4																					
AECOM_BH57	BH57_4.0-4.2	Fill	Block 4																					
AECOM_BH57	BH57_7.0-7.2	Fill	Block 4																					
AECOM_BH57	BH57_11.5-11.7	Fill	Block 4																					
AECOM_BH57	BH57_16.5-16.7	Natural Clayey Sand	Block 4																					
AECOM_BH58	BH58_0.15-0.16	Fill	PDA - Block 4																					
AECOM_BH58	BH58_1.0-1.2	Fill	PDA - Block 4																					
AECOM_BH58	BH58_3.2-3.4	Fill	PDA - Block 4																					
AECOM_BH58	QC225		PDA - Block 4																					
AECOM_BH58	QC226		PDA - Block 4																					
AECOM_BH58	BH58_5.2-5.4	Fill	PDA - Block 4																					
AECOM_BH58	BH58_8.6-8.8	Fill	PDA - Block 4	<0.5	<0.5	<0.5	1.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM_BH58	BH58_10.2-10.4	Fill	PDA - Block 4																					
AECOM_BH58	BH58_10.8-11.2	Fill	PDA - Block 4				<0.5																	
AECOM_BH59	BH59_0.15-0.16	Fill	PDA - Block 4																					
AECOM_BH59	BH59_1.0-1.1	Fill	PDA - Block 4																					
AECOM_BH59	BH59_1.9-2.0	Fill	PDA - Block 4																					
AECOM_BH59	BH59_3.4-3.5	Fill	PDA - Block 4	<1.2	4.2	1.4	1.8	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	1.3	<1.2	<1	186	327	59.3	24.2	0.8	1.2	<0.5	5.5
AECOM_BH59	BH59-3.4-3.5	Fill	PDA - Block 4																					
AECOM_BH59	BH59_4.2-4.3	Fill	PDA - Block 4																					
BH019	BH019 0.3-0.5	Fill	PDA - Block 4																					
BH019	BH019 1.5-1.95	Fill	PDA - Block 4																					
BH019	BH019 2.5-3.0	Fill	PDA - Block 4																					
BH019	BH019 3.0-3.45	Fill	PDA - Block 4																					
BH020	BH020 0.3-0.5	Fill	PDA - Block 4																					
BH020	BH021 0.3-0.5	Fill	PDA - Block 4																					
BH020	BH020 1.5-2.1	Fill	PDA - Block 4																					
BH020	D0905-1	Fill	PDA - Block 4																					
BH020	BH020 3.0-3.25	Fill	PDA - Block 4																					
BH020	D0905-2	Fill	PDA - Block 4																					
BH035	BH035_ 0.3-0.5	Fill	Block 4																					
BH035	BH035_ 1.5-1.95	Fill	Block 4																					
BH035	D1805-1	Fill	Block 4																					
BH035	BH035_ 4.0-4.5	Fill	Block 4																					
BH035	D1805-2	Fill	Block 4																					
BH055	BH055-0.8-1.0	Fill	Public Domain Blocks																					
BH055	D3005-1	Fill	Public Domain Blocks																					
BH055	BH055-1.8-2.0	Fill	Public Domain Blocks																					
BH055	D3005-2	Fill	Public Domain Blocks																					
BH055	BH055-3.3-3.5	Fill	Public Domain Blocks																					
BH063	BH063-1.5-1.65	Fill	Public Domain Blocks																					
BH063	BH063-2.8-3.0	Fill	Public Domain Blocks																					
BH065	BH065-0.3-0.5	Fill	PDA - Block 4																					
BH065	D0106-1	Fill	PDA - Block 4																					
BH065	BH065-1.5-1.95	Fill	PDA - Block 4																					
BH065	BH065-3.0-3.45	Fill	PDA - Block 4																					
BH065	D0106-2	Fill	PDA - Block 4																					
BH068	BH068-0.3-0.5	Fill	Block 4																					
BH068	BH068-3.0-3.45	Fill	Block 4																					

Chemical Group			OCPs*		OPPs		SVOCs										VOCs								
Location	Field ID	Matrix	Area	Chemical Name	a-BHC	Endosulfan sulphate	Pirimphos-ethyl	Organic Matter	1,2,4,5-tetrachlorobenzene	1,3,5-Trichlorobenzene	1,3,5-Trinitrobenzene	1-naphthylamine	2-Picoline	3,3-Dichlorobenzidine	4-(dimethylamino) azobenzene	4-aminobiphenyl	Azobenzene	Carbazole	Dibenzofuran	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-propylbenzene	p-isopropyltoluene	Styrene
				Units	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				EQL	0.05	0.05	0.05	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
BH068	BH068-9.5-10.0	Fill	Block 4																						
BH070	BH070_0.3-0.5	Fill	PDA - Block 4																						
BH070	D0206-1	Fill	PDA - Block 4																						
BH070	BH070_1.5-1.95	Fill	PDA - Block 4																						
BH071	BH071_1.5-1.95	Fill	PDA - Block 4																						
BH071	BH071_3.0-3.45	Fill	PDA - Block 4																						
BH072	BH072_0.3-0.5	Fill	PDA - Block 4																						
BH072	BH072_3.0-3.45	Fill	PDA - Block 4																						
BH072	BH072_9.5-10.0	Fill	PDA - Block 4																						
BH073	BH073_1.5-1.95	Fill	PDA - Block 4																						
BH073	BH073_2.0-2.4	Fill	PDA - Block 4																						
BH075	BH075_0.3-0.5	Fill	PDA - Block 4																						
BH075	D0606-1	Fill	PDA - Block 4																						
BH075	BH075_3.0-3.45	Fill	PDA - Block 4																						
BH087	BH087 1.5-1.95	Fill	PDA - Block 4																						
BH087	BH087 3.0-3.45	Fill	PDA - Block 4																						
BH087	BH087 7.0-7.5	Fill	PDA - Block 4																						
BH089	BH089 0.3-0.5	Fill	PDA - Block 4																						
BH089	BH089 1.5-1.95	Fill	PDA - Block 4																						
BH089	BH089 3.0-3.45	Fill	PDA - Block 4																						
BH090	BH090 1.5-1.95	Fill	PDA - Block 4																						
BH090	D0906-2	Fill	PDA - Block 4																						
BH090	BH090 3.0-3.45	Fill	PDA - Block 4																						
BH109	BH109 0.3_0.5	Fill	PDA - Block 4																						
BH109	BH109 3.0_3.45	Fill	PDA - Block 4																						
BH109	BH109 9.5_10.0	Fill	PDA - Block 4																						
BH113	BH113 1.5_1.95	Fill	PDA - Block 4																						
BH113	BH113 3.0_3.45	Fill	PDA - Block 4																						
BH114	BH114 0.3_0.5	Fill	PDA - Block 4																						
BH114	BH114 3.0_3.45	Fill	PDA - Block 4																						
BH115	BH115 0.8_1.0	Fill	PDA - Block 4																						
BH115	D2806_1	Fill	PDA - Block 4																						
BH115	BH115 1.5_1.95	Fill	PDA - Block 4																						
BH115	D2806_2	Fill	PDA - Block 4																						
BH115	BH115 3.0_3.45	Fill	PDA - Block 4																						
BH119	BH119 1.6_2.05	Fill	PDA - Block 4																						
BH119	BH119 7.5_8.0	Fill	PDA - Block 4																						
BH119	BH119 9.5_10.0	Fill	PDA - Block 4																						
BH132	BH132_1.5-1.95	Fill	PDA - Block 4																						
BH132	BH132_8.0-8.5	Natural Clayey Sand	PDA - Block 4																						
BH133	BH133_0.3-0.5	Fill	PDA - Block 4																						
BH133	BH133 1.5_1.95	Fill	PDA - Block 4																						
BH135	BH135A-0.4-0.6	Fill	PDA - Block 4																						
BH135	BH135A-1.6-2.05	Fill	PDA - Block 4																						
BH135	D1207-01	Fill	PDA - Block 4																						
BH135	BH135A-3.0-3.45	Fill	PDA - Block 4																						
BH135	D1207-02	Fill	PDA - Block 4																						
BH137	BH137 1.5_1.95	Fill	Block 4																						
BH137	BH137 3.0_3.45	Fill	Block 4																						
BH137	BH137 12.5_13.0	Fill	Block 4																						
BH141	BH141 1.5_1.95	Fill	PDA - Block 4																						
BH141	BH141 3.0_3.45	Fill	PDA - Block 4																						
BH142	BH142 1.5_1.95	Fill	Block 4																						
BH142	BH142 9.5_10.0	Fill	Block 4																						
BH143	BH143 1.5_1.95	Fill	Block 4																						
BH143	BH143 3.0_3.45	Fill	Block 4																						
BH146	BH146-1.5-1.95	Fill	PDA - Block 4																						
BH146	BH146-3.0-3.33	Fill	PDA - Block 4																						
BH146	BH146-4.1-4.6	Fill	PDA - Block 4																						
BH156	BH156_0.4-0.5	Fill	PDA - Block 4																						
BH156	D1408-4	Fill	PDA - Block 4																						
BH156	BH156_0.9-1.0	Fill	PDA - Block 4	<0.05	<0.05	<0.05																			
BH156	D1408-5	Fill	PDA - Block 4	<0.05	<0.05																				
BH159	BH159_0.25-0.35	Fill	PDA - Block 4																						
BH159	D1408-8	Fill	PDA - Block 4																						
BH160	D1408-11	Fill	PDA - Block 4			<0.05																			
BH160	BH160_0.3-0.4	Fill	PDA - Block 4	<0.05	<0.05	<0.05																			
BH160	D1408-11	Fill	PDA - Block 4																						
BH161	BH161_0.3-0.4	Fill	PDA - Block 4																						

Chemical Group		OCPs*		OPPs		SVOCs										VOCs								
Chemical Name		a-BHC	Endosulfan sulphate	Pirimphos-ethyl	Organic Matter	1,2,4,5-tetrachlorobenzene	1,3,5-Trichlorobenzene	1,3,5-Trinitrobenzene	1-naphthylamine	2-Picoline	3,3-Dichlorobenzidine	4-(dimethylamino) azobenzene	4-aminobiphenyl	Azobenzene	Carbazole	Dibenzofuran	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-propylbenzene	p-isopropyltoluene	Styrene
Units		mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL		0.05	0.05	0.05	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Location	**Field ID**	**Matrix**	**Area**																					
BH161	D1408-12	Fill	PDA - Block 4																					
BH200	BH200_0 - 1.6	Fill	PDA - Block 4																					
BH200	BH200/1.0	Fill	PDA - Block 4																					
BH200	BH200_2 - 2.2	Fill	PDA - Block 4																					
BH200	BH200/2.5	Fill	PDA - Block 4																					
BH200	BH200/6.53	Natural Sandstone	PDA - Block 4																					
BH202	BH202/2.3	Fill	PDA - Block 4																					
BH202	BH202/4.7	Fill	PDA - Block 4																					
BH202	BH202/6.8	Natural Sandstone	PDA - Block 4																					
BH203	BH203/1.9	Fill	PDA - Block 4																					
BH203	BH203/7.3	Fill	PDA - Block 4																					
BH204	BH204/1.0	Fill	PDA - Block 4																					
BH204D	BH204D/1.5	Fill	PDA - Block 4																					
BH204D	BH204D_2 - 3.2	Fill	PDA - Block 4																					
BH204D	BH204D/3.0	Fill	PDA - Block 4																					
BH204D	BH204D_3.5 - 3.7	Fill	PDA - Block 4																					
BH204D	BH204D/4.0	Fill	PDA - Block 4																					
BH205	BH205/7.8	Natural Sandy Clay	PDA - Block 4																					
BH205	D01_270308	Natural Sandy Clay	PDA - Block 4																					
BH205	BH205_4.8 - 11.7	Fill	PDA - Block 4																					
BH205	BH205/9.3	Natural Clayey Sand	PDA - Block 4																					
BH205	BH205/13.0	Natural Sandstone	PDA - Block 4																					
BH205	BH205/13.8	Natural Sandstone	PDA - Block 4																					
BH205	D01_010408	Natural Sandstone	PDA - Block 4																					
BH205	BH205/19.2	Natural Sandstone	PDA - Block 4																					
BH205	BH205/22.2	Natural Sandstone	PDA - Block 4																					
BH206	BH206/0.5	Fill	PDA - Block 4																					
BH206	BH206/1.8	Fill	PDA - Block 4																					
BH206	BH206/4.6	Fill	PDA - Block 4																					
BH206	BH206/7.1	Natural Clayey Sand	PDA - Block 4																					
BH206	BH206/10.7	Natural Sandstone	PDA - Block 4																					
BH207	BH207/7.45	Fill	PDA - Block 4																					
BH207	BH207/12.0	Fill	PDA - Block 4																					
BH207	BH207/13.1	Fill	PDA - Block 4																					
BH207	BH207/15.0	Natural Sandstone	PDA - Block 4																					
BH208	BH208/2.25	Fill	PDA - Block 4																					
BH208	BH208/9.5	Fill	PDA - Block 4																					
BH208	BH208/13.5	Natural Sandy Clay	PDA - Block 4																					
BH209	BH209/2.3	Fill	PDA - Block 4																					
BH209	BH209/4.5	Natural Clay	PDA - Block 4																					
BH209	BH209/6.1	Natural Sandstone	PDA - Block 4																					
BH209	BH209/9.4	Natural Sandstone	PDA - Block 4																					
BH210	BH210/1.5	Fill	PDA - Block 4																					
BH210	BH210/15.9	Natural Sandstone	PDA - Block 4																					
BH211	BH211/14.0	Fill	PDA - Block 4																					
BH211	BH211/15.5	Natural Clayey Sand	PDA - Block 4																					
BH211	BH211/16.05-16.15	Natural Sandstone	PDA - Block 4																					
BH404	BH404_0.4-0.5	Fill	Block 4																					
BH404	BH404_4.0-4.4	Fill	Block 4																					
BH404	BH404_7.0-7.4	Fill	Block 4																					
BH404	BH404_12-12.4	Fill	Block 4																					
BH404	BH404_14-14.4	Fill	Block 4																					
BH404	QC653		Block 4																					
BH404	BH404_15-15.4	Fill	Block 4																					
BH405	BH405_4.0-4.3	Fill	PDA - Block 4																					
BH405	BH405_7.0-7.3	Fill	PDA - Block 4																					
BH405	BH405_13.0-13.2	Natural Sand	PDA - Block 4																					
BH405	BH405_14.0-14.4	Natural Sandy Clay	PDA - Block 4																					
BH405	QC609		PDA - Block 4																					
BH406	BH406_4.0-4.2	Fill	Block 4																					
BH406	BH406_7.0-7.2	Fill	Block 4																					
BH406	BH406_10.0-10.3	Fill	Block 4																					
BH406	BH406_14.0-14.4	Fill	Block 4																					
BH406	BH406_15.0-15.4	Natural Silty Clay	Block 4																					
BH406	QC602		Block 4																					
BH406	QC603		Block 4																					
BH406	BH406_16.0-16.5	Natural Silty Sand	Block 4																					
BH407	BH407_8.0-8.1	Fill	Block 4																					
BH407	BH407_12.0-12.18	Fill	Block 4																					

Chemical Group			OCPs*		OPPs		SVOCs										VOCs						
Chemical Name	a-BHC	Endosulfan sulphate	Pirimphos-ethyl	Organic Matter	1,2,4,5-tetrachlorobenzene	1,3,5-Trichlorobenzene	1,3,5-Trinitrobenzene	1-naphthylamine	2-Picoline	3,3-Dichlorobenzidine	4-(dimethylamino) azobenzene	4-aminobiphenyl	Azobenzene	Carbazole	Dibenzofuran	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-propylbenzene	p-isopropyltoluene	Styrene
Units	mg/kg	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.05	0.05	0.05	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
BH407	BH407_14.0-14.5	Natural Clayey Sand	Block 4																				
BH407	QC610		Block 4																				
BH407	QC611		Block 4																				
BH407	BH407_15.1-15.45	Natural Clayey Sand	Block 4														<0.5						<0.5
BH407	BH407_16.3-16.5	Natural Clayey Sand	Block 4																				
BH407	BH407_17.4-17.6	Natural Sand	Block 4																				
BH407	BH407_18.0-18.3	Natural Sand	Block 4																				
BH408	BH408_2.0-2.4	Fill	PDA - Block 4																				
BH408	BH408_8.0-8.3	Natural Sandy Clay	PDA - Block 4																				
BH408	BH408_9.0-9.4	Natural Clayey Sand	PDA - Block 4																				
BH408	QC613		PDA - Block 4																				
BH409	BH409_3.7-4.0	Fill	PDA - Block 4																				
BH409	BH409_5.0-5.3	Natural Sand	PDA - Block 4																				
BH409	BH409_6.0-6.4	Natural Sandy Clay	PDA - Block 4														<0.5						<0.5
BH409	BH409_7.0-7.3	Natural Clayey Sand	PDA - Block 4																				

Notes
mg/kg = milligrams per kilogram
EQL = Estimated Quantitation Limit
< denotes result less than EQL
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)
TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)
SVOCs - Semi-volatile organic compounds
VOCs - Volatile Organic Compounds
PCBs - Polychlorinated Biphenyls
OCPs - Organochlorine Pesticides
OPPs - Organophosphorus Pesticides
* TPH C6-C9 aliphatic
* *TPH C10-C14 aliphatic and aromatic
note TPH in table not speciated
* Detected compounds shown only for phenols, OCPs, OPPs, SVOCs and VOCs (all other compounds less than laboratory EQL)

			Field Sample ID	IT3D	IT3M	IT3S	MW15	MW200	MW200	MW210	MW204S	MW204S	MW205	MW206	MW209	MW209	MW40	MW45	MW52	MW54	MW58	QC237	QC328
			Location	BH405	BH405	BH405	BH087	BH200	BH200	MW210	BH204	BH204	BH205	BH206	BH209	BH209	AECOM_BH40	MW45	AECOM_BH52	AECOM_BH54	AECOM_BH58	AECOM_BH58	AECOM_BH58
			Sample Date	25/02/2011	25/02/2011	25/02/2011	15/03/2010	28/02/2011	16/03/2010	24/02/2011	25/02/2011	15/03/2010	17/03/2010	19/03/2010	28/02/2011	16/03/2010	20/03/2010	19/03/2010	19/03/2010	19/03/2010	17/03/2010	17/03/2010	17/03/2010
			Area	PDA - Block 4	PDA - Block 4	PDA - Block 4	PDA - Block 4	PDA - Block 4	PDA - Block 4		PDA - Block 4	PDA - Block 4	PDA - Block 4	PDA - Block 4	PDA - Block 4	PDA - Block 4	PDA - Block 4		PDA - Block 4	PDA - Block 4	PDA - Block 4	PDA - Block 4	PDA - Block 4
Chemical Group	**Chemical Name**	**Unit**	**Groundwater SSTC^{DEV}**																				
Metals	Aluminium (Filtered)	mg/L		<0.01	0.01	<0.01		0.014		<0.01	0.05				0.01			-					
	Antimony (Filtered)	mg/L		0.0005	0.0021	0.0017		<0.0002		<0.0005	0.0005				<0.0005			-					
	Arsenic (Filtered)	µg/L		0.7	0.8	1.7	3.3	5.3	3.4	1.5	2	2.3			1.1	2.9	5.2	1.1	2.1	5.4	2.4	1.8	<0.2
	Barium (Filtered)	mg/L		0.714	0.1	0.096	0.293	0.0854	0.0918	0.075	0.0854	0.0866			0.048	0.083	0.468	0.062	0.074	0.136	1.85	1.47	0.0005
	Beryllium (Filtered)	µg/L		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			0.1	0.2	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Cadmium (Filtered)	µg/L		<0.2	0.4	0.9	0.08	0.11	0.27	0.2	0.78	0.06			0.5	0.4	0.4	11.5	<0.2	<0.05	3.4	3.3	<0.05
	Calcium (Filtered)	mg/L					95		130	-		11				383	540	588	487	92	309	319	
	Chromium (Filtered)	µg/L		<0.5	<0.5	<0.5	0.8	0.9	0.5	<0.5	1	1.3			<0.5	10.2	<0.5	<0.5	<0.5	1	<0.5	0.8	0.4
	Chromium (hexavalent)	mg/L					<0.002		<0.002	-		<0.002				0.005	0.016	<0.002	0.003	0.019	<0.002	0.006	
	Cobalt (Filtered)	µg/L		0.4	0.3	0.8	0.8	1.5	1.2	0.3	1.2	0.8			0.3	1.3	1.9	8	1.3	6	1	1	<0.1
	Copper (Filtered)	µg/L		<1	<1	<1	<0.5	<0.5	<0.5	<1	3.1	5.2			<1	<1	4	<1	<1	<0.5	<1	<1	<0.5
	Iron (Filtered)	mg/L					0.97		8.99	-		0.62				10	14.1	187	<0.5	5.74		7.03	7.15
	Lead (Filtered)	µg/L		0.2	2.4	0.8	0.1	<0.1	0.1	-	0.4	0.5			<0.2	17.6	0.2	1120	0.3	0.2	1.2	1.5	0.3
	Magnesium (Filtered)	mg/L					54		159	1.81		13				1110	995	4.89	1210	40	742	749	
	Manganese (Filtered)	mg/L		0.294	0.0336	0.072	0.239	0.85	0.617	<0.1	0.099	0.055			0.018	0.0492	0.437	<0.1	0.679	0.509	0.226	0.208	0.0006
	Mercury (Filtered)	µg/L		<0.1	<0.1	<0.1	0.2	0.2	0.2	164	<0.1	<0.1			<0.1	<0.1	<0.1	36	<0.1	0.1	<0.1	<0.1	<0.1
	Nickel (Filtered)	µg/L		<0.5	1.2	5.4	7.8	46.4	13.7	-	72.1	15.6			55.7	20.6	19.5	259	6.7	72.6	104	97	<0.5
	Potassium (Filtered)	mg/L					25		65	<0.002		16				353	195	-	429	23	306	318	
	Selenium (Filtered)	mg/L		<0.002	<0.002	<0.002		0.0013		<0.1	0.0005				<0.002			-					
	Silver (Filtered)	µg/L		<0.1	<0.1	<0.1		<0.1		-	<0.1				0.3			-					
	Sodium (Filtered)	mg/L					244		1120	-		167				10,300	7860	9850	11,300	180	8840	9100	
	Vanadium (Filtered)	µg/L		0.9	0.9	1.9	0.9	2.8	1.8	<0.5	4.7	6.6			1	22.8	1.7	<0.5	1.5	1.9	2.4	1.8	<0.2
	Zinc (Filtered)	mg/L		<0.005	0.046	0.017	0.006	0.008	0.006	0.016	0.019	0.075			0.006	0.613	0.021	0.014	0.016	0.065	0.089	0.086	0.009
PAHs	2-methylnaphthalene	µg/L	4500				541		209	-		314	105,000	4040		14	36	<2	<2	294	<2	<2	
	3-methylcholanthrene	µg/L					<9		<9	-		<9	131	<47		<2	<0.9	<2	<2	<2	<2	<2	
	Acenaphthene	µg/L		25	<1	<1	49	<98	15	<1	85.5	96	4480	274	1.8	7	4	<2	<2	72	<2	<2	
	Acenaphthylene	µg/L	80,000	158	<1	<1	155	<98	40	3.1	45.4	55	43,200	1380	6.2	26	16	<2	<2	113	<2	<2	
	Acetophenone	µg/L					13		<9	-		<9	<74	<47		<2	<0.9	<2	<2	<2	<2	<2	
	Anthracene	µg/L		25.7	<1	<1	18	<98	<9	<1	<10	<9	15,400	680	1	4	3	<2	<2	19	<2	<2	
	Benz(a)anthracene	µg/L		19.6	<1	2.2	<9	<98	<9	1.1	<10	<9	12,600	592	1	2	<0.9	<2	<2	3	<2	<2	
	Benzo(a) pyrene	µg/L		12.8	<0.5	3.8	<9	<98	<9	0.9	<10	<9	9260	299	0.8	3	<0.9	<2	<2	<2	<2	<2	
	Benzo(b)&(k)fluoranthene	µg/L					<19		<19	-		<19	9860	362		<4	<2	<4	<4	<4	<4	<4	
	Benzo(b)fluoranthene	µg/L		12.4	<1	4.8		<98		<1	<10				<1			-					
	Benzo(g,h,i)perylene	µg/L		<10	<1	3	<9	<98	<9	<1	<10	<9	1910	89	<1	<2	<0.9	<2	<2	<2	<2	<2	
	Benzo(k)fluoranthene	µg/L		<10	<1	2.5		<98		<1	<10				<1			-					
	Chrysene	µg/L		11.3	<1	1.4	<9	<98	<9	<1	<10	<9	9780	462	<1	<2	<0.9	<2	<2	2	<2	<2	
	Dibenz(a,h)anthracene	µg/L		<10	<1	<1	<9	<98	<9	<1	<10	<9	728	<47	<1	<2	<0.9	<2	<2	<2	<2	<2	
	Fluoranthene	µg/L		28.6	<1	1.9	18	<98	<9	2.6	<10	<9	25,200	1250	1.2	4	2	<2	4	19	<2	<2	
	Fluorene	µg/L	13000	75.9	<1	<1	83	<98	11	<1	80.6	92	21,100	1030	<1	10	12	<2	<2	92	<2	<2	
	Indeno(1,2,3-c,d)pyrene	µg/L		<10	<1	2.2	<9	<98	<9	<1	<10	<9	1910	81	<1	<2	<0.9	<2	<2	<2	<2	<2	
	Phenanthrene	µg/L	5800	77.7	<1	<1	87	<98	12	<1	54.6	97	74,100	2840	2	14	14	<2	<2	98	<2	<2	
	Pyrene	µg/L		41.8	1	4.5	16	<98	<9	4.2	<10	<9	27,900	1520	1.8	6	2	<2	4	14	<2	<2	
	Naphthalene	µg/L	240	2560	<1	<1	7800	5450	7950	<1	8580	6740	283,000	10,600	10.8	677	244	8	4	8640	<2	<2	<7
	CPAH	µg/L		96.1	<7.5	20.9	<54	<784	<54	1.01	<80	<54	36,188	1570	7.8	13	<5.4	<4.44	<12	13	<12	<12	
	PAH (TOTAL)	µg/L		3088.8	15.5	33.3	8280	6920	8109	11.9	8956.1	7161	530,568	21,144	33.6	761	302.4	8	34	9080	<28	<28	<7
Phenols	2,4-dimethylphenol	µg/L		360	<1	<1	898	8690	12,200	<1	61.4	231	11,600	<47	1.2	10	69	<2	<2	439	<2	<2	
	2-methylphenol	µg/L		159	<1	<1	267	6900	4770	<1	<10	36	2840	<47	<1	6	15	<2	<2	83	<2	<2	
	3-&4-methylphenol	µg/L	130000	123	<2	<2	68	3640	2270	<2	<20	<19	2830	<94	<2	<4	20	<4	<4	24	<4	<4	
	Phenol	µg/L		<10	<1	<1	24	836	300	<1	<10	<9	503	<47	<1	<2	2	<2	<2	6	<2	<2	
TPH	TPH C15-C36	mg/L		3.23	<0.15	0.65	14.87	17.25	22.65	0.8	2.82	7.85	1852	85.4	0.27	1.16		<0.15	<0.15	11.3	<0.15	<0.15	<0.15
	TPH C10 - C14	µg/L	1800	5590	<50	<50	41,000	47,400	100,000	80	8430	19,600	1,730,000	68,000	100	2230		<50	<50	28,000	<50	<50	<50
	TPH C15-C28	µg/L		2970	<100	410	14,400	17,200	22,500	730	2690	7400	1,520,000	70,600	220	1000		<100	<100	10,900	<100	<100	<100
	TPH C29-C36	µg/L		260	<50	240	470	<50	150	70	130	450	332,000	14,800	<50	160		<50	<50	400	<50	<50	<50
	TPH C6 - C9	µg/L	7,300,000	2120	<20	<20	46,200	37,600	22,400	<20	2380	890		13,300	100	1380		<20	<20	3730	<20	<20	<20
	TPH+C10 - C36 (Sum of total)	µg/L		8820	<50	650	55,870	64,600	122,650	880	11250	19,600	3,582,000	153,400	320	3390		<50	<50	39,300	<50	<50	<50
BTEX	Benzene	µg/L	7700	595	<1	<1	13,100	17,900	16,200	2	237	92		5450	56	772	52	<1	<1	621	<1	<1	<1
	Ethylbenzene	µg/L	750000	51	<2	<2	3010	659	686	3	169	60		1250	15	149	2	<2	<2	206	<2	<2	<2
	Toluene	µg/L	4,000,000	465	<5	<5	5030	1660	1820	<5	440	180		101	5	48	46	<5	<5	502	<5	<5	<5
	Xylene (m & p)	µg/L		325	<2	<2	3920	1350	1800	<2	466	172		1230	8	76	26	<2	<2	626	<2	<2	<2
	Xylene (o)	µg/L		136	<2	<2	2180	560	536	<2	229	82		1540	10	104	12	<2	<2	328	<2	<2	<2
	Total Xylene	µg/L	176,000	461	<4	<4	6100	1910	2336	<4	695	254		2770	18	180	38	<4	<4	954	<4	<4	<4
Inorganics	Ammonia as N	mg/L	630				37.2		<0.01	-		5.36				7.48	9.7	<0.1	<0.1	10.8	13.6	13.8	
	Cyanide (Free)	mg/L		<0.004	<0.004	<0.004	0.005	<0.004	0.007	<0.004	<0.004	<0.004			<0.004	<0.004		<0.004	0.007	<0.004	<0.004	<0.004	
	Ferrous Iron	mg/L					0.84		9.58	-		0.55				9.52		-			7.84	7.96	
	Nitrate (as N)	mg/L					0.04		3.4	-		0.03				0.1	<0.01	0.03	0.1	<0.01	0.06	0.06	
	Nitrite (as N)	mg/L					0.02		0.05	-		0.02				<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	
	Nitrogen (Total Oxidised)	mg/L					0.07		3.44	-		0.05				0.1	<0.01	0.03	0.12	<0.01	0.06	0.06	
	Reactive Phosphorus as P	mg/L								-								<0.01	0.07	0.29	0.27	0.27	
	Sulphate	mg/L					49.5		200	-		22.3				1900	687	2100	2510	103	270	289	
	Sulphur as S	mg/L					18		123	-		11				645		588	863	33	169	172	
	TOC	mg/L					52		112	-		26				9	8	3	4	40	15	15	
	Weak Acid Dissociable Cyanide	mg/L		<0.004	<0.004	<0.004	0.011	<0.004	0.004	<0.004	<0.004	<0.004			<0.004	<0.004		<0.004	0.008	<0.004	<0.004	<0.004	
OCPs*	OCP compounds	µg/L					<EQL		<EQL	<EQL		<EQL	<EQL	<EQL		<EQL	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL	
OPPs*	OPP compounds	µg/L					<EQL		<EQL	<EQL		<EQL	<EQL	<EQL		<EQL	<EQL	<EQL	<EQL	<EQL	<EQL	<EQL	
other	Plasticiser Compounds	mg/L					<0.02		0.02	-		<0.02	<0.07	<0.05		0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
SVOCs*	1-naphthylamine	µg/L					<9		91	-		<9	<74	<47		<2	<0.9	<2	<2	<2	<2	<2	
	2-Picoline	µg/L					129		<9	-		69	<74	<47		<2	<0.9	<2	<2	21	<2	<2	
	Aniline	µg/L	180,000				86		212	-		28	<74	<47		<2	<0.9	<2	<2	24	<2	<2	
	Bis(2-ethylhexyl) phthalate	µg/L					<20		20	-		<20	<70	<50		20	<20	<20	<20	<20	<20	<20	
	Carbazole	µg/L					285		34	-		316	4600	68		4	17	<2	<2	326	<2	<2	
	Dibenzofuran	µg/L					78		25	-		113	10,200	344		3	9	<2	<2	100	<2	<2	
VOCs*	1,2,4-trimethylbenzene	µg/L	22000				559		201	-		39		920		36	9	<5	<5	153	<5	<5	<5
	1,3,5-trimethylbenzene	µg/L					<200		<200	-		14		210		<20	<5	<5	<5	59	<5	<5	<5
	Isopropylbenzene	µg/L					<200		<200	-		<5		30		<20	<5	<5	<5	<10	<5	<5	<5
	n-propylbenzene	µg/L					<200		<200	-		<5		44		<20	<5	<5	<5	<10	<5	<5	<5
	Styrene	µg/L	840000				<200		<200	-		8		167		<20	8	<5	<5	72	<5	<5	<5

Notes

mg/L - milligrams per litre
ug/L - micrograms per litre
EQL = Estimated Quantitation Limit
< denotes result less than EQL
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene and Indeno(1,2,3-c,d)pyrene)

TPH - Total Petroleum Hydrocarbons
PAH - Polycyclic Aromatic Hydrocarbons (PAH)

SVOCs - Semi-volatile organic compounds
VOCs - Volatile Organic Compounds
PCBs - Polychlorinated Biphenyls
OCPs - Organochlorine Pesticides
OPPs - Organophosphorus Pesticides

* Detected compounds shown only for phenols, OCPs, OPPs, SVOCs and VOCs (all other compounds less than laboratory

SSTC^{DEV} - Site Specific Target Criteria for the Block 4 Development Area

Remediation Technology	Technology Description	Feasibility					Sustainability					Comments	Total Score
		Technical	Financial	Logistical	Timing	Community	RU	WG	MR	CO2	OGM		
		30%	15%	10%	10%	10%	5%	5%	5%	5%	5%		
Ex Situ Stabilisation or Solidification (on or off site) - disposal to landfill	Encapsulation of contaminant by ex situ blending with chemical binders to immobilise and solidify contaminants of concern. Stabilised material disposed off-site to a licensed landfill.	5	3	3	4	3	4	3	3	3	5	Immobilises contaminants within the soil matrix. Has been used for treatment of source zone soils at a number of MGP sites in North America and Australia. Difficult to mix saturated fine grained material (such as marine sediment) but use of a pug mill and potential soil conditioning prior to mixing can mitigate this. Pre-treatment (eg. screening to remove oversize and moisture reduction to improve efficiency) would be reuqired in advance of treatment. Treated material assumed to require off-site disposal. Off-site disposal would likely require disposal to landfill - which depending on quantities may present difficulties with existing landfill licence conditions. An immobilisation approval from the EPA is required in the case of disposal to landfill. Excavation of soil can create significant odour issues thereby requiring negative pressure excavation enclosure and air emissions control. Excavation in Hickson Road will have significant logistical issues due to proximity to residences, and businesses and below ground services. Requires bench scale trials to design stabilisation regime.	3.85
Ex Situ Stabilisation or Solidification (on or off site) - reuse on-site	Encapsulation of contaminant by ex situ blending with chemical binders to immobilise and solidify contaminants of concern. Stabilised material reused on-site as part of the development.	3	4	2	4	3	4	5	5	3	4	Immobilises contaminants within the soil matrix. Has been used for treatment of source zone soils at a number of MGP sites in North America and Australia. Difficult to mix saturated fine grained material (such as marine sediment) but use of a pug mill and potential soil conditioning prior to mixing can mitigate this. Pre-treatment (eg. screening to remove oversize and moisture reduction to improve efficiency) would be reuqired in advance of treatment. Treated material assumed to be re-used on-site as part of the development. Based on proposed development plan it is unlikely that a significant volume of material can be reused due to the cut fill balance of the development. Excavation of soil can create significant odour issues thereby requiring negative pressure excavation enclosure and air emissions control. Excavation in Hickson Road will have significant logistical issues due to proximity to residences, and businesses and below ground services. Requires bench scale trials to design stabilisation regime - the standard of treatment required for retention of material on-site may be difficult to achieve.	3.45
Surfactant-enhanced Ex Situ Chemical Oxidation (S-ESCO) off-site disposal to landfill	Strong oxidants such as hydrogen peroxide or persulphate are applied to excavated materials along with a surfactant (typically using a pugmill) to degrade a wide range of organic contaminants. Remediated material disposed of to an off-site licensed landfill.	4	4	3	4	3	4	3	3	3	5	Efficacy dependent on soil oxidant demand and contaminant type. Use of pugmill improves effectiveness of technology. Has been applied at several former MGP sites in North America with good effectiveness. Surfactant enhancement overcomes some difficulties associated with tar contamination from former MGP sites. Difficult to mix saturated fine grained material (such as marine sediment) but use of a pug mill and potential soil conditioning prior to mixing can mitigate this. Pre-treatment (eg. screening to remove oversize and moisture reduction to improve efficiency) would be reuqired in advance of treatment. Treated material assumed to require off-site disposal. Off-site disposal would likely require disposal to landfill - which depending on quantities may present difficulties with existing landfill licence conditions. An immobilisation approval from the EPA may be required in the case of disposal to landfill (depending on the standard of treatment). Excavation of soil can create significant odour issues thereby requiring negative pressure excavation enclosure and air emissions control. Excavation in Hickson Road will have significant logistical issues due to proximity to residences and businesses and below ground services. Bench scale trials have been performed as part of the S-ISCO bench scale trial process.	3.70
Surfactant-enhanced Ex Situ Chemical Oxidation (S-ESCO) reuse on site	Strong oxidants such as hydrogen peroxide or persulphate are applied to excavated materials along with a surfactant (typically using a pugmill) to degrade a wide range of organic contaminants. Remediated material reused on-site as part of the development.	2	4	2	4	3	4	5	5	3	4	Efficacy dependent on soil oxidant demand and contaminant type. Use of pugmill improves effectiveness of technology. Has been applied at several former MGP sites in North America with good effectiveness. Surfactant enhancement can be used to overcome some difficulties associated with tar contamination from former MGP sites. Difficult to mix saturated fine grained material (such as marine sediment) but use of a pug mill and potential soil conditioning prior to mixing can mitigate this. Pre-treatment (eg. screening to remove oversize and moisture reduction to improve efficiency) would be reuqired in advance of treatment. Treated material assumed to be re-used on-site as part of the development. Based on proposed development plan it is unlikely that a significant volume of material can be reused due to the cut fill balance of the development. Excavation of soil can create significant odour issues thereby requiring negative pressure excavation enclosure and air emissions control. Excavation in Hickson Road will have significant logistical issues due to proximity to residences and businesses and below ground services. Bench scale trails have been performed as part of the S-ISCO bench scale trial process.	3.15
Surfactant Enhanced In Situ Chemical Oxidation (S-ISCO)	Strong oxidants such as hydrogen peroxide and persulphate are injected into the subsurface along with a surfactant (to emulsify contamination) to degrade a wide range of organic contaminants.	4	5	5	4	5	5	5	5	4	4	Efficacy dependent on soil oxidant demand and contaminant type. Technology generally used for treatment of discrete source zones and not generally applied over broad acreage. Limited previous application primarily in North America, but full scale and pilot scale implementations have included former MGP sites with good effectiveness. There may be challenges with injection of oxidants into very shallow unsaturated soil. Density of injection wells would be requried to be increased for treatment of fine grained materials (such as marine sediments). Surfactant enhancement is designed to overcome some difficulties associated with tar contamination from former MGP sites and sorbed or diffused contaminants. Bench scale trials have been completed. Proving Scale Pilot Trial is in progress. Proposed further Pilot Trials will also address concerns regarding potential impact to the harbour and other sensitive receptors and support the efficacy of the approach.	4.50
In Situ Chemical Oxidation (ISCO)	Strong oxidants such as hydrogen peroxide, permanganate and persulphate are injected into the subsurface to degrade a wide range of organic contaminants.	3	3	5	2	5	4	5	5	4	3	Efficacy dependent on soil oxidant demand and contaminant type. Technology generally used for treatment of discrete source zones and not generally applied over broad acreage. Has been applied at several former MGP sites in North America with good effectiveness. There may be issues with injection of oxidants into very shallow unsaturated soil. Density of injection wells would be requried to be increased for treatment of fine grained materials (such as marine sediments). Not effective for sorbed or diffused contaminants. Difficulties associated with tar contamination from former MGP sites. Requires bench scale and Pilot Scale trials to demonstrate efficacy - potentially unacceptable with respect to timing.	3.60
In Situ Stabilisation or Solidification (on site)	Encapsulation of contaminant by in situ blending with chemical binders to immobilise contaminants of concern.	4	3	3	2	4	4	5	5	3	4	Immobilises contaminants and neutralises soil. Stabilisation agents added using overlapping auger holes. Has been used for treatment of source zone soils at a number of MGP sites in North America. Recently successfully implemented on a MGP Site in Albury NSW. Effective in situ mixing is difficult in fine grained soils (for example marine sediments) and where large obstructions are present as would be expected in areas of significant fill. Limited in depth to a maximum of 12 m bgl. Significant spoil (approximately 30%) produced as a result of displacement by the auger mixing and addition of stabilsiation agents. Alternative management of the spoil is requried. Incompatible with the number of services with Hickson Road - would require relocation of services. Requires Bench Scale and Pilot Scale trials to demonstrate efficacy - potentially unacceptable with respect to timing.	3.60

Remediation Technology	Technology Description	Feasibility					Sustainability					Comments	Total Score
		Technical	Financial	Logistical	Timing	Community	RU	WG	MR	CO2	OGM		
		30%	15%	10%	10%	10%	5%	5%	5%	5%	5%		
Excavation and Ex Situ Thermal Desorption (likely off site with disposal to landfill)	Desorption and/or destruction of organic contaminants in excavated soil by heating, usually by direct heating thermal unit.	4	3	2	4	1	2	3	3	1	4	Demonstrated PAH and organic contaminant reduction and has been widely used for the remediation of MGP residues at many sites in both North America and Australia. Based on understanding of community requirements, treatment would need to be as an off site location - which would need to be appropriately licensed by the EPA. Unlikely therefore to be practical to return the treated material to site for reuse. Identification of a suitable off-site loation will be difficult. Pre-treatment (eg. screening to remove oversize and moisture reduction to improve efficiency) would be reuqired in advance of treatment. Logistically and timing likely to be preferable where volumes are large (>20,000 m^3) may be financially more viable. Air emissions control required. Excavation of soil can create significant odour issues thereby requiring negative pressure excavation enclosure. Excavation in Hickson Road will have significant logistical issues due to proximity to residences and business and below ground services. Public perception of thermal treatment and regulatory licensing requirements would make establishment of a thermal treatment plant difficult and time consuming.	3.00
Thermal Conductive Heating (TCH)	Soil heating via in-well heaters or thermal blankets in the case of very shallow soil to vaporise/volatilise fluids and contaminants. Temperatures can be raised to above 450^{o}C to remove 4 and 5 ring PAHs and other recalcitrant compounds.	4	1	2	3	4	2	5	5	1	2	Works well under wide range of soil types including clay. Removes contaminants under existing structures. Temperature increases will likely be incompatable with services within Hickson Road. Has been used for in situ remediation at former MGP sites including staged heating for removal of volatile components only. Requires closely spaced wells (<5 m) and has high electrical consumption.	3.00
Physical Containment	Containment or capping of contaminated soil to prevent or significantly reduce contaminant migration and to prevent human and environmental exposure.	2	3	3	3	4	4	5	4	4	1	Does not remove contamination sources and would require long term management and deed restriction. Will not satisfy regulatory requirements.	2.95
Excavation & Co-burning	Combustion of MGP residues with coal in utility boilers and cement kilns.	4	3	1	2	1	1	3	4	1	4	Technology has been used for remediation of several MGP sites in North America. Significantly lower cost than on-site thermal treatment. Requires the removal and transport to a large coal fired boiler. Coordination with co-burners can be problematic. Pre-treatment (eg. screening to remove oversize and moisture reduction to improve efficiency) would be reuqired in advance of treatment / disposal. Daily throughput can be very low, making storage and staging of excavated materials difficult to manage leading to increased costs. Handling and transportation of coal tar, including associated odour could be a logistical problem. Technology has never been used in Australia and may not be acceptable to community and regulators. Excavation of soil can create significant odour issues thereby requiring negative pressure excavation enclosure. Excavation in Hickson Road will have significant logistical issues due to proximity to residences and businesses and below ground services.	2.70
Excavation & Cold or Hot-Mix Asphalt Batching	Encapsulation of contaminant by blending residues, wet aggregate and asphalt emulsion at ambient or high temperatures.	2	4	3	3	1	2	3	4	2	4	Viable treatment technology for coal tars. Immobilises PAHs and reuses materials. Not suitable for fine-grained materials (e.g., clays or marine sediments) and would require addition of high grade aggregate. Physical properties of final product not always appropriate for reuse in trafficable roads. May be suitable for zones where extensive tar is present, but unlikely to be suitable for all contamination. Excavation of soil can create significant odour issues thereby requiring negative pressure excavation enclosure. Excavation in Hickson Road will have significant logistical issues due to proximity to residences and businesses and below ground services.	2.65
In Situ Steam Stripping	Injection of steam into subsurface contaminants to volatilise and mobilise contaminants.	1	1	3	3	3	2	2	2	2	2	Technology works best in sandy permeable soils and generally not suitable for very shallow unsaturated zone soils. Temperature is limited to 100 ^{o}C and therefore suitable for removal of volatile component only. Temperature increases will likely be incompatable with services within Hickson Road. Very high initial capital cost.	1.85
Monitored Natural Attenuation (MNA)	Natural subsurface processes—such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials—are allowed to reduce contaminant concentrations to acceptable levels.	1	5	3	1	5	4	5	1	4	1	Not effective as first approach in source areas. Very long time frame - inconsistent with declaration removal requirements Will not satisfy regulatory requirements. Retain for future option as part of post-remediation.	2.70
Soil Vapour Extraction System (SVE)	Soil vapour extraction (SVE) is an in situ unsaturated (vadose) zone soil remediation technology in which a vacuum is applied to the soil to induce the controlled flow of air and remove volatile and some semi volatile contaminants from the soil. The extracted vapour requires treatment to recover or destroy the contaminants.	2	3	3	2	4	4	4	3	3	2	Well established proven technology will remove volatile component and reduce risks to future users of site. Has additional benefit of removing contaminants from areas where excavation is not feasible (e.g. easements). Will also promote in situ biodegradation through increased oxygen in unsaturated zone. Will not remove the higher chain TPH fraction and may not be as effective in fine grained soils. Will not address tar and tar containing material. Long time frame - inconsistent with declaration removal requirements Technology may not be suitable for use over large source zone but may be used in conjunction with other technologies for targeted source removal.	2.75
In Situ Enhanced Bioremediation (ISEB)	Destruction of organic compounds in subsurface contaminated soil by microorganisms.	1	2	3	2	4	4	5	3	3	2	Timeframe for reduction of contaminants, in particular coal tar may be very long and inconsistent with Declaration removal requirements. Treatment uniformity uncertain because of subsurface variables. Verification of destruction is sometimes difficult. Not effective for higher molecular-weight hydrocarbons. Whilst technology has been highly successful for the treatment of hydrocarbons and lower molecular weight PAHs at many sites, it has not been demonstrated for treatment of MGP coal tar.	2.35
Ex Situ Bioremediation (Landfarming / Biopiles / Bioreactor) and disposal off-site to landfill	Destruction of organic compounds in contaminated soil by microorganisms. Treatment occurs through soil amendment and stockpiling or enclosed reactor vessel.	1	4	3	3	1	4	2	3	3	5	Shorter treatment period that in situ bioremediation alternative. However, not effective for higher molecular weight hydrocarbons and will be significantly slower than alternative treatment technologies. May be suitable for impacted soil but unlikely to be feasible for residual coal tar. Requires a large amount of space and VOC and odour emissions likely to be a significant constraint in urban setting. Excavation of soil can create significant odour issues thereby requiring negative pressure excavation enclosure. Excavation in Hickson Road will have significant logistical issues due to proximity to residences and business and below ground services.	2.45

Remediation Technology	Technology Description	Feasibility					Sustainability					Comments	Total Score
		Technical	Financial	Logistical	Timing	Community	RU	WG	MR	CO2	OGM		
		30%	15%	10%	10%	10%	5%	5%	5%	5%	5%		
Phytoremediation	Phytoremediation is a process that uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediment. Contaminants may be either organic or inorganic.	1	4	1	1	3	4	5	3	4	2	Technology requires long timeframe for removal of contaminants which renders site unusable for other purposes. Incompatible with proposed redevelopment. Has not been demonstrated for use at MGP sites.	2.30
Electrical Resistive Heating	Similar to TCH, however electrodes are used instead of heater wells. Temperature cannot exceed 100 ^{o}C since process requires transmission of heat via pore water	3	1	3	3	3	2	5	4	1	2	Technology is suitable for most soil types and in particular low permeability clays. Technology can not exceed temperatures of 100^{o}C and is suitable for removal of volatile compounds only. Technology requires moisture in the soil for conduction of heat between electrodes and may not be suitable for unsaturated zone soils. Temperature increases will likely be incompatable with services within Hickson Road. Requires closely spaced electrodes (<5 m) and has high electrical consumption.	2.65
Soil Washing and disposal to landfill	Physical/chemical process for scrubbing soils ex situ to remove contaminants.	1	3	3	3	2	4	2	3	3	5	High degree of uncertainty regarding treatment performance. Material handling possibly expensive. Effectiveness limited by complex waste mixtures and high humic content. Generally not suitable for fine grained soil (for example marine sediment). Excavation of soil can create significant odour issues thereby requiring negative pressure excavation enclosure. Excavation in Hickson Road will have significant logistical issues due to proximity to residences and business and below ground services.	2.40
In Situ Vitrification (ISV)	In situ vitrification (ISV) is another in situ S/S process which uses an electric current to melt soil or other earthen materials at extremely high temperatures (1,600 to 2,000 °C) and thereby immobilise most inorganics and destroy organic pollutants by pyrolysis.	2	1	1	2	1	1	4	3	1	2	Method designed for sandy soils. Prohibitively expensive.	1.70
Permeable Reactive Barrier (PRB)	A permeable reaction wall is installed across the flow path of a contaminant plume, allowing the water portion of the plume to passively move through the wall. The contaminants will either be degraded or retained in a concentrated form by the barrier material.	1	3	3	4	3	4	4	4	3	1	Technology not suitable for unsaturated zone soils.	2.55
Supercritical water oxidation	Supercritical Water Oxidation (SCWO) is a high-efficiency, thermal oxidation process capable of treating a wide variety of hazardous and non-hazardous wastes.	1	1	1	1	2	2	2	2	2	2	Technology is not suitable for treatment of soils. Typically used to treat small quantities of hazardous liquid waste/slurries in commercial reactors.	1.35
Electrokinetics	Electrokinetic remediation uses electrochemical and electrokinetic processes to desorb, and then remove, metals and polar organics	1	1	1	1	2	1	2	2	2	2	Not applicable for the contaminants of concern.	1.30

RU **Resource Use**
WG **Waste Generation**
MR **Material Reusability**
CO2 **CO2 Generation**
OGM **Ongoing Management and Risk**

Ranking 5 - highest (most preferred)
1 - lowest (least preferred)

Appendix B

Figures

Appendix B Figures

Figure F1 Site Location

Figure F2 Site Layout and Surrounding Area

Figure F3: Proposed future land use – Block 4

Figure F4: Proposed basement – Block 4

Figure F5: Site Plan and Sampling Locations

Figure F6: Locations of Separated Phase Gasworks Related Wastes and Tar (SPGWT)

Figure F7: VMP Remediation Works – unsaturated soil SSTC exceedances

Figure F8: VMP Remediation Works – groundwater SSTC exceedances

Figure F9: Block 4 Development Remediation Works – groundwater SSTC exceedances

Figure F10: VMP Remediation Works - Extent of Remediation (Unsaturated)

Figure F11: VMP Remediation Works - Extent of Remediation (Saturated)

Figure F12: Block 4 Development Remediation Works - Extent of Remediation (Saturated)

Figure F13: Site Services Plan (Rygate survey plan)

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AECOM

BARANGAROO SITE LOCATION

VMP/Block 4 Remedial Action Plan

FIGURE F1

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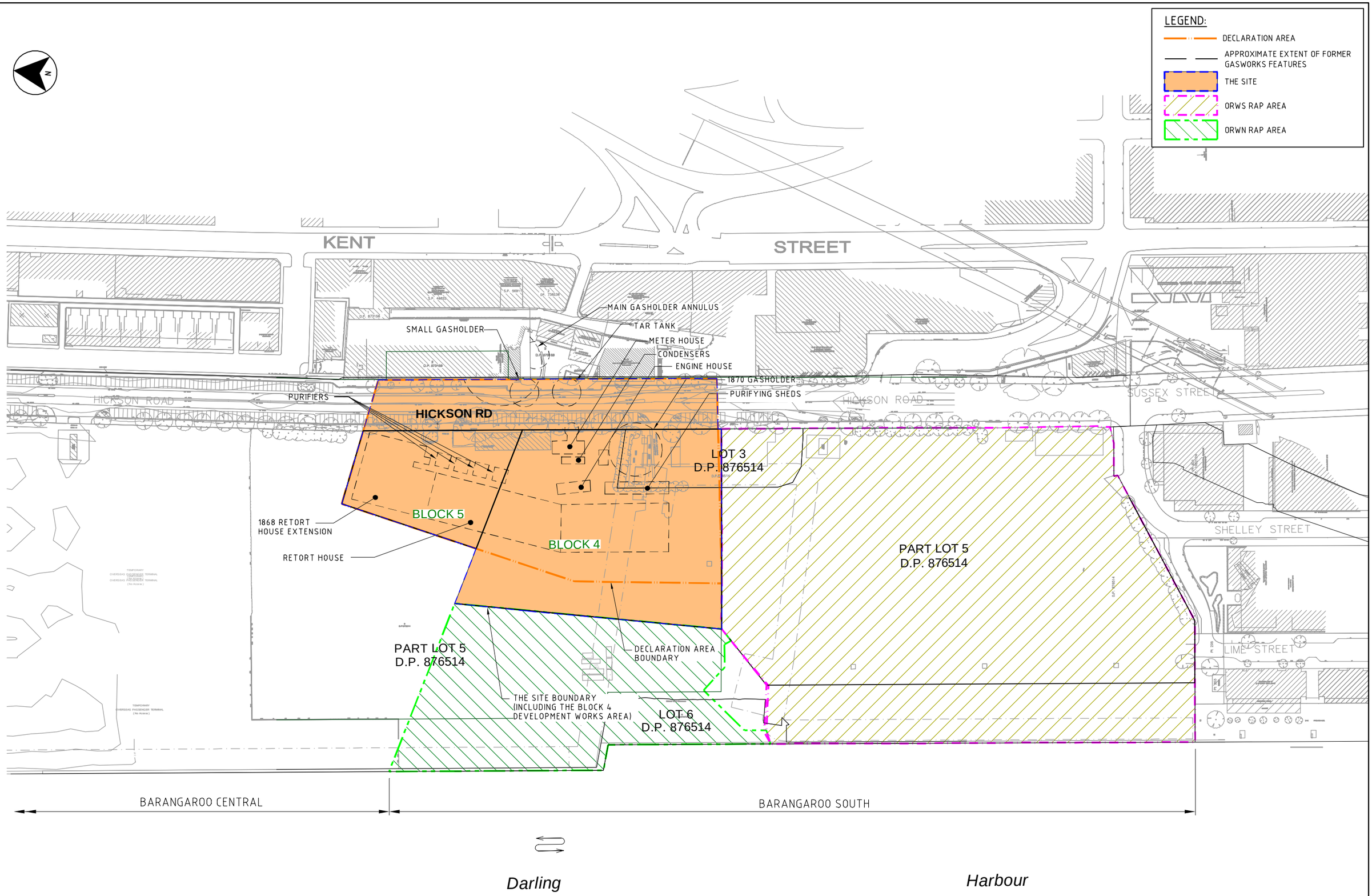

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03	PAS	20.06.13	DRAFT ISSUE	
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

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20 AR 0 20 40 60 80m

1 : 2000 FULL SIZE A3

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APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER:

AECOM

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CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F2:
SITE LAYOUT AND SURROUNDING AREA

STATUS: FINAL DRAFT

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REV: 04

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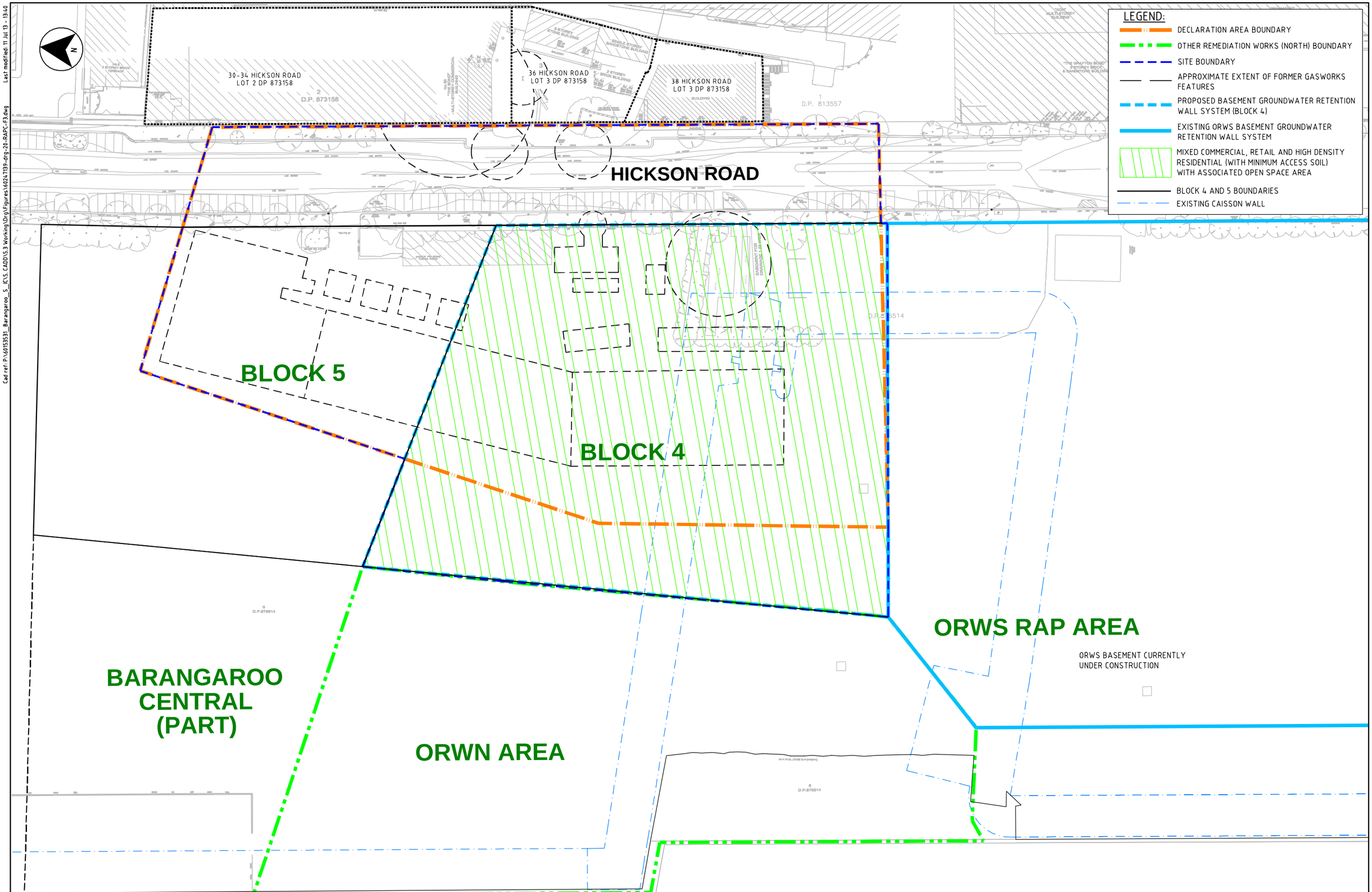

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No.	BY	DATE	DESCRIPTION	APPD

SCALES:

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FIGURE F3:
PROPOSED FUTURE LAND USE - BLOCK 4

STATUS: FINAL DRAFT

DRAWING NO: 60247139-DRG-20-RAPC-F3

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30-34 HICKSON ROAD
LOT 2 DP 873158

36 HICKSON ROAD
LOT 3 DP 873158

38 HICKSON ROAD
LOT 3 DP 873158

JENKINS STREET

HICKSON ROAD

A

A'

BLOCK 5

BLOCK 4

BARANGAROO CENTRAL (PART)

ORWN AREA

ORWS RAP AREA

ORWS BASEMENT CURRENTLY UNDER CONSTRUCTION

LEGEND:

- DECLARATION AREA BOUNDARY
- OTHER REMEDIATION WORKS (NORTH) BOUNDARY
- THE SITE BOUNDARY
- APPROXIMATE EXTENT OF FORMER GASWORKS FEATURES
- PROPOSED BASEMENT GROUNDWATER RETENTION WALL SYSTEM (BLOCK 4)
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- BLOCK 4 BASEMENT EXCAVATION TO APPROX. RL -10.5m AHD FINAL BASEMENT DEPTH IS SUBJECT TO DESIGN FINALISATION
- BLOCK 4 AND 5 BOUNDARIES
- EXISTING CAISSON WALL

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01	TT	12.09.12	DRAFT ISSUED	DM

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CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F4:
PROPOSED BASEMENT - BLOCK 4

STATUS: FINAL DRAFT

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REV: 04

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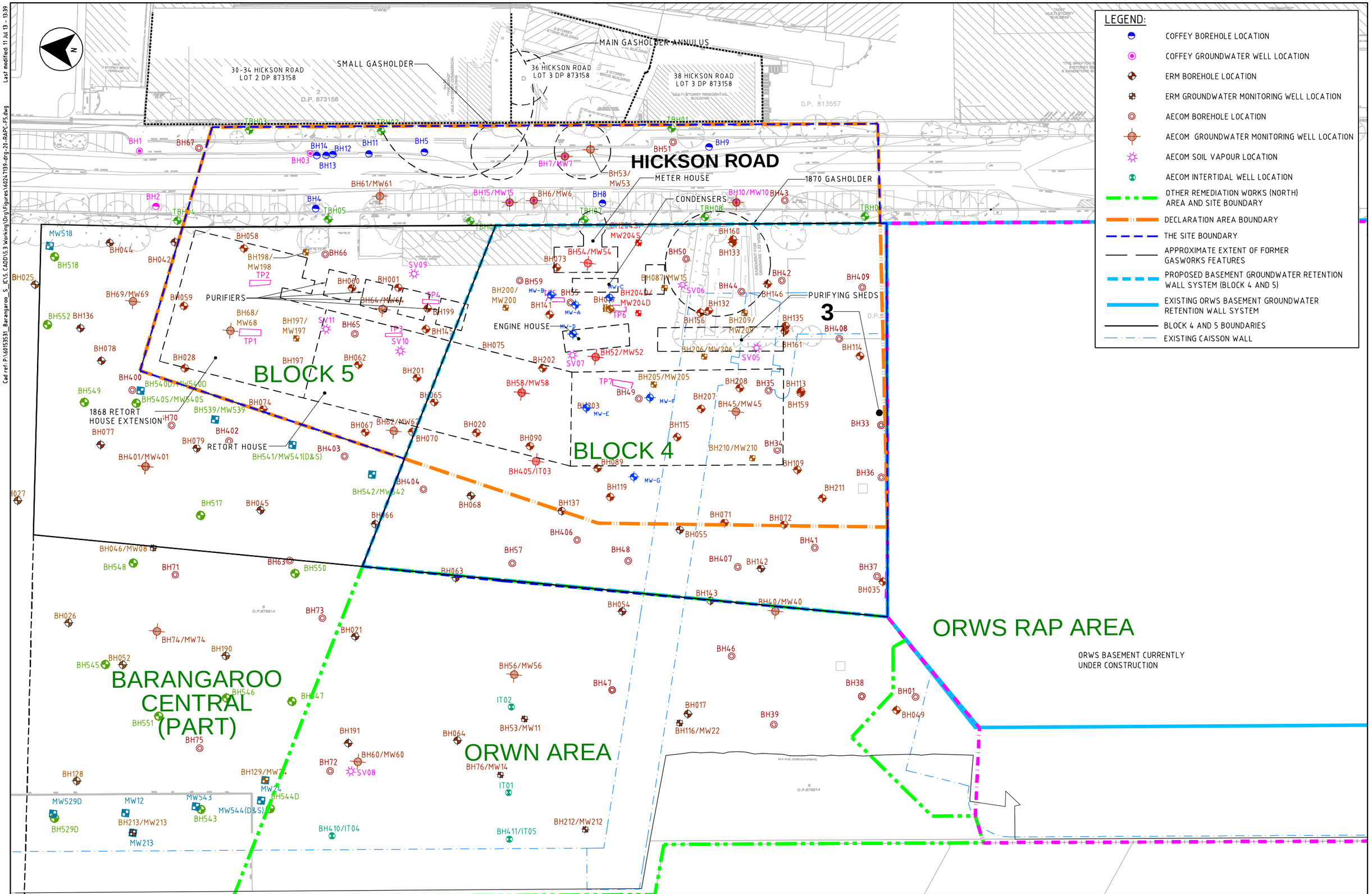

LEGEND:

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- OTHER REMEDIATION WORKS (NORTH) AREA AND SITE BOUNDARY
- DECLARATION AREA BOUNDARY
- THE SITE BOUNDARY
- APPROXIMATE EXTENT OF FORMER GASWORKS FEATURES
- PROPOSED BASEMENT GROUNDWATER RETENTION WALL SYSTEM (BLOCK 4 AND 5)
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- BLOCK 4 AND 5 BOUNDARIES
- EXISTING CAISSON WALL

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03	PAS	20.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

SCALES: 5 0 5 10 15m — 1:1000 A3

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CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F5:
SITE PLAN AND SAMPLING LOCATION

STATUS: FINAL DRAFT

DRAWING NO: 60247139-DRG-20-RAPC-F5

REV: 04

Last modified: 11 Jul 13 - 13:39

Cad ref: P:\60153531_Barangaroo_S_ICS_CADD\5.3 Working\Drg\Figures\60247139-drg-20-RAPC-F6.dwg

30-34 HICKSON ROAD
LOT 2 DP 873158

36 HICKSON ROAD
LOT 3 DP 873158

38 HICKSON ROAD
LOT 3 DP 873158

HICKSON ROAD

BLOCK 5

BLOCK 4

BARANGAROO CENTRAL (PART)

ORWN AREA

ORWS RAP AREA

ORWS BASEMENT CURRENTLY UNDER CONSTRUCTION

LEGEND

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- AECOM STILLING WELL LOCATION
- JBS BOREHOLE LOCATION - 2012
- JBS GROUNDWATER MONITORING WELL LOCATION - 2012
- DECLARATION AREA BOUNDARY
- OTHER REMEDIATION WORKS (NORTH) BOUNDARY
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- PROPOSED BASEMENT GROUNDWATER RETENTION WALL SYSTEM (BLOCK 4 AND 5)
- BLOCK 4 AND 5 BOUNDARIES
- EXISTING CAISSON WALL

BLOCK 4 PROPOSED DEVELOPMENT BLOCK AREA

1.0 - 2.0 DEPTH OF IMPACT

- PRESENCE OF DNAPL NOTED
- PRESENCE OF TCM NOTED IN FILL MATERIAL
- PRESENCE OF SHEEN NOTED
- PRESENCE OF TCM NOTED IN MARINE SEDIMENTS

NOTE:
LOCATION OF COFFEY GROUNDWATER WELLS ARE APPROXIMATE ONLY.

This drawing is confidential and shall only be used for the purposes of this project.

REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
04	PAS	11.07.13	FINAL DRAFT ISSUE	AR
03	PAS	20.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

SCALES: 5 0 5 10 15m — 1:1000 A3

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DESIGNED	KM	CHECKED	AR
DRAWN	TT	CHECKED	JA
APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER: AECOM

AECOM Australia Pty Ltd A.B.N. 20 093 846 925

CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F6:
LOCATIONS OF SEPARATED PHASE GASWORKS WASTE AND TAR (SPGWT)

STATUS: FINAL DRAFT

DRAWING NO: 60247139-DRG-20-RAPC-F6

REV: 04

Last modified: 11 Jul 13 - 13:38

Cad ref: P:\60153531_Barangaroo_S_ICS_CADD\S3 Working\Dgn\Figures\60247139-drg-20-RAPC-F7.dwg

HICKSON ROAD

BLOCK 5

BLOCK 4

BARANGAROO CENTRAL (PART)

ORWN AREA

ORWS RAP AREA

ORWS BASEMENT CURRENTLY UNDER CONSTRUCTION

BH001_1	1/05/2006
CPAH (TEF)	67.0

BH64_1-1.2	1/03/2010
CPAH (TEF)	108.0

BH200_1	7/04/2008
CPAH (TEF)	166.0

BH073_1.5-1.95	2/05/2006
CPAH (TEF)	140.1

BH54_1-1.4	23/02/2010
CPAH (TEF)	842.6

BH204S_1	18/03/2008
CPAH (TEF)	119.4

BH087_1.5-1.95	8/06/2006
CPAH (TEF)	114.5

BH55_1-1.2	25/02/2010
CPAH (TEF)	372.1

BH145_0.3-0.5	1/05/2006
CPAH (TEF)	110.0

BH204D_1.5	7/04/2008
TPH C10-C14	54200.0
TPH C15-C28	72400.0
CPAH (TEF)	921.6

LEGEND

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- AECOM STILLING WELL LOCATION
- DECLARATION AREA BOUNDARY
- OTHER REMEDIATION WORKS (NORTH) BOUNDARY
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- BLOCK 4 AND 5 BOUNDARIES
- EXISTING CAISSON WALL

NOTE:
LOCATION OF COFFEY GROUNDWATER WELLS ARE APPROXIMATE ONLY.

TPH C10-C14 EXCEEDS SITE SPECIFIC CRITERIA
TPH C15-C28 EXCEEDS SITE SPECIFIC CRITERIA
CPAHs EXCEEDS SITE SPECIFIC CRITERIA

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REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
04	PAS	11.07.13	FINAL DRAFT ISSUE	AR
03	PAS	20.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

SCALES:
10 0 10 20 30 40m
1 : 1000 FULL SIZE A3

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DRAWN	TT	CHECKED	JA
APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER:
AECOM
AECOM Australia Pty Ltd A.B.N. 20 093 846 925

CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F7:
VMP REMEDIATION WORKS -
UNSATURATED SOILS SSTC^{VMP} EXCEEDANCES

STATUS: FINAL DRAFT
DRAWING NO: 60247139-DRG-20-RAPC-F7
REV: 04

Last modified: 11 Jul 13 - 13:37

Cad ref: P:\60153531_Barangaroo_S_ICIS_CADD\5.3 Working\Drg\Figures\60247139-drg-20-RAPC-F8.dwg

30-34 HICKSON ROAD
LOT 2 DP 873158

36 HICKSON ROAD
LOT 3 DP 873158

38 HICKSON ROAD
LOT 3 DP 873158

HICKSON ROAD

BLOCK 5

BLOCK 4

ORWS RAP AREA

ORWS BASEMENT CURRENTLY UNDER CONSTRUCTION

BARANGAROO CENTRAL (PART)

ORWN AREA

MW7/BH7	26/03/2008
TPH C10-C14	830000
Benzene	25200
Ammonia as N	294
Naphthalene	4800

MW15/BH15	1/05/2008
TPH C10-C14	494000
TPH C15-C28	754000
Naphthalene	192000
Benzene	40200
CPAH (TEF)	11162

MW10/BH10	26/03/2008
CPAH (TEF)	1054.69
TPH C10-C14	528000
Benzene	5450
Ammonia as N	348
Naphthalene	15800

MW204S/BH204S	25/02/2011
Naphthalene	8580

MW15/BH087A	15/03/2010
TPH C10-C14	41000
Benzene	13100
Naphthalene	7800

MW54/BH54	19/03/2012
TPH C10-C14	28000
Naphthalene	8640

MW69/BH69	19/03/2010
Naphthalene	1920

MW206/BH206	19/03/2010
TPH C10-C14	68000
Benzene	5450
Naphthalene	10600

MW200/BH200	28/02/2011
TPH C10-C14	47400
Benzene	17900
Naphthalene	5450

IT03D/BH405	25/02/2011
Naphthalene	2560

MW205/BH205	17/03/2010
CPAH (TEF)	11556
Naphthalene	283000
TPH C10-C14	1730000
TPH C15-C28	1520000
TPH C29-C36	332000

MW541D	25/05/2012
Benzene	4300
Naphthalene	1900

MW60/BH60	18/03/2010
TPH C10-C14	18500
Naphthalene	1500

LEGEND

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- AECOM STILLING WELL LOCATION
- JBS BOREHOLE LOCATION - 2012
- JBS GROUNDWATER MONITORING WELL LOCATION - 2012
- DECLARATION AREA BOUNDARY
- OTHER REMEDIATION WORKS (NORTH) BOUNDARY
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- BLOCK 4 AND 5 BOUNDARIES
- EXISTING CAISSON WALL

BLOCK 4 PROPOSED DEVELOPMENT BLOCK AREA

NOTE:
LOCATION OF COFFEY GROUNDWATER WELLS ARE APPROXIMATE ONLY.

BENZENE EXCEEDS SITE SPECIFIC CRITERIA
NAPHTHALENE EXCEEDS SITE SPECIFIC CRITERIA
AMMONIA AS N EXCEEDS SITE SPECIFIC CRITERIA
TPH C_{10}-C_{14} EXCEEDS SITE SPECIFIC CRITERIA
TPH C_{29}-C_{36} EXCEEDS SITE SPECIFIC CRITERIA
TPH C_{15}-C_{28} EXCEEDS SITE SPECIFIC CRITERIA
CPAHs EXCEEDS SITE SPECIFIC CRITERIA

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REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
04	PAS	11.07.13	FINAL DRAFT ISSUE	AR
03	PAS	20.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

SCALES:
5 0 5 10 15m
1:1000 A3

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APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER:
AECOM
AECOM Australia Pty Ltd A.B.N. 20 093 846 925

CLIENT:

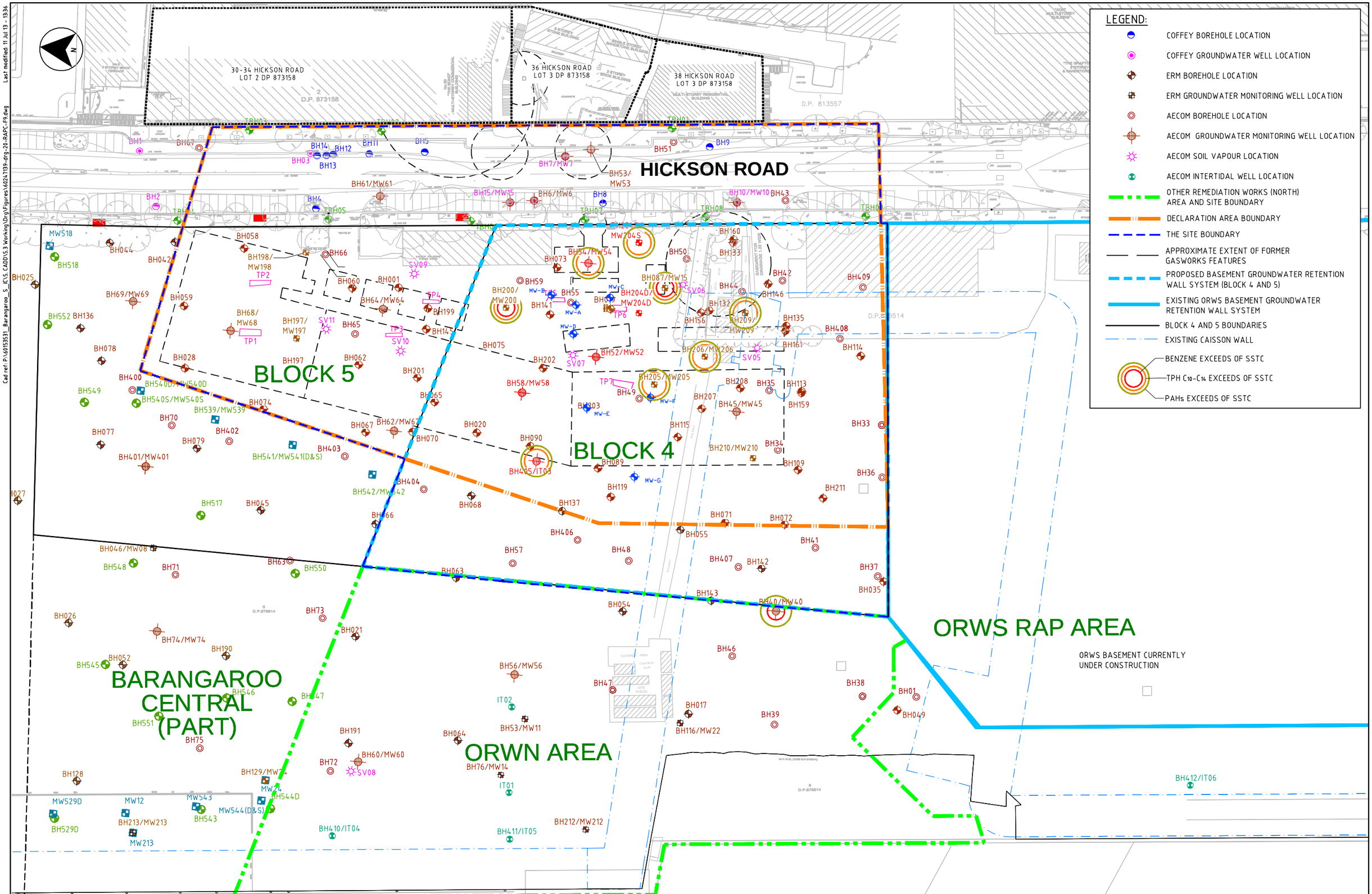
VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F8:
VMP REMEDIATION WORKS -
GROUNDWATER SSTC VMP EXCEEDANCES

STATUS: FINAL DRAFT
DRAWING NO: 60247139-DRG-20-RAPC-F8
REV: 04

Last modified: 11 Jul 13 - 13:36

Cad ref: P:\60153531_Barangaroo_S_ICS_CADD\5.3 Working\Drg\Figures\60247139-drg-20-RAPC_F9.dwg



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REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
04	PAS	11.07.13	FINAL DRAFT ISSUE	AR
03	PAS	20.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

SCALES:

5000 0 5000 10000 15000mm

1 : 500 FULL SIZE A1

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DRAWN	TT	CHECKED	JA
APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER:

AECOM

AECOM Australia Pty Ltd A.B.N. 20 093 846 925

CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F9:
BLOCK 4 DEVELOPMENT REMEDIATION WORKS
GROUNDWATER SSTC DEV EXCEEDANCES

STATUS: FINAL DRAFT

DRAWING NO: 60247139-DRG-20-RAPC-F9

REV: 04

Last modified: 11 Jul 13 - 13:42

Cad ref: P:\60\153531_Barangaroo_S_(CS_CADD\S3 Working\Drg\Figures\60247139-drg-28-RAPC-F10.dwg

30-34 HICKSON ROAD
LOT 2 DP 873158

36 HICKSON ROAD
LOT 3 DP 873158

38 HICKSON ROAD
LOT 3 DP 873158

SEWERAGE PUMPING STATION SP1129 (TO BE RETAINED)

HICKSON ROAD

BLOCK 5

BLOCK 4

BARANGAROO CENTRAL (PART)

ORWN AREA

ORWS RAP AREA

ORWS BASEMENT CURRENTLY UNDER CONSTRUCTION

LEGEND

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- AECOM STILLING WELL LOCATION
- DECLARATION AREA BOUNDARY
- THE SITE BOUNDARY
- OTHER REMEDIATION WORKS (NORTH) BOUNDARY
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- BLOCK 4 AND 5 BOUNDARIES
- EXISTING CAISSON WALL
- BLOCK 4 PROPOSED DEVELOPMENT BLOCK AREA
- ESTIMATED REMEDIATION DEPTH (0-2m bgl)

NOTE:
LOCATION OF COFFEY GROUNDWATER WELLS ARE APPROXIMATE ONLY.

This drawing is confidential and shall only be used for the purposes of this project.

REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
04	PAS	11.07.13	FINAL DRAFT ISSUE	AR
03	PAS	20.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

SCALES:
5 0 5 10 15m
1:1000 A3

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DRAWN	TT	CHECKED	JA
APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER:
AECOM
AECOM Australia Pty Ltd A.B.N. 20 093 846 925

CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F10:
VMP EXTENT OF REMEDIATION (UNSATURATED)

STATUS: FINAL DRAFT

DRAWING NO: 60247139-DRG-20-RAPC-F10

REV: 04

Last modified: 11 Jul 13 - 13:41

Cad ref: P:\60153531_Barangaroo_S_JCIS_CAD\S3.3 Working\Drg\Figures\60247139-drg-20-RAPC-F11.dwg

AA A B C D E F G H I J K L M N

1 2 3 4 5 6 7 8 9 10 11 12

SEWERAGE PUMPING STATION SP1129 (TO BE RETAINED)

REMEDIATION TO APPROXIMATE 5.5m BGL

REMEDIATION TO GREATER DEPTH WITHIN FORMER TAR TANK AND ANNULUS STRUCTURES

HICKSON ROAD

JENKINS STREET

BLOCK 5

BLOCK 4

BARANGAROO CENTRAL (PART)

ORWN AREA

ORWS RAP AREA

ORWS BASEMENT CURRENTLY UNDER CONSTRUCTION

REFER TO NOTE 1

LEGEND

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- AECOM STILLING WELL LOCATION
- AECOM SUPPLEMENTARY VMP DGI BOREHOLE LOCATION
- JBS BOREHOLE LOCATION - 2012
- JBS GROUNDWATER MONITORING WELL LOCATION - 2012
- DECLARATION AREA BOUNDARY
- THE SITE BOUNDARY
- OTHER REMEDIATION WORKS (NORTH) BOUNDARY
- EXISTING CAISSON WALL
- APPROXIMATE EXTENT OF FORMER GASWORKS FEATURES
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- BLOCK 4 AND 5 BOUNDARIES

BLOCK 4 PROPOSED DEVELOPMENT BLOCK AREA

ESTIMATED REMEDIATION DEPTH:

- 2.0-3.0m BGL
- 3.0-5.0m BGL
- 5.0-10.0m BGL

- MARINE SEDIMENT CONTOURS mAHD
- BEDROCK CONTOURS mAHD

NOTES:

1. REMEDIATION UNDERTAKEN AS PART OF THE ORWS DEVELOPMENT WORKS.
2. THE ESTIMATED REMEDIATION DEPTHS ARE INDICATIVE. REMEDIATION WILL BE UNDERTAKEN TO THE DEPTH OF THE UNDERLYING BEDROCK TO A MAXIMUM DEPTH OF 10m BGL, SUBJECT TO THE REQUIREMENTS OF THE RAP.

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REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
05	PAS	11.07.13	FINAL DRAFT ISSUE	AR
04	PAS	20.06.13	DRAFT ISSUE	AR
03	PAS	12.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

SCALES: 5 0 5 10 15m — 1:1000 A3

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APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER: AECOM

AECOM Australia Pty Ltd A.B.N. 20 093 846 925

CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F11:
VMP EXTENT OF REMEDIATION (SATURATED)

STATUS: FINAL DRAFT

DRAWING NO: 60247139-DRG-20-RAPC-F11

REV: 05

Last modified: 11 Jul 13 - 13:41

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HICKSON ROAD

SEWERAGE PUMPING STATION SP1129 (TO BE RETAINED)

BLOCK 5

BLOCK 4

BARANGAROO CENTRAL (PART)

ORWN AREA

ORWS RAP AREA

ORWS BASEMENT CURRENTLY UNDER CONSTRUCTION

HYDROCARBON ODOUR AND BLACK STAINING FROM AT 7.5 - 8.5m BGL

MODERATE TAR ODOUR FROM 4.2 - 9.4m BGL

HYDROCARBON ODOUR AND SHEEN FROM 7.0 - 8.0m BGL

MODERATE HYDROCARBON ODOUR AT 3.0m BGL

LEGEND:

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- OTHER REMEDIATION WORKS (NORTH) AREA AND SITE BOUNDARY
- DECLARATION AREA BOUNDARY
- THE SITE BOUNDARY
- APPROXIMATE EXTENT OF FORMER GASWORKS FEATURES
- ESTIMATED EXTENT OF REMEDIATION
- PROPOSED BASEMENT GROUNDWATER RETENTION WALL SYSTEM (BLOCK 4)
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- EXISTING CAISSON WALL
- BLOCK 4 AND 5 BOUNDARIES

ESTIMATED REMEDIATION DEPTH

- 0.0-3.0m BGL
- 3.0-5.0m BGL
- 5.0-10.0m BGL
- MATERIAL TO BE EXCAVATED FOR BASEMENT, WHICH MAY REQUIRE MANAGEMENT PER THIS RAP
- BEDROCK CONTOURS mAHD
- ODOROUS MATERIAL OBSERVED IN BOREHOLE WITHIN PROPOSED BASEMENT EXCAVATION DEPTH (APPROX. 8m BGL)

NOTES:

1. IT HAS BEEN ASSUMED, FOR THE PURPOSES OF ASSESSING THE EXTENT OF REMEDIATION, THAT THE BASEMENT WILL BE CONSTRUCTED TO A DEPTH BELOW THE GROUNDWATER TABLE. THAT IS, THE EXTENT OF REMEDIATION IS BASED ON CONSIDERATION OF RISK BASED CRITERIA FOR GROUNDWATER.
2. THE ESTIMATED REMEDIATION DEPTHS ARE INDICATIVE. REMEDIATION WILL BE UNDERTAKEN TO THE DEPTH OF THE UNDERLYING BEDROCK TO A MAXIMUM DEPTH OF 10m BGL, SUBJECT TO THE REQUIREMENTS OF THE RAP.

This drawing is confidential and shall only be used for the purposes of this project.

REVISIONS					
No.	BY	DATE	DESCRIPTION	APPD
04	PAS	11.07.13	FINAL DRAFT ISSUE	AR
03	PAS	20.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

SCALES: 5 0 5 10 15m — 1:1000 A3

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DESIGNED	KM	CHECKED	AR
DRAWN	TT	CHECKED	JA
APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER: AECOM

AECOM Australia Pty Ltd A.B.N. 20 093 846 925

CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F12:
BLOCK 4 DEVELOPMENT EXTENT OF REMEDIATION (SATURATED)

STATUS: FINAL DRAFT

DRAWING NO: 60247139-DRG-20-RAPC-F12

REV: 04

M.G.A. NORTH

KENT STREET

DECCW
Declaration Area
N21122

5 4 3 2 1

TEMPORARY
OVERSEAS PASSENGER TERMINAL
(No Access)

TEMPORARY
OVERSEAS PASSENGER TERMINAL
(No Access)

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REV.	DATE	AMENDMENTS

0 100
REDUCTION RATIO 1: 1000 @ A1

THIS TITLE BLOCK AND NOTES FORM AN INTEGRAL PART OF THE PLAN AND MUST BE REPRODUCED IN ANY USE, DUPLICATION OR AMENDMENT.

DATUM : AUSTRALIAN HEIGHT DATUM
CONTOUR INTERVAL : N/A
ORIGIN OF LEVELS : S.S.M. 46693
R.L. 2.454 A.H.D.

RYGATE & COMPANY PTY. LIMITED
REGISTERED LAND SURVEYORS
81 YORK STREET, SYDNEY 2000
MEMBER OF ASSOCIATION OF CONSULTING SURVEYORS
PHONE 9262 6800
FAX 9262 6843
ABN 61 001 204897
www.rygate.com.au
Email: surveyors@rygate.com.au

SURVEYOR	DRAWN	CHECKED	APPROVED
SG	GD		

CLIENT
LEND LEASE (Millers Point) PTY. LTD.

LOCALITY
BARANGAROO

L.G.A.
CITY OF SYDNEY

PLAN
SHOWING DETAIL, LEVELS & SERVICES
LOTS 3 & 5 DP 876514
AND ALONG HICKSON ROAD

REFERENCE No.	PLAN No.	DATE	SHEET No. 1
74479	74479-1	18/10/2010	OF 1 SHEETS

Appendix C

Declaration Site HHERA Letter (AECOM, 2012d)

AECOM Australia Pty Ltd
Level 21, 420 George Street
Sydney NSW 2000
PO Box Q410
QVB Post Office NSW 1230
Australia
www.aecom.com

+61 2 8934 0000 tel
+61 2 8934 0001 fax
ABN 20 093 846 925

3 July 2012

Mark Burns
Environment Manager
Lend Lease (Millers Point) Pty Ltd
Level 4, 30 Hickson Road

Millers Point, NSW, 2000

Dear Mark

Human Health and Ecological Risk Assessment - Declaration Site, Barangaroo. Assessment of the Implications of the Revised Basement Design.

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) previously prepared the *Human Health and Ecological Risk Assessment, Declaration Site (Development Works) Remediation Works Area - Barangaroo* (June 2011) (*HHERA Declaration Site*) (AECOM, 2011a). The objective of the *HHERA Declaration Site* (AECOM, 2011a) was to develop human health based site-specific target criteria (SSTC) and site-specific ecological screening criteria (SSESC) that would be applicable during the remediation and validation works associated with the redevelopment of the Declaration Site Area. The SSTC and SSESC were developed to be protective of the identified receptors associated with the proposed future land use.

The *HHERA Declaration Site* (AECOM, 2011a) utilised conceptual development plans available at the time the document was produced. In particular, the *HHERA Declaration Site* (AECOM, 2011a) identified that two basement areas (an upper and lower basement) would potentially be constructed at the Declaration Site. The development of the human health SSTC presented within the *HHERA Declaration Site* (AECOM, 2011a) made use of proposed design considerations associated with the lower and upper basement (Scenario 1 and Scenario 2 respectively). Design considerations adopted included:

- the smallest area within the proposed basement that would be accessible to the public was proposed to have dimensions of 25 meters by 25 meters;
- the basement ventilation rate would be maintained at an average air exchange rate of 4 per hour; and
- the lower basement would be used for car parking only (with no attendant or loading dock).

The *HHERA Declaration Site* (AECOM, 2011a) was accepted by the NSW EPA accredited Site Auditor as part of his Site Audit Report (SAR, ENVIRON Australia Pty Limited, 14 July 2011). The NSW EPA (then NSW OEH) granted approval of the *HHERA Declaration Site* (AECOM, 2011a) on the 11 July 2011 (Document reference: MP10_0023-MOD CBMK; Ref DOC11/30983). As a condition of the EPA approval, it was noted that if the basis of design, construction and operational parameters detailed in the *HHERA Declaration Site* (2011a) were not met, then the HHERA would require revision.

Subsequent to completion of the *HHERA Declaration Site* (AECOM, 2011a), the proposed design and use of the lower and upper basements has been revised. This design development has included optimising the layout and proposed uses of the basement, and consideration of likely ventilation rates required to optimise building energy use. Based on this, the following design modifications are proposed in relation to the HHERA assumptions:

a) Amending the proposed basement ventilation rates to be more consistent with strict environmental requirements for future building ratings (e.g. Greenstar / NABERS)

b) Amending the size (area and height) of the smallest area within the proposed basement that would be accessible to the public based on the revised basement layout.

c) Amending the usage of the lower basement level to include a loading dock utilised by full time workers.

This letter presents an assessment of changes to the SSTCs that will result from the proposed design modifications, and provides a comparison of the revised SSTCs with the previously approved SSTCs presented within the *HHERA Declaration Site* (AECOM, 2011a).

As detailed in the *HHERA Declaration Site* (AECOM, 2011a), the proposed design for the Declaration Site includes encapsulation of the entire Site (excepting Hickson Road), by a basement groundwater retention wall

system that will extend to and be keyed into bedrock. The development of SSESCs for the areas of Site within the retention wall system is therefore not required for ecological protection. Furthermore, the basement groundwater retention wall system will effectively cut off direct groundwater migration from Hickson Road to Darling Harbour, requiring groundwater from Hickson Road to migrate to the north or south around the perimeter of the Stage 1 Development. Therefore, in consideration of the distance between Hickson Road and Darling Harbour, the development of SSESCs for Hickson Road is not considered to be required for ecological protection.

2.0 Objective

The objective of this letter is to demonstrate whether the revised basement design and ventilation rates and inclusion of loading dock workers within the lower basement level within the *Declaration Site* basement will result in SSTCs which are equivalent to, greater (i.e. less conservative) or less (i.e. more conservative) than those presented within the *HHERA Declaration Site* (AECOM, 2011a).

3.0 Scope of Work

The following scope of works was undertaken.

1) Re modelling of the relevant soil and groundwater SSTCs (Scenario 1 and 2 which are representative of the proposed lower and upper basement) to reflect:

   - The revised layout for the lower and upper basement areas (both area and height).
   - A reduction in the average air exchange rate associated with ventilation of the lower and upper basement areas.

   Information pertaining to the proposed basement dimensions and the corresponding air exchange rates were provided to AECOM during meetings with Lend Lease. Additionally information provided by Lend Lease (Fitzpatrick, 2012), which reflects minimum average ventilation rates within proposed basement areas within the ORWS have been considered as being representative of the ventilation rates that will be provided within the basement constructed in the Declaration Area. This information is presented in **Enclosure A** of this letter report.

2) Re-modelling of groundwater (Scenario 1 which is representative of the lower basement levels) SSTCs to reflect use of the lower basement level as a loading dock with a full time worker.

3) Comparison of the revised SSTCs for soil and groundwater (based on revised layout, ventilation rate and worker exposures) with those presented within the *HHERA Declaration Site* (AECOM, 2011a) to assess whether the re-modelled SSTC are less (i.e. more conservative) or greater (i.e. less conservative) than those presented within *HHERA Declaration Site* (AECOM, 2011a);

4) Preparation of this letter report including:

   - Description of vapour modelling assumptions and input parameters which differ from those presented within the *HHERA Declaration Site* (AECOM, 2011a);
   - Justification for the application of revised input parameters, including Lend Lease calculated ventilation rates and revised basement layout areas;
   - Tables comparing the re-modelled SSTC with those presented within the *HHERA Declaration Site* (AECOM, 2011a).

4.0 Revised Vapour Modelling Assumptions

Based on the information provided by Lend Lease (**Enclosure A**) the assumptions made in the *HHERA Declaration Site* (AECOM, 2011a), have been revised to assess the effect on the derived SSTC with respect to:

- a reduction in the anticipated ventilation rates within the proposed lower and upper basements;
- the revised dimensions of the basement car park areas (to which the public and commercial workers will have access); and
- the use of the lower basement level as a loading dock where workers will be present.

AECOM considers that the revision of the SSTCs based on the revised design dimensions and potentially reduced air exchange rates and usage is more representative than the previously presented calculations and

resulting SSTC (which were based on a default of 25m by 25m basement area with four air exchanges per hour and no workers on the lower basement level).

Lend Lease (Fitzpatrick, 2012) provided AECOM average daily air exchange rates based on the proposed basement design configuration for the Barangaroo Area known as the Other Remediation Works South (ORWS Area) based on:

- 100% fan operation/ ventilation;
- 25% minimum fan operation/ ventilation; and
- 0% fan operation/ ventilation.

Where ventilation rates are likely to be reduced (i.e. less than four air exchanges per hour, based on the daily average) a revision of a number of assumptions related to the development of the SSTC is considered appropriate. The assumptions adopted for the revised SSTCs are based on the worst case scenario, considered to be in areas where daily average ventilation rates are lower than the previously modelled four air exchanges per hour. The reduction in the daily average ventilation rates is understood to occur as a result of energy saving controls which will be implemented within the proposed ORWS development. These controls include turning off ventilation systems during off-peak times.

For the purpose of assessing the potential impact of reduced ventilation rates within the lower and upper basements to be constructed in the Declaration Area, AECOM has considered the lowest ventilation rates calculated for the ORWS basement areas (identified within the lower basement B2 Residential car park). This ventilation rate is 3.17 air exchanges per hour (when periods of 0% fan/ventilation occurs throughout out the day).

Additional information presented to AECOM from Lend Lease also indicates that a loading dock may be present in the lower basement car park where a full time worker will be present. The revised modelling has therefore considered a commercial worker exposure of an eight hour day, 5 days per week for 48 weeks per year (to account for vacation time) for 30 years.

Table 1 and **Table 2** present the revised model assumptions for Scenario 1 (lower basement level) and Scenario 2 (upper basement level), respectively. AECOM notes that only those assumptions which have been revised are presented within this letter report.

Table 1 Revised Scenario 1 Model Assumptions

Model Input	Original HHERA Declaration Site Model Input	Revised Model Input	Comment
Scenario 1 – Lower Basement			
Water with Flow Model			
Dimensions of Basement - Height (m)	2.5	4.5	Provided by Lend Lease.
Dimensions of Basement - Width (m)	30	50	Based on information provided by Lend Lease.
Dimensions of Basement - Depth (m)	30	50	
Dimensions of Basement - Volume total basement (m^3)	2,250	11,250	Calculated from information provided by Lend Lease.
Dimensions of Wet Section of Basement – Length (m)	35	59	Two walls measuring 4.5 m in height plus the width of the floor (50 m).
Dimensions of Wet Section of Basement – Width (m)	15	25	Based on 50% of the total 50 m length of surface area, considered to have water flowing across it in the basement.

Model Input	Original HHERA Declaration Site Model Input	Revised Model Input	Comment
Fetch/ Depth (m) ratio of Wet Basement Section	1,500	2,500	Calculated.
Volume of wet basement (m^3)	5.3	14.8	Equivalent to the length and width of wet basement areas multiplied by a water thickness of 0.01 m.
Area covered in water (m2)	525	2,250	Based on 50% of the total 50 m length of surface area, considered to have water flowing down two walls and across the floor of the basement carpark.
Effective diameter of basement (m)	25.9	43.3	Calculated.
Volume of water entering basement (m^3/sec)	$5.25x\ 10^{-6}$	1.48×10^{-5}	Calculated by the volume of the wet basement multiplied by the permeability rate of the concrete basement walls.
Air exchange rate (exchanges/day)	96	76.1	Provided by Lend Lease. Based on an average daily air exchange rate of 3.17, which includes periods of 0% ventilation.
Exposure Time (years)	64	30	30 years based on a worker exposure.
Exposure Duration	1	8	Based on a worker exposure over a day (assumed to be 8 hours per day).
Exposure Frequency	350	240	Based on a worker working 5 days per week, 48 weeks per year (minus 4 weeks annual holidays).

Table 2 Revised Scenario 2 Model Assumptions

Model Input	Original HHERA Declaration Site Model Input	Revised Model Input	Comment
Scenario 2 – Upper Basement			
Soil to Air Model			
Enclosed-space volume/infiltration area (ratio) (cm)	1,875	5,625	Assumes 50 m by 50 m by 2 m high basement section adjacent to soil impacts, with soil vapour infiltration through upper 2m of 2 of 4 walls only. Therefore, volume = 11250 m^3 and infiltration area = 200 m^2.
Enclosed-space air exchange rate (1/s)	0.00111	0.0008806	Provided by Lend Lease. Based on an average daily air exchange rate of 3.17, which includes periods of 0% ventilation.
Slab Area (cm^2)	$7.25x\ 10^6$	2.7×10^7	Area through which vapours may enter (conservatively includes floor and all walls). Basement dimensions 50 m width x 50 m length x 2 m height.
Slab perimeter (cm)	10,000	20,000	Perimeter of basement footprint. Based on 50m x 50m basement.
Water with Flow Model			
Dimensions of Basement - Height (m)	3	4.5	Provided by Lend Lease.
Dimensions of Basement - Width (m)	25	50	Based on information provided by Lend Lease.

Model Input	Original HHERA Declaration Site Model Input	Revised Model Input	Comment
Dimensions of Basement - Depth (m)	25	50	
Dimensions of Basement - Volume total basement (m^3)	1,875	11,250	Calculated.
Dimensions of Wet Section of Basement – Length (m)	5	25	Based on the assumption 50% of the total wall length will have water flowing across it.
Dimensions of Wet Section of Basement – Width (m)	5	5	Assuming groundwater will be encountered across the face of 2.5 m of 2 walls. The upper 2 meters of the wall is considered to be unsaturated soils. No water is considered to flow across the floor, as this would not be in contact with saturated material.
Fetch/ Depth (m) ratio of Wet Basement Section	500	500	Calculated.
Volume of wet basement (m^3)	0.25	1.25	Equivalent to the length and width of wet basement areas multiplied by a water thickness of 0.01 m.
Area covered in water (m^2)	25	125	Equivalent to the length multiplied by the width of the wet area.
Effective diameter of basement (m)	5.6	12.6	Calculated.
Volume of water entering basement (m^3/sec)	2.5×10^{-7}	1.25×10^{-6}	Calculated by the volume of the wet basement multiplied by the permeability rate of the concrete basement walls.
Air exchange rate (exchanges/day)	96	76	Based on information provided by Lend Lease, where minimum average daily air exchange rates have been calculated at 3.17per hour, which includes periods of 0% ventilation.

5.0 Development of SSTCs

For the purpose of deriving SSTCs, AECOM has considered the lowest air exchange rate provided by Lend Lease (3.17 per hour) to be representative of the most conservative exposure scenario for inhalation of volatile contaminants within the lower basement (Scenario 1) and upper basement (Scenario 2) .

AECOM has also revised the exposure assumptions for frequency and duration for Scenario 1 to account for a worker within the loading dock of the lower basement level.

SSTCs have been derived using the approach and methodology detailed in both the *HHERA Declaration Site* (AECOM, 2011a).

Based on the revised model inputs provided in **Table 1** and **Table 2**, revised soil and groundwater SSTC have been developed for the two modelled exposure scenarios (Scenario 1- Lower Basement and Scenario 2- Upper Basement), which are representative of the proposed basement dimensions, ventilation rates and exposure parameters. The results of the model are presented within **Enclosure B** of this letter report.

Note no changes have been made to Scenarios 3 to Scenario 8 inclusive as these scenarios do not consider the inclusion of a basement. The only exception is Scenario 7, which considers a multi storey residential building constructed above a basement car park. Scenario 7 has not been considered further in this letter because it adopts a 10 fold dilution between the basement and the upper floors where residents may reside. Therefore, it is not representative of the most conservative SSTCs derived.

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5.1 Revised Groundwater SSTC (mg/L)

Based on the revised model inputs (presented in **Section 4.0**) the results of the risk assessment models (including the odour models) are presented in **Enclosure B** of this letter report. **Table 3** below provides a comparison of the previously derived SSTC for groundwater as presented within the *HHERA Declaration Site* (AECOM 2011a), with the revised SSTC for groundwater presented in **Enclosure B**.

Table 3 Groundwater Scenario 1 and Scenario 2 SSTC

Chemical	Previous SSTC		Revised SSTC		Previous SSTC		Revised SSTC	
	Derived	Proposed	Derived	Proposed	Derived	Proposed	Derived	Proposed
Scenario	**Scenario 1 – Lower Basement mg/L**				**Scenario 2 – Upper Basement mg/L**			
Acenaphthene	610	##	180	##	1,900	##	1800	##
Acenaphthylene	300	##	80	80	910	##	890	##
Ammonia	2,400	2,400	630	630	6,800	6,800	6,800	6,800
Aniline	**1,400,000**	##	***180,000***	***180,000***	***3,800,000***	**##**	**4,000,000**	##
Anthracene	17	##	4.6	##	50	##	50	##
Arsenic, Inorganic	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-
Benzene	21	21	7.7	7.7	95	95	90	90
Benzo(a)pyrene	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-

Chemical	Previous SSTC		Revised SSTC		Previous SSTC		Revised SSTC	
	Derived	Proposed	Derived	Proposed	Derived	Proposed	Derived	Proposed
Scenario	Scenario 1 – Lower Basement mg/L				Scenario 2 – Upper Basement mg/L			
Cadmium	-	-	-	-	-	-	-	-
Chromium(III)	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-
Dibenzofuran	1,100	##	270	##	3,200	##	3100	##
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-
Ethylbenzene	4,000	##	***750***	750	13,000	##	12,000	##
Fluoranthene	-	-	-	-	-	-	-	-
Fluorene	48	##	13	13	140	##	140	##
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-
Methylphenol, 2-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	***38***	***38***	***4.5***	***4.5***	**120**	**120**	**110**	**110**

Chemical	Previous SSTC		Revised SSTC		Previous SSTC		Revised SSTC	
	Derived	Proposed	Derived	Proposed	Derived	Proposed	Derived	Proposed
Scenario	Scenario 1 – Lower Basement mg/L				Scenario 2 – Upper Basement mg/L			
Methylphenol, 3&4	***1,000***	***1,000***	***130***	***130***	***2,700***	***2,700***	**2,800**	**2,800**
Naphthalene	0.92	0.92	0.24	0.24	2.9	2.9	2.8	2.8
Nickel	-	-	-	-	-	-	-	-
Phenanthrene	22	##	5.8	5.8	64	##	64	##
Phenol	***310,000***	***310,000***	***39,000***	***39,000***	***830,000***	***830,000***	**860,000**	##
Pyrene	11	##	2.8	##	*29*	##	30	##
Styrene	3,300	##	840	840	10,000	##	9,900	##
Toluene	160,000	##	4000	4000	49,500	##	47,000	##
TPH C_6-C_9 aliphatic ($)	28,000	28,000	7300	7300	90,000	90,000	86,000	86,000
TPH C_{10}-C_{14} aliphatic ($)	7.7	7.7	1.8	1.8	14.5	15	14	14
TPH C_{10}-C_{14} aromatic ($)								
TPH C_{15}-C_{28} aliphatic	-	-	-	-	-	-	-	-
TPH C_{15}-C_{28} aromatic								
TPH C_{29}-C_{36} aliphatic	-	-	-	-	-	-	-	-
TPH C_{29}-C_{36} aromatic								
Trimethylbenzene, 1,2,4-	87	87	22	22	278	280	270	270
Vanadium	-	-	-	-	-	-		
Xylenes (total) ($)	650	##	176	176	2,200	##	2,070	##

Chemical	Previous SSTC		Revised SSTC		Previous SSTC		Revised SSTC	
	Derived	Proposed	Derived	Proposed	Derived	Proposed	Derived	Proposed
Scenario	Scenario 1 – Lower Basement mg/L				Scenario 2 – Upper Basement mg/L			
CPAH#[1]	-	-	-	-	-	-		

Shading = SSTC exceeds aqueous solubility limit however the derived SSTC is within 10 times the solubility limit.
= an SSTC has not been determined for remediation purposes as the derived level is at least 10 times greater than solubility limits
# [1]= the solubility limits for individual carcinogenic PAHs are in the order of 10^{-3} to 10^{-4} mg/L and are assumed to represent the solubility of the CPAH group. The derived SSTC for CPAH is 0.01 mg/L and is considered to be well over the solubility limits and has therefore not been adopted.
CPAH = carcinogenic PAHs and includes: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h) anthracene and indeno (1,2,3-cd)pyrene (see text for details)
Italics= odour SSTC (were lower than human health SSTC)
$ = SSTC is greater than 10 times the saturation/ solubility limit and has been adopted on the following basis: **TPH fractions:** SSTC has been adopted as it is not considered appropriate to exclude this complex and chemically diverse group of chemicals based on the solubility/ saturation characteristics of an analytical surrogate.

Key Assumptions:

- The derivation of SSTCs has been based on plans and design assumptions provided by Lend Lease .
- The development of SSTCs has assumed that tar will be removed from the immediate vicinity of outer basement walls to the extent practicable, and basement design and engineering controls should ensure that tar seepage into basements does not occur.
- There are significant biodegradation processes occurring within sub-surface soils based on measured oxygen concentrations beneath the sub-surface. To account for these biodegradation processes, a 10 fold factor (Davis 2009) has been adopted for site specific target criteria for soil for the paved and unpaved areas of the Site, where biodegradation processes are considered to be significant.
- Risks associated with mixtures of chemicals have been modelled by applying proportional risks as follows: BTEX (HI 0.25 each), PAH (HI 0.2), TPH (HI 0.25 total for aliphatic and aromatic per fraction), all other chemicals HI = 1.
- The lower and upper basements have been modelled using a water seepage model adopted from Water 9 (USEPA, 1994).
- In the lower and upper basements a windspeed of 0.03 m/sec within the basements (Scenario 1 and Scenario 2) has been modelled
- Chemicals are assumed to be volatile if Henry's Law constant is greater than 1 x 10^{-5} atm-m^3/mole (USEPA,2004)
- In basement scenarios (Scenario 1 and Scenario 2) it has been assumed that no more than two walls will be in contact with contaminated soil / groundwater (with Scenario 1 also considering exposures to the floor). Based on building plans provided by LL, it has been assumed that basement areas will be compartmentalised with each compartment adjacent to basement areas leaving a maximum of 2 exposed walls.
- The basement groundwater retention wall system will comprise a diaphragm wall (or equivalent), extending to and keyed into bedrock, with a reinforced concrete basement wall, constructed on the inside. A sealed plenum constructed immediately inside the reinforced concrete basement wall will include: (a) passive ventilation to the atmosphere; and (b) dish drains that will drain any seepage.

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5.2 Revised Soil SSTC

Based on the revised model inputs (presented in **Section 4.0**) the results of the risk assessment models (including the odour models) are presented in **Enclosure B** of this letter report. **Table 4** below provides a comparison of the previously derived SSTC for soil, as presented within the *HHERA Declaration Site* (AECOM 2011a), with the revised SSTC for soil shown in **Enclosure B**.

As discussed in the *HHERA Declaration Site* (AECOM, 2011a), unsaturated soil impacts are not likely to exist adjacent to the lower basement wall. Therefore no soil SSTCs have been derived for Scenario 1 receptors.

Table 4 Soil SSTC Scenario 2 Upper Basement

Chemical	Previous SSTC (HHERA Declaration Site)		Revised SSTC	
	Derived	Proposed	Derived	Proposed
Scenario 2 – Upper Basement				
Acenaphthene	22,200	##	90,000	##
Acenaphthylene	35,800	##	146,000	##
Anthracene	1,190,000	##	4,900,000	##
Arsenic, Inorganic	-	-	-	-
Benz(a)anthracene	-	-	-	-
Benzene	15.3	15	62	62
Benzo(a)pyrene	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-
Chromium(III), Insol. Salts	-	-	-	-
Chromium(VI)	-	-	-	-
Chrysene	-	-	-	-
Copper	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-

Chemical	Previous SSTC (HHERA Declaration Site)		Revised SSTC	
	Derived	Proposed	Derived	Proposed
Scenario 2 – Upper Basement				
Dibenzofuran	174,000	##	709,000	##
Ethylbenzene	***602***	***600***	**2,500**	##
Fluoranthene	-	-	-	-
Fluorene	51,400	##	210,000	##
Indeno(1,2,3-cd)pyrene	-	-	-	-
Lead	-	-	-	-
Methylnaphthalene, 2-	***1,080***	***1,100***	**4,400**	##
Methylphenol, 3&4	***8,800***	***8,800***	***36,000***	***36,000***
Naphthalene	40.8	41	170	170
Phenanthrene	319,000	##	1,300,000	##
Pyrene	1,840,000	##	7,500,000	##
Toluene	***6,040***	**6,000**	***25,000***	##
TPH C06-C09 aliphatic ($)	3,360	3,400	14,000	14,000
TPH C10-C14 aliphatic ($)	13,000	13,000	53,000	53,000
TPH C10-C14 aromatic ($)				
TPH C15-C28 aliphatic	-	-	-	-
TPH C15-C28 aromatic				
TPH C29-C36 aliphatic	-	-	-	-
TPH C29-C36 aromatic				
Trimethylbenzene, 1,2,4-	14.3	14	58	58
Vanadium	-	-	-	-

Chemical	Previous SSTC (HHERA Declaration Site)		Revised SSTC	
	Derived	Proposed	Derived	Proposed
Scenario 2 – Upper Basement				
Xylenes (total)	856	##	3,500	##
Zinc	-	-	-	-
CPAH	-	-	-	-

Notes:

Shading = SSTC exceeds saturation limit however the derived SSTC is within 10 times the saturation limit.

= an SSTC has not been determined for remediation purposes as the derived level is at least 10 times greater than saturation/ solubility limits, therefore maximum vapour phase concentration of chemical cannot result in unacceptable risk level.

CPAH = carcinogenic PAHs and includes: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h) anthracene and indeno (1,2,3-cd)pyrene (see HHERA – Declaration Site (AECOM, 2011a) for details)

Italics= odour SSTC (where lower than human health SSTC)

$ = SSTC is greater than 10 times the saturation/ solubility limit and has been adopted on the following basis: **TPH fractions:** SSTC has been adopted as it is not considered appropriate to exclude this complex and chemically diverse group of chemicals based on the solubility/ saturation characteristics of an analytical surrogate up to the maximum observed concentrations on site of TPH C_6-C_9 7,500 mg/kg, C_{10}-C_{14} 70,000 mg/kg and C_{15+} 130,000 mg/kg.

5.3 Key Assumptions Relating to the Derivation of the SSTCs:

The following key assumptions have been made, in the process of deriving the revised SSTCs:

- The derivation of the revised SSTCs has been based on:
  - design assumptions provided by Lend Lease, as shown in **Enclosure A.**
  - the assumption that workers within a loading dock on the lower basement level will work on average an 8 hour day, 240 days per year for a maximum period of 30 years.
- The development of SSTCs has assumed that tar will be removed from the immediate vicinity of outer basement walls to the extent practicable, and basement design and engineering controls should ensure that tar seepage into basements does not occur.
- The current theoretical estimation of soil concentrations within indoor and outdoor air is based on partitioning modelling which has been demonstrated to overestimate concentrations between 10 -1,000 fold. To account for this conservatism, an adjustment factor of 10 has been applied. In all scenarios a soil partitioning factor of 10 has been applied to BTEX, TPH (fractions C_6-C_9 and C_{10}-C_{14} to account for the over-conservative nature of vapour modelling associated with these chemicals (CCME, 2008b and CRC Care, 2010)
- Risks associated with mixtures of chemicals have been modelled by applying proportional risks as follows: BTEX (HI 0.25 each), PAH (HI 0.2), TPH (HI 0.25 total for aliphatic and aromatic per fraction), all other chemicals HI = 1
- Chemicals are assumed to be volatile if Henry's Law constant is greater than 1×10^{-5} atm-m^3/mole (USEPA,2004)

6.0 Results of the Revised SSTCs

In accordance with the scope of this report, AECOM has developed revised SSTCs (for soil and groundwater) for the proposed lower and upper basement car park areas.

The revision of the SSTCs was undertaken to assess the impact of the potential reduction in the proposed air exchange (or ventilation) rates within selected areas of the proposed basement car park, revised basement dimensions and to account for workers within a loading dock on the lower basement level.

Original SSTCs were modelled on a predicted ventilation rate of 4 air exchanges per hour for a basement with dimensions of 25 m wide by 25m long. Based on the information provided by Lend Lease (**Enclosure A),** the revised SSTCs consider a reduced air exchange rate and larger basement dimensions within the upper and lower basement car park areas. Additionally, exposure assumptions within the lower basement now consider commercial workers within the lower basement working an 8 hour day, 240 days per year for 30 years.

The SSTCs for soil and groundwater presented in the *HHERA Declaration Site* (AECOM, 2011a) have been compared to the revised SSTCs (refer to **Table 3 and Table 4)**.

Comparison of the previous SSTC (as presented in the *HHERA Declaration Site* (AECOM, 2011a)) and the revised SSTC indicates:

Scenario 1 (Lower Basement)

- Revised groundwater SSTCs are lower than the Scenario 1 groundwater SSTCs originally presented in the *HHERA Declaration Site* (AECOM, 2011a).
- Unsaturated soil impacts are not considered to occur adjacent to the lower basement walls, therefore no soil SSTC are presented for Scenario 1.

Scenario 2 (Upper Basement)

- Revised groundwater SSTCs are lower than the Scenario 2 groundwater SSTCs originally presented in the *HHERA Declaration Site* (AECOM, 2011a).
- Revised soil SSTCs are greater than the soil SSTCs originally presented in the *HHERA Declaration Site* (AECOM, 2011a). Therefore the values originally presented within the *HHERA Declaration Site* (AECOM, 2011a) are more conservative and therefore considered to be protective of the receptors modelled within exposure Scenario 2 based on the revised basement dimensions provided by Lend Lease.

7.0 Conclusions

This letter report presents an assessment of the proposed design modifications, and provides a comparison of the revised SSTCs with the previously approved SSTCs presented within the *HHERA Declaration Site* (AECOM, 2011a). The conclusions provided within this letter are based on revisions to a number of assumptions, as presented in **Section 4.0**, to account for the modification to the lower and upper basement design and use. The proposed design modifications considered within this letter include:

- amending the proposed ventilation rates within the lower and upper basements (in particular, reducing the daily average ventilation rates to less than 4 air exchanges per hour, to reflect the likely basement and the ventilation system design and operation);
- amending the actual shape and size of the basement car park areas (to which the public will have access) (in particular revising them from an indicative area of 25 m x 25 m x 3 m height to an area of 50 m x 50 m x 4.5 m height based on the proposed basement design); and
- amending the use of the lower basement level to also include a loading dock utilised by full time workers in addition to a commercial/residential car park.

As a conservative approach, AECOM has adopted the lowest calculated ventilation rates provided by Lend Lease, as reduced ventilation rates (likely required to optimise building energy use) influence the potential risks associated with vapour inhalation at the Declaration Site. The adopted value is based on calculated ventilation rates for the basement designed for the Barangaroo ORWS.

The revised groundwater SSTCs for Scenario 1 and 2 are lower than those previously calculated. That is, the values originally presented within the *HHERA Declaration Site* (AECOM, 2011a) are less conservative; and based on the revised basement design and use, may not be protective of the Scenario 1 and 2 receptors. AECOM considers the revised groundwater SSTCs should be adopted in place of those in the *HHERA Declaration Site* (AECOM, 2011a) by the Remedial Action Plan (RAP) for the Declaration Area.

The revised soil SSTCs for Scenario 2 are greater than the SSTCs originally presented in the *HHERA Declaration Site* (AECOM, 2011a). That is, the values originally presented within the *HHERA Declaration Site* (AECOM, 2011a) are more conservative and therefore are considered to be protective of the receptors modelled within exposure Scenario 2 based on the revised basement plans provided by Lend Lease.

AECOM notes that the conclusions provided within this letter report are specific to the adopted assumptions, and should the proposed development deviate from these assumptions, the impact to derived SSTCs should be reviewed.

8.0 References

AECOM, 2011a. *Human Health and Ecological Risk Assessment -Declaration Site (Development Works) Remediation Works Area – Barangaroo (HHERA Declaration Site).* AECOM Australia Pty Ltd, 9 June 2011.

CRC Care, 2011. *Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater, Summary for NEPC Consultation,* E. Friebel and P Nadebaum, September 2011, CRC for Contamination Assessment and Remediation of the Environment.

CCME 2008. *Canadian Soil Quality Guidelines: Carcinogenic, Other Polycyclic Aromatic Hydrocarbons, Scientific Support Document*, Environment Canada. January 2008.

Fitzpatrick, C., cole.fitzpatrick@lendlease.com (2012) *Subject: 12013 - Basement Airchange Study - Basements & Infrastructure*. [email] Message to Lee, a. (amanda.lee@aecom.com). Sent 16 April 2012.

ENVIRON, 2011, *Site Audit Report.,* ENVIRON Australia Pty Limited, 14 July 2011

9.0 Limitations

This document was prepared by AECOM Australia Pty Ltd (AECOM) for the sole use of Lend Lease (Millers Point) Pty Ltd, 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 before relying on this document. AECOM cannot be held liable for any third party reliance on this document, as AECOM is not aware of the specific needs of the third party. No other party should rely on the document without the prior written consent of AECOM, and AECOM undertakes no duty to, nor accepts any responsibility to, any third party who may rely upon this document.

This document was prepared for the specific purpose described in our proposal dated 14 October 2011 and as agreed to by Lend Lease (Millers Point) Pty Ltd. 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 the date of this document. 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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Kind regards,

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Enclosures

Enclosure A: Ventilation parameters provided by Lend Lease.

Enclosure B: Revised SSTC Calculations Scenario 1 and Scenario 2

Enclosure C: Comparison of Scenario 1 SSTC Groundwater to ORWS Groundwater Data

Enclosure A

Ventilation parameters provided by Lend Lease

Lend Lease BARANGAROO SOUTH

Lend Lease Project Management & Construction (Australia) Pty Limited ABN 97 000 098 162

Correspondence

No. 12013

Master Project Name:
Barangaroo Basement & Infrastructure

Project Address:
30 The Bond 30 Hickson Road
Millers Point NSW 2000
Australia

Project Office Phone:
02 9277 6111

Project Office Fax:
02 9383 8124

Project Name:	Barangaroo - Basement
Project Number:	161804
Subject:	Basement Airchange Study
Area/Zone:	Basements & Infrastructure
Sub-Area/Sub-Zone:	GENERAL Basement & Infrastructure File
Category:	Mechanical Services
Date:	16 Apr 2012 09:13:00

Sender	Company	Phone	Fax
Cole Fitzpatrick	Lend Lease Project Management & Construction (Australia) Pty Limited	92375404	-

Author	Company	Phone	Fax
Cole Fitzpatrick	Lend Lease Project Management & Construction (Australia) Pty Limited	92375404	

To Recipient(s)	Company	Phone	Fax
Amanda Lee	AECOM	89340457	-

cc Recipient(s)	Company	Phone	Fax
No cc recipients selected.			

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Message:

Amanda,

I have attached the corresponding zone drawings which accompany the table. I have also made a small amendment to the table since friday.

Thanks again.

Cole.

>Original No.: 11991
>From: Cole Fitzpatrick
>Date: 13 Apr 2012 05:55 PM
>Subject: Basement Airchange Study
>Attachments in email:
>120413 Airchanges Study.pdf
>==========
>Amanda,

I spoke with Joseph this afternoona dn he asked me to recut the airchange calcs.

here are my results, let me know if you have any questions.

have a good weekend.

Cole.

File Attachments:

Attachment Name	Size
120416 Airchanges Study.pdf	25 Kb
120416_Airchange_Study_Zones_B1.pdf	3794 Kb
120416_Airchange_Study_Zones_B2.pdf	3350 Kb

Related Correspondence:

No.	Date	Title	Author	Company
11991	13 Apr 2012	**Basement Airchange Study**	Cole Fitzpatrick	Lend Lease Project Man ...

Document Links:

No.	Module	Title	Author	Doclink Creator
No document links				

100% Air Quantity

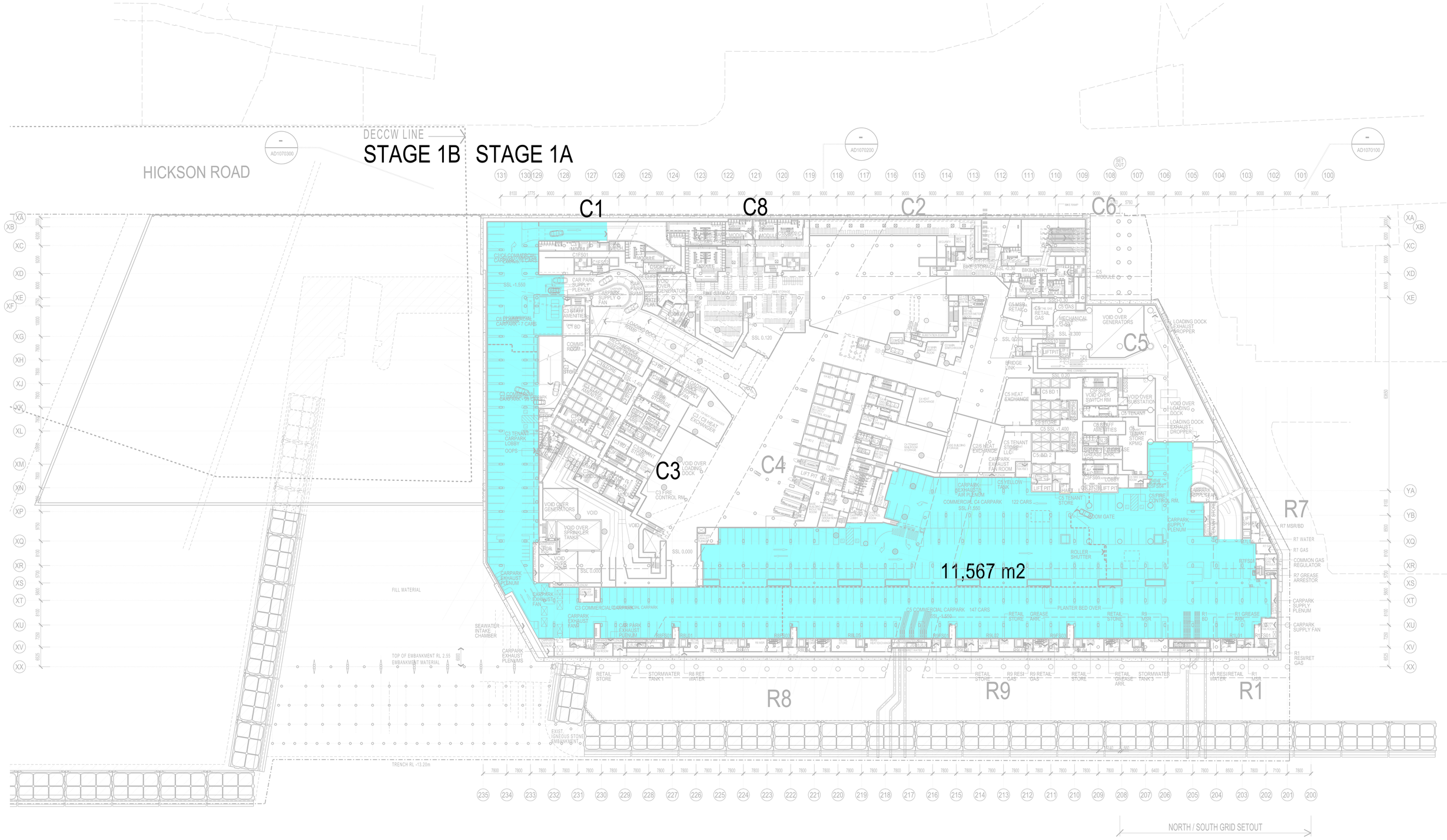
Space	Area - m2	Height - m	Volume - m3	No of Cars	L/s per Car	Current Design - L/s	Arch/hr
B1 COMMERCIAL	11,567	3.75	43,346	402	250	100,500	8.35
B2 COMMERCIAL	5,052	2.68	13,539	158	250	39,500	10.50
B2 NORTH COMMERCIAL	2,369	2.67	6,325	82	250	20,500	11.67
B2 RESIDENTIAL	3,570	2.68	9,568	135	150	20,250	7.62
C3/C4 DOCK	3,220	6.03	19,401	28	1500	42,000	7.79
C4/C5 DOCK	2,460	5.08	12,487	37	750	27,750	8.00

Scenario 1 - 25% Min. Flow

Space	Area - m2	Height - m	Volume - m3	No of Cars	L/s per Car	Current Design - L/s	Arch/hr
B1 COMMERCIAL	11,567	3.75	43,346	402	250	50,041	4.16
B2 COMMERCIAL	5,052	2.68	13,539	158	250	19,668	5.23
B2 NORTH COMMERCIAL	2,369	2.67	6,325	82	250	10,207	5.81
B2 RESIDENTIAL	3,570	2.68	9,568	135	150	10,083	3.79
C3/C4 DOCK	3,220	6.03	19,401	28	1500	25,900	4.81
C4/C5 DOCK	2,460	5.08	12,487	32	1500	17,113	4.93

Scenario 2 - 0% Min. Flow

Space	Area - m2	Height - m	Volume - m3	No of Cars	L/s per Car	Current Design - L/s	Arch/hr
B1 COMMERCIAL	11,567	3.75	43,346	402	250	41,875	3.48
B2 COMMERCIAL	5,052	2.68	13,539	158	250	16,458	4.38
B2 NORTH COMMERCIAL	2,369	2.67	6,325	82	250	8,542	4.86
B2 RESIDENTIAL	3,570	2.68	9,568	135	150	8,438	3.17
C3/C4 DOCK	3,220	6.03	19,401	28	1500	22,400	4.16
C4/C5 DOCK	2,460	5.08	12,487	32	1500	14,800	4.27



PRELIMINARY

INDICATIVE LAYOUT ONLY

Key Plan

B1

Rev.	Item	Revision Description	Date
07		ISSUED FOR REVIEW	20.03.12
06		ISSUED FOR SERVICES COORDINATION	03.02.12
05		ISSUED FOR REVIEW AND INFORMATION	13.01.12
04		ISSUED FOR REVIEW AND INFORMATION	30.11.11
03		ISSUED FOR REVIEW AND INFORMATION	31.07.11
02		ISSUED FOR CONTRACT PRICE	25.07.11
01		ISSUED FOR CLIENT REVIEW	06.06.11

Rev. | Item | Revision Description | Date

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Consultant

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Developer	Lend Lease
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Project
BARANGAROO SOUTH

Title
PLAN
FLOOR PLAN
BASEMENT LEVEL 1

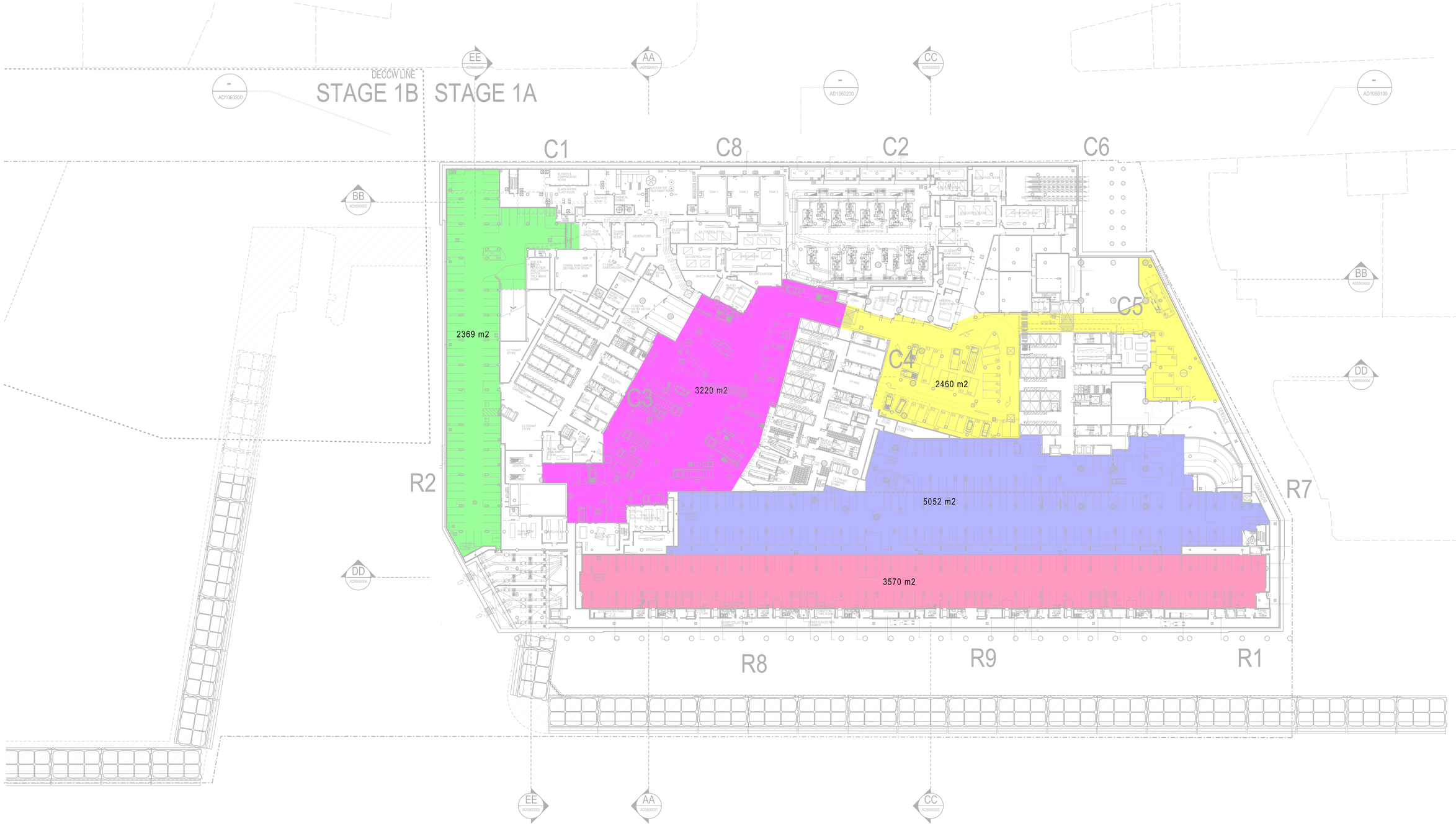
Drawn By	Date	Purpose	Approved By	Date
	04/10/11	FOR INFO		

0 25
SCALE 1:500 @ B1 1:1250 @ A3 N/A

Project No.	Site No.	Drawing No.	Revision
161804	BB1	AD0000009	07

BB1_GOL_101.dgn
8:53:30 AM
10/04/2012

B1



PRELIMINARY

INDICATIVE LAYOUT ONLY

Key Plan

B1

Rev.	Item	Revision Description	Date
07		ISSUED FOR REVIEW	20.03.12
06		ISSUED FOR SERVICES CO ORDINATION	03.02.12
05		ISSUED FOR REVIEW AND INFORMATION	13.01.12
04		ISSUED FOR REVIEW AND INFORMATION	30.11.11
03		ISSUED FOR REVIEW AND INFORMATION	21.09.11
02		ISSUED FOR CONTRACT PRICE	25.07.11
01		ISSUED FOR CLIENT REVIEW	06.06.11

Rev.	Item	Revision Description	Date

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Consultant

Principal
Lend Lease

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Project
BARANGAROO SOUTH

Title
PLAN
FLOOR PLAN
BASEMENT LEVEL 2

Drawn By	Date	Purpose	Approved By	Date
	04/10/11	FOR INFO		

0 25
SCALE 1:500 @ B1 1:1250 @ A3 N/A

Project No.	Site No.	Drawing No.	Revision
161804	BB1	AD0000008	07

B1

BB1_LAYO_110.dgn
9/04/2012 8:56:11 AM
Bo48

AECOM

Enclosure B

Revised SSTC Calculations Scenario 1 and Scenario 2

1. General Information:

Site:	Barangaroo
Address:	Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Client:	Lend Lease
Scenario:	Scenario 1 - Lower Basement with Commercial Worker (Risk Based Calculations)

Header Colour (Defaults = Blue):

Blue

2. Select Receptor:

Commercial/Industrial

3. Select Exposure Pathways to Include:

Enter "x" in box, or select from dropdown box.

Soil Pathways

	Incidental Ingestion of Soil
	Dermal Contact with Soil
	Inhalation of Surface Soil-Derived Dust in Indoor Air
	Inhalation of Surface Soil-Derived Dust in Outdoor Air
	Inhalation of Surface Soil-Derived Vapours in Outdoor Air
	Inhalation of Soil-Derived Vapours From Excavation (USEPA 2002 method)
	Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
	Inhalation of Subsurface Soil-Derived Vapours in Outdoor Air

Groundwater Pathways

	Inhalation of Groundwater-Derived Vapours in Indoor Air
	Inhalation of Groundwater-Derived Vapours in Outdoor Air
	Ingestion of Potable Groundwater
	Incidental Ingestion of Groundwater (Bathing or Excavation)
	Dermal Contact with Groundwater (Bathing or Excavation)
	Inhalation of Groundwater Vapours during Irrigation/ Showering
	Ingestion of Vegetables Irrigated with Groundwater
	Inhalation of Groundwater Vapours (Where GW Enters Trench)
x	Inhalation of vapour emissions from flowing water (groundwater in basement)
	Inhalation of Soil Vapour-Derived Vapours in Indoor Air
	Inhalation of Soil Vapour-Derived Vapours in Outdoor Air

Y	Soil RBSLs saturation limited?
Y	Groundwater RBSLs solubility limited?

4. Select Chemicals for Quantitative Assessment:

	Target Hazard Index	Target Cancer Risk	5. Enter Chemical Concentrations (if only calculating RBSLs, enter 1 for media for which you want RBSLs):	
	default = 1 (or manually overwrite)	default = $1x10^{-5}$ (or manually overwrite)	Soil (mg/kg)	Groundwater (mg/L)
Acenaphthene	0.2	1.00E-05	511	4.48
Acenaphthylene	0.2	1.00E-05	1700	43.2
Ammonia	1	1.00E-05		348
Aniline	1	1.00E-05		0.212
Anthracene	0.2	1.00E-05	2150	15.4
Arsenic, Inorganic	1	1.00E-05		0.024
Barium	1	1.00E-05		2.23
Benz(a)anthracene			1470	12.6
Benzene	0.25	1.00E-05	1510	40.2
Benzo(a)pyrene			652	9.26
Benzo(b)fluoranthene			587	8.33
Benzo(g,h,i)perylene			305	4.22
Benzo(k)fluoranthene			231	2.93
Bis(2-ethylhexyl)phalate	1	1.00E-05		0.03
Cadmium (Water)	1	1.00E-05		0.108
Chromium(III), Insoluble Salts	1	1.00E-05	210	0.102
Chromium(VI)	1	1.00E-05	2.3	0.102
Chrysene			771	9.78
Cobalt	1	1.00E-05		0.057
Cresol, m-&p-	1	1.00E-05	2290	436
Cresol, o-	1	1.00E-05		182
Blank				
Dibenz(a,h)anthracene			71.4	0.822
Dibenzofuran	1	1.00E-05	277	10.2
Dimethylphenol, 2,4-	1	1.00E-05		38
Ethylbenzene	0.25	1.00E-05	261	3.02
Fluoranthene			2440	25.9
Fluorene	0.2	1.00E-05	2100	21.1
Indeno(1,2,3-cd)pyrene			247	3.05
Iron	1	1.00E-05	60600	187
Lead and Compounds	1	1.00E-05	13600	0.555
Manganese	1	1.00E-05		4.89
Methylnaphthalene, 2-	0.2	1.00E-05	7650	105
Naphthalene	0.2	1.00E-05	10200	283
Nickel Soluble Salts	1	1.00E-05		0.303
Phenanthrene	0.2	1.00E-05	5180	74.1
Phenol	1	1.00E-05		249
Pyrene	0.2	1.00E-05	2640	27.9
Styrene	1	1.00E-05		0.194
Toluene	0.25	1.00E-05	2650	17.6
TPH C06-C09 aliphatic	0.125	1.00E-05	593	6.08
TPH C10-C14 aliphatic	0.125	1.00E-05	69400	1730
TPH C10-C14 aromatic	0.125	1.00E-05	69400	1730
TPH C15-C28 aliphatic	0.125	1.00E-05	93200	1520
TPH C15-C28 aromatic	0.125	1.00E-05	93200	1520
TPH C29-C36 aliphatic	0.125	1.00E-05	20600	332
TPH C29-C36 aromatic	0.125	1.00E-05	20600	332
Trimethylbenzene, 1,2,4-	1	1.00E-05	220	0.92
Vanadium and compounds	1	1.00E-05	248	0.0228
Xylenes (total)	0.25	1.00E-05	2576	6.7

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

6. Confirm/Modify Exposure Parameters:

		Site-Specific Value (leave blank to use default value)		Value Used in Calculations	
General receptor parameters:	**Units**	**Adult**	**Child**	**Adult**	**Child**
Body weight	kg	70	13	70	13
Exposure duration	yr	30	6	30	6
Averaging time (carcinogens)	yr	70	70	70	70
Averaging time (non-carcinogens)	yr	30	6	30	6
Incidental Soil Ingestion					
Daily soil ingestion rate	mg/day				
Exposure frequency for soil ingestion	days/yr				
Fraction of daily soil intake from site	unitless				
Dermal Absorption of Soil					
Exposed skin surface area for soil contact	cm2				
Soil to skin adherence factor	mg/cm2				
Exposure frequency for dermal contact with soil	days/yr				
Indoor Inhalation					
Exposure time (indoor air)	hrs/day				
Exposure frequency (indoor air)	days/yr				
Particulate emission factor (indoor air)	m3/kg				
Outdoor Inhalation					
Exposure time (outdoor air)	hrs/day				
Exposure frequency (outdoor air)	days/yr				
Particulate emission factor (outdoor air)	m3/kg				
Potable Water Ingestion					
Potable water intake rate	L/day				
Exposure frequency for potable water intake	days/yr				
Incidental Water Ingestion					
Incidental ingestion rate	L/day				
Exposure frequency for incidental water ingestion	days/yr				
Dermal Contact with Water					
Exposed skin surface for water contact	cm2				
Exposure time for dermal water contact	hr/day				
Exposure frequency for dermal water contact	days/yr				
Vapour Inhalation Shower/ Sprinkler					
Exposure frequency	days/yr				
Exposure time	min/ day				
Inhalation rate	m3/hr				
Inhalation Absorption Adjustment Factor	mg/mg				
Lung retention factor	unitless				
Ingestion of Home Grown Produce					
Proportion of homegrown produce ingested					
Exposure frequency	days/year				
Inhalation of Vapours from Flowing Water					
Exposure time	hrs/day	8	1	8	1
Exposure frequency	days/year	240	350	240	350

7. Enter Target Risk Levels for RBSL Calculation (per chemical)

	Target Hazard Index	Target Cancer Risk
Default Values:	1	1.00E-05
Site specific value (optional):		
Value Used in Calculations:	**1**	**1.00E-05**

Links to Model Setup:

Groundwater to Air Vapour Model Setup
Soil to Air Vapour Model Setup
Soil Vapour to Air Model Setup
Calculation of source vapour concentrations from NAPL
Groundwater to Plant Model Setup
Shower/ Sprinkler Model
Water with Flow

Links to RBSL and Risk Summaries:

RBSL Summary
Risk Estimate Summary

Links to Risk Calculation Detail:

SOIL:
Soil Ingestion
Soil Dermal Contact
Soil-Derived Dust Inhalation - Indoors
Soil-Derived Dust Inhalation - Outdoors
Inhalation of Surface Soil Derived Vapours - Outdoors
Inhalation of Soil Derived Vapours - Excavation
Inhalation of Subsurface Soil Derived Vapours - Indoors
Inhalation of Subsurface Soil Derived Vapours - Outdoors
GROUNDWATER:
Potable Groundwater Ingestion
Incidental Groundwater Ingestion
Dermal Contact with Groundwater
Inhalation of GW Derived Vapours - Indoors
Inhalation of GW Derived Vapours - Outdoors
Inhalation of GW Derived Vapour- Shower/Sprinkler
Ingestion of homegrown produce
Inhalation of GW Vapours - Trench with Pooled Water
Inhalation of vapour emissions from water with flow
SOIL VAPOUR:
Inhalation of SV Derived Vapours - Indoors
Inhalation of SV Derived Vapours - Outdoors

Links to RBSL Detail:

Soil - Adult Threshold
Soil - Child Threshold
Soil - Non-Threshold
Groundwater - Adult Threshold
Groundwater - Child Threshold
Groundwater - Non-Threshold
Soil Vapour - Adult Threshold
Soil Vapour - Child Threshold
Soil Vapour - Non-Threshold

PRINT FOR REPORT

Calculation of Vapour Emissions from Water with Flow
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

PARAMETERS

Concrete permeability	(select from drop down list)	High permeability
Permeability Rate (m/day)		8.6.E-02
Water Temperature (deg. C)		18.0
Dimensions of Basement / Impoundment		
Height (m)		4.5
Width (m)		50.0
Depth (m)		50.0
Volume total basement/ impoundment (m3)		11250

Dimensions of Wet Section of Basement/ Impoundment	
Length (m)	59.0
Width (m)	25.0
Depth of Water (m)	0.01
Fetch/ Depth (m) ratio of Wet Basement Section	2500
Volume of wet basement/ impoundment (m3)	14.8
Area covered in water (m2)	1475
Effective diameter of impoundment/ basement) (m)	43.3
Volume of water entering basement (m^3/sec)	1.48E-05

Air exchange rate (exchanges/day)		7.60E+01
Windspeed (m/s)	if < 3.5 m/sec	3.00E-02
	if = or > 3.5 m/sec	

Parameter Definition	Volatile	Chemical Concentration in Water (mg/L)	Molecular weight (g/mol)	Vapour Pressure (mmHg)	Vapour Pressure (atm)	Henry's Law Coefficient (unitless)	Henry's Law Coefficient (calculated)	Equilibrium Coefficient (at 25 deg C)	Diffusivity in Water (cm^2/sec)	Schmidt Number on Gas Side (*)	Gas Phase Mass Transfer Coefficient (m/sec)	Schmidt Number on Liquid Side #	Liquid Phase Mass Transfer Coefficient (m/s) <3.5 m/s	Overall Mass Transfer Coefficient (m/s) (windspeed <3.5 m/s)	Adopted Liquid Mass Transfer Coefficient (m/s)	Overall Mass Transfer Coefficient (m/s)	Diffusivity in Air (cm2/sec)	Equilibrium Concentration of water in Basement/ Impoundment (g/m^3)	Air Emission Rate from Liquid Surface (g/sec)	Air Emission Rate from Liquid Surface (mg/day)	Adjusted Concentration in Basement Air (includes air exchange) (mg/m3)
		C	MW	Vap	Vap	unitless	atm.m3/g mol	K_{eq}	D_{water}	Sc_G	k_G	Sc_L	K_L	K	K_L	K	D_{air}	C_L	E	E	
Acenaphthene	Y	4.48	154	2.15E-03	2.83E-06	7.52E-03	1.80E-04	7.345E-03	8.33E-06	3.0E+00	9.939E-05	1.08E+03	2.7E-07	2.0E-07	2.7E-07	2.0E-07	0.0506	1.6E-01	4.63E-05	4.00E+03	4.68E-03
Acenaphthylene	Y	43.2	152	6.68E-03	8.79E-06	4.66E-03	1.11E-04	4.551E-03	6.98E-06	3.4E+00	9.188E-05	1.29E+03	2.4E-07	1.5E-07	2.4E-07	1.5E-07	0.045	1.7E+00	3.87E-04	3.34E+04	3.91E-02
Ammonia	Y	348	17	-	-	6.58E-04	1.57E-05	6.427E-04	1.10E-05	6.6E-01	2.725E-04	8.18E+02	3.3E-07	1.1E-07	3.3E-07	1.1E-07	0.228	1.0E+01	1.73E-03	1.49E+05	1.74E-01
Aniline	N	0.212	93.1		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	Y	15.4	178	6.53E-06	8.59E-09	2.27E-03	5.42E-05	2.217E-03	7.85E-06	3.9E+00	8.348E-05	1.15E+03	2.6E-07	1.1E-07	2.6E-07	1.1E-07	0.039	5.6E-01	9.03E-05	7.80E+03	9.12E-03
Arsenic, Inorganic	N	0.024	78		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	N	2.23	137		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	N	12.6	228		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	Y	40.2	78.1	9.48E+01	1.25E-01	2.27E-01	5.42E-03	2.217E-01	1.03E-05	1.7E+00	1.456E-04	8.74E+02	3.2E-07	3.1E-07	3.2E-07	3.1E-07	0.0895	1.2E+00	5.69E-04	4.92E+04	5.75E-02
Benzo(a)pyrene	N	9.26	252		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	N	8.33	252		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	N	4.22	276		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	N	2.93	252		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	N	0.03	391		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	N	0.108	112		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	N	0.102	52		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	N	0.102	52		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	N	9.78	228		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	N	0.057	58.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	N	436	108		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	N	182	108		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	N	0.822	278		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	Y	10.2	168	2.48E-03	3.26E-06	8.71E-03	2.08E-04	8.507E-03	7.38E-06	3.7E+00	8.632E-05	1.22E+03	2.5E-07	1.9E-07	2.5E-07	1.9E-07	0.041	3.9E-01	1.08E-04	9.30E+03	1.09E-02
Dimethylphenol, 2,4-	N	38	122		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	Y	3.02	106	9.60E+00	1.26E-02	3.22E-01	7.69E-03	3.145E-01	8.46E-06	2.2E+00	1.217E-04	1.06E+03	2.8E-07	2.8E-07	2.8E-07	2.8E-07	0.0685	1.1E-01	4.27E-05	3.69E+03	4.31E-03
Fluoranthene	N	25.9	202		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	Y	21.1	166	6.00E-04	7.90E-07	3.93E-03	9.38E-05	3.838E-03	7.89E-06	3.4E+00	9.050E-05	1.14E+03	2.6E-07	1.5E-07	2.6E-07	1.5E-07	0.044	7.7E-01	1.70E-04	1.47E+04	1.72E-02
Indeno(1,2,3-cd)pyrene	N	3.05	276		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	N	187	55.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	N	0.555	207		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	N	4.89	54.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	Y	105	142	5.50E-02	7.24E-05	2.12E-02	5.06E-04	2.071E-02	7.78E-06	2.9E+00	1.017E-04	1.16E+03	2.6E-07	2.3E-07	2.6E-07	2.3E-07	0.0524	3.9E+00	1.33E-03	1.15E+05	1.34E-01
Naphthalene	Y	283	128	8.50E-02	1.12E-04	1.80E-02	4.30E-04	1.758E-02	8.38E-06	2.5E+00	1.120E-04	1.07E+03	2.8E-07	2.4E-07	2.8E-07	2.4E-07	0.0605	9.9E+00	3.53E-03	3.05E+05	3.57E-01
Nickel Soluble Salts	N	0.303	58.7		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	Y	74.1	178	1.21E-04	1.59E-07	1.73E-03	4.13E-05	1.690E-03	6.69E-06	4.4E+00	7.689E-05	1.35E+03	2.4E-07	8.4E-08	2.4E-07	8.4E-08	0.0345	3.0E+00	3.71E-04	3.21E+04	3.75E-02
Phenol	N	249	94.1		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	Y	27.9	202	4.50E-06	5.92E-09	4.87E-04	1.16E-05	4.756E-04	7.25E-06	5.4E+00	6.654E-05	1.24E+03	2.5E-07	2.8E-08	2.5E-07	2.8E-08	0.0278	1.1E+00	4.45E-05	3.84E+03	4.49E-03
Styrene	Y	0.194	104	6.40E+00	8.42E-03	1.12E-01	2.67E-03	1.094E-01	8.78E-06	2.1E+00	1.248E-04	1.03E+03	2.8E-07	2.8E-07	2.8E-07	2.8E-07	0.0711	6.6E-03	2.71E-06	2.34E+02	2.74E-04
Toluene	Y	17.6	92.1	2.84E+01	3.74E-02	2.71E-01	6.47E-03	2.647E-01	9.20E-06	1.9E+00	1.326E-04	9.78E+02	2.9E-07	2.9E-07	2.9E-07	2.9E-07	0.0778	5.8E-01	2.49E-04	2.15E+04	2.52E-02
TPH C06-C09 aliphatic	Y	6.08	103	9.16E+01	1.21E-01	5.05E+01	1.21E+00	4.932E+01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.1E-07	3.1E-07	3.1E-07	3.1E-07	0.1	1.9E-01	8.69E-05	7.51E+03	8.78E-03
TPH C10-C14 aliphatic	Y	1730	170	1.16E+00	1.53E-03	6.26E+01	1.49E+00	6.114E+01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.1E-07	3.1E-07	3.1E-07	3.1E-07	0.1	5.4E+01	2.47E-02	2.14E+06	2.50E+00
TPH C10-C14 aromatic	Y	1730	136	1.16E+00	1.53E-03	1.41E-01	3.37E-03	1.377E-01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.1E-07	3.1E-07	3.1E-07	3.1E-07	0.1	5.4E+01	2.44E-02	2.11E+06	2.46E+00
TPH C15-C28 aliphatic	n	1520	260		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	n	1520	209		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	n	332	270		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	N	332	240		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	Y	0.92	120	2.10E+00	2.76E-03	2.52E-01	6.02E-03	2.461E-01	7.92E-06	2.5E+00	1.123E-04	1.14E+03	2.7E-07	2.6E-07	2.7E-07	2.6E-07	0.0607	3.3E-02	1.30E-05	1.12E+03	1.31E-03
Vanadium and compounds	N	0.0228	50.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	Y	6.7	106	7.99E+00	1.05E-02	2.12E-01	5.06E-03	2.071E-01	9.90E-06	1.8E+00	1.404E-04	9.09E+02	3.1E-07	3.0E-07	3.1E-07	3.0E-07	0.0847	2.1E-01	9.47E-05	8.18E+03	9.57E-03

Notes:
Assumes viscosity of air at 25 deg C
(*) Adopted density and viscosity of air values are those published in USEPA Air Emissions for Wast and Waste Water Nov 1994. (viscosity = 1.81 x 10^{-4}, density = 1.2 x 10^{-3})
** where windspeeds are greater than 3.25 m/s, F/D ratios greater than 51.2 and diffusivity of ether is 8.5 x 10-5
# where viscosity of water is assumed to be 9 x 10^{-3} g/cm per sec and density of water 1g/cm^3.
Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Summary of Derived RBSLs
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

Chemical	Soil RBSLs (mg/kg)						Groundwater RBSLs (mg/L)					
	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Saturation Limited?	Site Concentration	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Solubility Limited?	Site Concentration
Acenaphthene	-	-	-	-	-	-	1.60E+02	8.75E+02	-	1.60E+02	>Sol	4.48E+00
Acenaphthylene	-	-	-	-	-	-	7.90E+01	4.33E+02	-	7.90E+01	>Sol	4.32E+01
Ammonia	-	-	-	-	-	-	6.32E+02	3.47E+03	-	6.32E+02	-	3.48E+02
Aniline	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	-	-	-	-	-	4.56E+00	2.50E+01	-	4.56E+00	>Sol	1.54E+01
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	-	-	-	-	-	7.65E+00	4.20E+01	1.20E+01	7.65E+00	-	4.02E+01
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	-	-	-	-	-	-	2.73E+02	1.50E+03	-	2.73E+02	>Sol	1.02E+01
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	1.04E+03	5.70E+03	-	1.04E+03	>Sol	3.02E+00
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	-	-	-	-	-	1.25E+01	6.88E+01	-	1.25E+01	>Sol	2.11E+01
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	-	-	-	-	-	-	2.34E+01	1.29E+02	-	2.34E+01	-	1.05E+02
Naphthalene	-	-	-	-	-	-	2.38E-01	1.30E+00	-	2.38E-01	-	2.83E+02
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	5.87E+00	3.22E+01	-	5.87E+00	>Sol	7.41E+01
Phenol	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	2.88E+00	1.58E+01	-	2.88E+00	>Sol	2.79E+01
Styrene	-	-	-	-	-	-	8.41E+02	4.61E+03	-	8.41E+02	>Sol	1.94E-01
Toluene	-	-	-	-	-	-	3.99E+03	2.19E+04	-	3.99E+03	>Sol	1.76E+01
TPH C06-C09 aliphatic	-	-	-	-	-	-	7.27E+03	3.99E+04	-	7.27E+03	>Sol	6.08E+00
TPH C10-C14 aliphatic	-	-	-	-	-	-	5.70E-01	3.13E+00	-	5.70E-01	>Sol	1.73E+03
TPH C10-C14 aromatic	-	-	-	-	-	-	1.17E+00	6.43E+00	-	1.17E+00	-	1.73E+03
TPH C15-C28 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	-	-	-	-	-	-	2.24E+01	1.23E+02	-	2.24E+01	-	9.20E-01
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	-	-	-	-	-	-	1.76E+02	9.64E+02	-	1.76E+02	>Sol	6.70E+00

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Pathways included in derivation of Soil RBSL:

Pathways included in derivation of Soil Vapour RBSL:

Pathways included in derivation of Groundwater RBSL:

Health Risk Calculations - Vapours from Flowing Water
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

			Threshold Intake and Risk Calculations							Non-Threshold Intake Risk Calculations					
Chemical	Vapour Concentration in Basement/ Impoundment	Aqueous Solubility	Inhalation RfC	Adult Exposure Factor (threshold)	Adult Exposure Adjusted Air Concentration (threshold)	Hazard Index (Adult)	Child Exposure Factor (threshold)	Child Exposure Adjusted Air Concentration (threshold)	Hazard Index (Child)	Inhalation Unit Risk	Adult Exposure Factor (non-threshold)	Child Exposure Factor (non-threshold)	Lifetime Exposure Factor (non-threshold)	Lifetime Exposure Adjusted Air Concentration (non-threshold)	Lifetime Excess Cancer Risk
	mg/m^3	(mg/L)	(mg/m3)	(L/m3)	(mg/m3)	(unitless)	(L/m3)	(mg/m3)	(unitless)	(ug/m3)-1	(L/m3)	(L/m3)	(L/m3)	(mg/m3)	(unitless)
Acenaphthene	4.68E-03	3.90E+00	2.10E-01	2.19E-01	1.03E-03	4.89E-03	4.00E-02	1.87E-04	8.91E-04	-	-	-	-	-	-
Acenaphthylene	3.91E-02	1.61E+01	2.10E-01	2.19E-01	8.56E-03	4.08E-02	4.00E-02	1.56E-03	7.43E-03	-	-	-	-	-	-
Ammonia	1.74E-01	4.82E+05	6.95E-02	2.19E-01	3.82E-02	5.50E-01	4.00E-02	6.97E-03	1.00E-01	-	-	-	-	-	-
Aniline	-	3.60E+04	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	9.12E-03	4.34E-02	1.05E+00	2.19E-01	2.00E-03	1.90E-03	4.00E-02	3.64E-04	3.47E-04	-	-	-	-	-	-
Arsenic, Inorganic	-	0.00E+00	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	0.00E+00	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	9.40E-03	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	5.75E-02	1.79E+03	9.60E-03	2.19E-01	1.26E-02	1.31E+00	4.00E-02	2.30E-03	2.39E-01	6.00E-06	9.39E-02	3.42E-03	9.74E-02	5.60E-03	3.36E-05
Benzo(a)pyrene	-	1.62E-03	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	1.50E-03	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	2.60E-04	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	8.00E-04	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	2.70E-01	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	0.00E+00	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	0.00E+00	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	1.69E+06	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	2.00E-03	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	0.00E+00	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	-	2.27E+04	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	-	2.59E+04	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	2.49E-03	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	1.09E-02	3.10E+00	2.10E-01	2.19E-01	2.38E-03	1.14E-02	4.00E-02	4.35E-04	2.07E-03	-	-	-	-	-	-
Dimethylphenol, 2,4-	-	7.87E+03	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	4.31E-03	1.69E+02	1.30E+00	2.19E-01	9.45E-04	7.27E-04	4.00E-02	1.72E-04	1.33E-04	-	-	-	-	-	-
Fluoranthene	-	2.60E-01	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	1.72E-02	1.69E+00	1.40E-01	2.19E-01	3.77E-03	2.69E-02	4.00E-02	6.87E-04	4.91E-03	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	1.90E-04	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	0.00E+00	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	0.00E+00	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	0.00E+00	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	1.34E-01	2.46E+01	1.40E-01	2.19E-01	2.94E-02	2.10E-01	4.00E-02	5.36E-03	3.83E-02	-	-	-	-	-	-
Naphthalene	3.57E-01	3.10E+01	3.00E-03	2.19E-01	7.83E-02	2.61E+01	4.00E-02	1.43E-02	4.76E+00	-	-	-	-	-	-
Nickel Soluble Salts	-	0.00E+00	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	3.75E-02	1.15E+00	2.10E-01	2.19E-01	8.23E-03	3.92E-02	4.00E-02	1.50E-03	7.14E-03	-	-	-	-	-	-
Phenol	-	8.28E+04	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	4.49E-03	1.35E-01	1.05E-01	2.19E-01	9.85E-04	9.38E-03	4.00E-02	1.80E-04	1.71E-03	-	-	-	-	-	-
Styrene	2.74E-04	3.10E+02	2.60E-01	2.19E-01	6.00E-05	2.31E-04	4.00E-02	1.09E-05	4.20E-05	-	-	-	-	-	-
Toluene	2.52E-02	5.26E+02	5.00E+00	2.19E-01	5.51E-03	1.10E-03	4.00E-02	1.01E-03	2.01E-04	-	-	-	-	-	-
TPH C06-C09 aliphatic	8.78E-03	1.18E+01	1.84E+01	2.19E-01	1.92E-03	1.05E-04	4.00E-02	3.51E-04	1.91E-05	-	-	-	-	-	-
TPH C10-C14 aliphatic	2.50E+00	9.99E-02	1.00E+00	2.19E-01	2.19E-02	2.19E-02	4.00E-02	3.99E-03	3.99E-03	-	-	-	-	-	-
TPH C10-C14 aromatic	2.46E+00	2.53E+01	2.00E-01	2.19E-01	5.40E-01	2.70E+00	4.00E-02	9.84E-02	4.92E-01	-	-	-	-	-	-
TPH C15-C28 aliphatic	-	1.11E-04	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	1.06E+00	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	2.50E-06	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	6.60E-03	-	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	1.31E-03	5.70E+01	7.00E-03	2.19E-01	2.87E-04	4.10E-02	4.00E-02	5.23E-05	7.47E-03	-	-	-	-	-	-
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	9.57E-03	1.06E+02	2.20E-01	2.19E-01	2.10E-03	9.54E-03	4.00E-02	3.82E-04	1.74E-03	-	-	-	-	-	-
TOTAL						**3.11E+01**			**5.66E+00**						**3.36E-05**

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

			Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)							Pathway Contributions to Total Estimated Risk at RBSL	
Chemical	Cgw	Solubility	GW vapours from flowing water	TOTAL (All Pathways)	GW vapours from flowing water	Total Vapour Pathways	TOTAL (All Pathways)	RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL	GW vapours from flowing water	TOTAL
	mg/L	mg/L	unitless	unitless	unitless	L/mg	L/mg	mg/L			mg/L	%	%
Acenaphthene	4.48	3.90E+00	4.89E-03	4.89E-03	1.25E-03	1.25E-03	1.25E-03	1.60E+02	4.89E-03	4.89E-03	**1.60E+02**	2.4%	2.44%
Acenaphthylene	43.2	1.61E+01	4.08E-02	4.08E-02	2.53E-03	2.53E-03	2.53E-03	7.90E+01	4.08E-02	4.08E-02	**7.90E+01**	20.4%	20.39%
Ammonia	348	4.82E+05	5.50E-01	5.50E-01	1.58E-03	1.58E-03	1.58E-03	6.32E+02	1.00E+00	-	**6.32E+02**	100.0%	100.00%
Aniline	0.212	3.60E+04	-	-	-		-	-	-	-	**-**	-	-
Anthracene	15.4	4.34E-02	1.90E-03	1.90E-03	4.39E-02	4.39E-02	4.39E-02	4.56E+00	1.90E-03	1.90E-03	**4.56E+00**	1.0%	0.95%
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	**-**	-	-
Barium	2.23		-	-	-		-	-	-	-	**-**	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	**-**	-	-
Benzene	40.2	1.79E+03	1.31E+00	1.31E+00	3.27E-02	3.27E-02	3.27E-02	7.65E+00	2.50E-01	-	**7.65E+00**	100.0%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	**-**	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	**-**	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	**-**	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	**-**	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	**-**	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	**-**	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	**-**	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	**-**	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	**-**	-	-
Cobalt	0.057		-	-	-		-	-	-	-	**-**	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-		-	-	-	-	**-**	-	-
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	**-**	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	**-**	-	-
Dibenzofuran	10.2	3.10E+00	1.14E-02	1.14E-02	3.66E-03	3.66E-03	3.66E-03	2.73E+02	1.14E-02	1.14E-02	**2.73E+02**	1.1%	1.14%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	**-**	-	-
Ethylbenzene	3.02	1.69E+02	7.27E-04	7.27E-04	2.41E-04	2.41E-04	2.41E-04	1.04E+03	4.07E-02	4.07E-02	**1.04E+03**	16.3%	16.28%
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	**-**	-	-
Fluorene	21.1	1.69E+00	2.69E-02	2.69E-02	1.59E-02	1.59E-02	1.59E-02	1.25E+01	2.69E-02	2.69E-02	**1.25E+01**	13.5%	13.47%
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	**-**	-	-
Iron	187		-	-	-		-	-	-	-	**-**	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	**-**	-	-
Manganese	4.89		-	-	-		-	-	-	-	**-**	-	-
Methylnaphthalene, 2-	105	2.46E+01	2.10E-01	2.10E-01	8.53E-03	8.53E-03	8.53E-03	2.34E+01	2.00E-01	-	**2.34E+01**	100.0%	100.00%
Naphthalene	283	3.10E+01	2.61E+01	2.61E+01	8.42E-01	8.42E-01	8.42E-01	2.38E-01	2.00E-01	-	**2.38E-01**	100.0%	100.00%
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	**-**	-	-
Phenanthrene	74.1	1.15E+00	3.92E-02	3.92E-02	3.41E-02	3.41E-02	3.41E-02	5.87E+00	3.92E-02	3.92E-02	**5.87E+00**	19.6%	19.58%
Phenol	249	8.28E+04	-	-	-		-	-	-	-	**-**	-	-
Pyrene	27.9	1.35E-01	9.38E-03	9.38E-03	6.95E-02	6.95E-02	6.95E-02	2.88E+00	9.38E-03	9.38E-03	**2.88E+00**	4.7%	4.69%
Styrene	0.194	3.10E+02	2.31E-04	2.31E-04	1.19E-03	1.19E-03	1.19E-03	8.41E+02	3.69E-01	3.69E-01	**8.41E+02**	36.9%	36.86%
Toluene	17.6	5.26E+02	1.10E-03	1.10E-03	6.27E-05	6.27E-05	6.27E-05	3.99E+03	3.30E-02	3.30E-02	**3.99E+03**	13.2%	13.18%
TPH C06-C09 aliphatic	6.08	1.18E+01	1.05E-04	1.05E-04	1.72E-05	1.72E-05	1.72E-05	7.27E+03	2.03E-04	2.03E-04	**7.27E+03**	0.2%	0.16%
TPH C10-C14 aliphatic	1730	9.99E-02	2.19E-02	2.19E-02	2.19E-01	2.19E-01	2.19E-01	5.70E-01	2.19E-02	2.19E-02	**5.70E-01**	17.5%	17.52%
TPH C10-C14 aromatic	1730	2.53E+01	2.70E+00	2.70E+00	1.07E-01	1.07E-01	1.07E-01	1.17E+00	1.25E-01	-	**1.17E+00**	100.0%	100.00%
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	**-**	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	**-**	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	**-**	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	**-**	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	4.10E-02	4.10E-02	4.45E-02	4.45E-02	4.45E-02	2.24E+01	1.00E+00	-	**2.24E+01**	100.0%	100.00%
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	**-**	-	-
Xylenes (total)	6.7	1.06E+02	9.54E-03	9.54E-03	1.42E-03	1.42E-03	1.42E-03	1.76E+02	1.51E-01	1.51E-01	**1.76E+02**	60.3%	60.34%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Child Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Residential Receptor) (Risk Based Calculations)

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW Vapurs from Flowing Water	TOTAL (All Pathways)	GW Vapour from Flowing Water	Total Vapour Pathways	TOTAL (All Pathways)					GW Vapours from Flowing Water	TOTAL
	mg/L	mg/L	unitless	unitless	unitless	L/mg	L/mg	mg/L			mg/L	%	%
Acenaphthene	4.48	3.90E+00	8.91E-04	8.91E-04	2.28E-04	2.28E-04	2.28E-04	8.75E+02	8.91E-04	8.91E-04	**8.75E+02**	0.4%	0.45%
Acenaphthylene	43.2	1.61E+01	7.43E-03	7.43E-03	4.62E-04	4.62E-04	4.62E-04	4.33E+02	7.43E-03	7.43E-03	**4.33E+02**	3.7%	3.72%
Ammonia	348	4.82E+05	1.00E-01	1.00E-01	2.88E-04	2.88E-04	2.88E-04	3.47E+03	1.00E+00	-	**3.47E+03**	100.0%	100.00%
Aniline	0.212	3.60E+04	-	-	-		-	-	-	-	**-**	-	-
Anthracene	15.4	4.34E-02	3.47E-04	3.47E-04	8.00E-03	8.00E-03	8.00E-03	2.50E+01	3.47E-04	3.47E-04	**2.50E+01**	0.2%	0.17%
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	**-**	-	-
Barium	2.23		-	-	-		-	-	-	-	**-**	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	**-**	-	-
Benzene	40.2	1.79E+03	2.39E-01	2.39E-01	5.95E-03	5.95E-03	5.95E-03	4.20E+01	2.50E-01	-	**4.20E+01**	100.0%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	**-**	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	**-**	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	**-**	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	**-**	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	**-**	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	**-**	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	**-**	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	**-**	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	**-**	-	-
Cobalt	0.057		-	-	-		-	-	-	-	**-**	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-		-	-	-	-	**-**	-	-
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	**-**	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	**-**	-	-
Dibenzofuran	10.2	3.10E+00	2.07E-03	2.07E-03	6.68E-04	6.68E-04	6.68E-04	1.50E+03	2.07E-03	2.07E-03	**1.50E+03**	0.2%	0.21%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	**-**	-	-
Ethylbenzene	3.02	1.69E+02	1.33E-04	1.33E-04	4.39E-05	4.39E-05	4.39E-05	5.70E+03	7.42E-03	7.42E-03	**5.70E+03**	3.0%	2.97%
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	**-**	-	-
Fluorene	21.1	1.69E+00	4.91E-03	4.91E-03	2.91E-03	2.91E-03	2.91E-03	6.88E+01	4.91E-03	4.91E-03	**6.88E+01**	2.5%	2.45%
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	**-**	-	-
Iron	187		-	-	-		-	-	-	-	**-**	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	**-**	-	-
Manganese	4.89		-	-	-		-	-	-	-	**-**	-	-
Methylnaphthalene, 2-	105	2.46E+01	3.83E-02	3.83E-02	1.56E-03	1.56E-03	1.56E-03	1.29E+02	3.83E-02	3.83E-02	**1.29E+02**	19.1%	19.13%
Naphthalene	283	3.10E+01	4.76E+00	4.76E+00	1.53E-01	1.53E-01	1.53E-01	1.30E+00	2.00E-01	-	**1.30E+00**	100.0%	100.00%
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	**-**	-	-
Phenanthrene	74.1	1.15E+00	7.14E-03	7.14E-03	6.21E-03	6.21E-03	6.21E-03	3.22E+01	7.14E-03	7.14E-03	**3.22E+01**	3.6%	3.57%
Phenol	249	8.28E+04	-	-	-		-	-	-	-	**-**	-	-
Pyrene	27.9	1.35E-01	1.71E-03	1.71E-03	1.27E-02	1.27E-02	1.27E-02	1.58E+01	1.71E-03	1.71E-03	**1.58E+01**	0.9%	0.85%
Styrene	0.194	3.10E+02	4.20E-05	4.20E-05	2.17E-04	2.17E-04	2.17E-04	4.61E+03	6.72E-02	6.72E-02	**4.61E+03**	6.7%	6.72%
Toluene	17.6	5.26E+02	2.01E-04	2.01E-04	1.14E-05	1.14E-05	1.14E-05	2.19E+04	6.01E-03	6.01E-03	**2.19E+04**	2.4%	2.40%
TPH C06-C09 aliphatic	6.08	1.18E+01	1.91E-05	1.91E-05	3.14E-06	3.14E-06	3.14E-06	3.99E+04	3.70E-05	3.70E-05	**3.99E+04**	0.0%	0.03%
TPH C10-C14 aliphatic	1730	9.99E-02	3.99E-03	3.99E-03	4.00E-02	4.00E-02	4.00E-02	3.13E+00	3.99E-03	3.99E-03	**3.13E+00**	3.2%	3.19%
TPH C10-C14 aromatic	1730	2.53E+01	4.92E-01	4.92E-01	1.94E-02	1.94E-02	1.94E-02	6.43E+00	1.25E-01	-	**6.43E+00**	100.0%	100.00%
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	**-**	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	**-**	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	**-**	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	**-**	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	7.47E-03	7.47E-03	8.12E-03	8.12E-03	8.12E-03	1.23E+02	4.63E-01	4.63E-01	**1.23E+02**	46.3%	46.29%
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	**-**	-	-
Xylenes (total)	6.7	1.06E+02	1.74E-03	1.74E-03	2.59E-04	2.59E-04	2.59E-04	9.64E+02	2.75E-02	2.75E-02	**9.64E+02**	11.0%	11.00%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Non-Threshold Health Effects
Barangaroo Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (ILCR)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW Vapours from Flowing Water	TOTAL (All Pathways)	GW Vapours from Flowing Water	Total Vapour Pathways	TOTAL (All Pathways)				GW Vapours from Flowing Water	TOTAL
	mg/L	mg/L	unitless	unitless	L/mg	L/mg	L/mg	mg/L		mg/L	%	%
Acenaphthene	4.48	3.90E+00	-	-	-		-	-	-	-	-	-
Acenaphthylene	43.2	1.61E+01	-	-	-		-	-	-	-	-	-
Ammonia	348	4.82E+05	-	-	-		-	-	-	-	-	-
Aniline	0.212	3.60E+04	-	-	-		-	-	-	-	-	-
Anthracene	15.4	4.34E-02	-	-	-		-	-	-	-	-	-
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	-	-
Barium	2.23		-	-	-		-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	-	-
Benzene	40.2	1.79E+03	3.36E-05	3.36E-05	8.36E-07	8.36E-07	8.36E-07	1.20E+01	1.00E-05	**1.20E+01**	100.00%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	-	-
Cobalt	0.057		-	-	-		-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-		-	-	-	-	-	-
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	-	-	-		-	-	-	-	-	-
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	-	-	-		-	-	-	-	-	-
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	-	-
Fluorene	21.1	1.69E+00	-	-	-		-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	-	-
Iron	187		-	-	-		-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	-	-
Manganese	4.89		-	-	-		-	-	-	-	-	-
Methylnaphthalene, 2-	105	2.46E+01	-	-	-		-	-	-	-	-	-
Naphthalene	283	3.10E+01	-	-	-		-	-	-	-	-	-
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	-	-	-		-	-	-	-	-	-
Phenol	249	8.28E+04	-	-	-		-	-	-	-	-	-
Pyrene	27.9	1.35E-01	-	-	-		-	-	-	-	-	-
Styrene	0.194	3.10E+02	-	-	-		-	-	-	-	-	-
Toluene	17.6	5.26E+02	-	-	-		-	-	-	-	-	-
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-		-	-	-	-	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-		-	-	-	-	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-		-	-	-	-	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	-	-	-		-	-	-	-	-	-
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	-	-	-		-	-	-	-	-	-

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

1. General Information:

Site:	Barangaroo
Address:	Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Client:	Lend Lease
Scenario:	Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations)

Header Colour (Defaults = Blue):

Blue

2. Select Receptor:

Commercial/Industrial

3. Select Exposure Pathways to Include:

Enter "x" in box, or select from dropdown box.

Soil Pathways

	Incidental Ingestion of Soil
	Dermal Contact with Soil
	Inhalation of Surface Soil-Derived Dust in Indoor Air
	Inhalation of Surface Soil-Derived Dust in Outdoor Air
	Inhalation of Surface Soil-Derived Vapours in Outdoor Air
	Inhalation of Soil-Derived Vapours From Excavation (USEPA 2002 method)
x	Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
	Inhalation of Subsurface Soil-Derived Vapours in Outdoor Air

Groundwater Pathways

	Inhalation of Groundwater-Derived Vapours in Indoor Air
	Inhalation of Groundwater-Derived Vapours in Outdoor Air
	Ingestion of Potable Groundwater
	Incidental Ingestion of Groundwater (Bathing or Excavation)
	Dermal Contact with Groundwater (Bathing or Excavation)
	Inhalation of Groundwater Vapours during Irrigation/ Showering
	Ingestion of Vegetables Irrigated with Groundwater
	Inhalation of Groundwater Vapours (Where GW Enters Trench)
x	Inhalation of vapour emissions from flowing water (groundwater in basement)
	Inhalation of Soil Vapour-Derived Vapours in Indoor Air
	Inhalation of Soil Vapour-Derived Vapours in Outdoor Air

Y	Soil RBSLs saturation limited?
Y	Groundwater RBSLs solubility limited?

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

4. Select Chemicals for Quantitative Assessment:	Target Hazard Index	Target Cancer Risk	5. Enter Chemical Concentrations (if only calculating RBSLs, enter 1 for media for which you want RBSLs):	
	default = 1 (or manually overwrite)	default = $1x10^{-5}$ (or manually overwrite)	Soil (mg/kg)	Groundwater (mg/L)
Acenaphthene	0.2	1.00E-05	511	4.48
Acenaphthylene	0.2	1.00E-05	1700	43.2
Ammonia	1	1.00E-05		348
Aniline	1	1.00E-05		0.212
Anthracene	0.2	1.00E-05	2150	15.4
Arsenic, Inorganic	1	1.00E-05		0.024
Barium	1	1.00E-05		2.23
Benz(a)anthracene			1470	12.6
Benzene	0.25	1.00E-05	1510	40.2
Benzo(a)pyrene			652	9.26
Benzo(b)fluoranthene			587	8.33
Benzo(g,h,i)perylene			305	4.22
Benzo(k)fluoranthene			231	2.93
Bis(2-ethylhexyl)phalate	1	1.00E-05		0.03
Cadmium (Water)	1	1.00E-05		0.108
Chromium(III), Insoluble Salts	1	1.00E-05	210	0.102
Chromium(VI)	1	1.00E-05	2.3	0.102
Chrysene			771	9.78
Cobalt	1	1.00E-05		0.057
Cresol, m-&p-	1	1.00E-05	2290	436
Cresol, o-	1	1.00E-05		182
Blank				
Dibenz(a,h)anthracene			71.4	0.822
Dibenzofuran	1	1.00E-05	277	10.2
Dimethylphenol, 2,4-	1	1.00E-05		38
Ethylbenzene	0.25	1.00E-05	261	3.02
Fluoranthene			2440	25.9
Fluorene	0.2	1.00E-05	2100	21.1
Indeno(1,2,3-cd)pyrene			247	3.05
Iron	1	1.00E-05	60600	187
Lead and Compounds	1	1.00E-05	13600	0.555
Manganese	1	1.00E-05		4.89
Methylnaphthalene, 2-	0.2	1.00E-05	7650	105
Naphthalene	0.2	1.00E-05	10200	283
Nickel Soluble Salts	1	1.00E-05		0.303
Phenanthrene	0.2	1.00E-05	5180	74.1
Phenol	1	1.00E-05		249
Pyrene	0.2	1.00E-05	2640	27.9
Styrene	1	1.00E-05		0.194
Toluene	0.25	1.00E-05	2650	17.6
TPH C06-C09 aliphatic	0.125	1.00E-05	593	6.08
TPH C10-C14 aliphatic	0.125	1.00E-05	69400	1730
TPH C10-C14 aromatic	0.125	1.00E-05	69400	1730
TPH C15-C28 aliphatic	0.125	1.00E-05	93200	1520
TPH C15-C28 aromatic	0.125	1.00E-05	93200	1520
TPH C29-C36 aliphatic	0.125	1.00E-05	20600	332
TPH C29-C36 aromatic	0.125	1.00E-05	20600	332
Trimethylbenzene, 1,2,4-	1	1.00E-05	220	0.92
Vanadium and compounds	1	1.00E-05	248	0.0228
Xylenes (total)	0.25	1.00E-05	2567	6.7

6. Confirm/Modify Exposure Parameters:

		Site-Specific Value (leave blank to use default value)		Value Used in Calculations	
		Adult	Child	Adult	Child
General receptor parameters:	**Units**				
Body weight	kg	70	na	70	
Exposure duration	yr	30	na	30	
Averaging time (carcinogens)	yr	70	na	70	
Averaging time (non-carcinogens)	yr	30	na	30	
Incidental Soil Ingestion					
Daily soil ingestion rate	mg/day				
Exposure frequency for soil ingestion	days/yr				
Fraction of daily soil intake from site	unitless				
Dermal Absorption of Soil					
Exposed skin surface area for soil contact	cm2				
Soil to skin adherence factor	mg/cm2				
Exposure frequency for dermal contact with soil	days/yr				
Indoor Inhalation					
Exposure time (indoor air)	hrs/day	8	8	8	8
Exposure frequency (indoor air)	days/yr	240	240	240	240
Particulate emission factor (indoor air)	m3/kg				
Outdoor Inhalation					
Exposure time (outdoor air)	hrs/day				
Exposure frequency (outdoor air)	days/yr				
Particulate emission factor (outdoor air)	m3/kg				
Potable Water Ingestion					
Potable water intake rate	L/day				
Exposure frequency for potable water intake	days/yr				
Incidental Water Ingestion					
Incidental ingestion rate	L/day				
Exposure frequency for incidental water ingestion	days/yr				
Dermal Contact with Water					
Exposed skin surface for water contact	cm2				
Exposure time for dermal water contact	hr/day				
Exposure frequency for dermal water contact	days/yr				
Vapour Inhalation Shower/ Sprinkler					
Exposure frequency	days/yr				
Exposure time	min/ day				
Inhalation rate	m3/hr				
Inhalation Absorption Adjustment Factor	mg/mg				
Lung retention factor	unitless				
Ingestion of Home Grown Produce					
Proportion of homegrown produce ingested					
Exposure frequency	days/year				
Inhalation of Vapours from Flowing Water					
Exposure time	hrs/day	8	na	8	
Exposure frequency	days/year	240	na	240	

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

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A. Model Input Parameters

Parameter Definition	Units	Default Value (Shell 2007 unless otherwise noted)	Notes	Site-Specific Value (leave blank if adopting Shell default)	Label	Adopted Value for Model	Justification for Site-specific value, if applicable
Lower depth of surficial soil zone	cm	100			LDSSZ	100	
Depth to subsurface soil sources (below building, ground surface or trench	cm	100			LS	0.001	Autocalculates from layer thicknesses
Vadose Zone Layer 1 (soil type where source is)							
Thickness	cm	100		0.001	HV	0.001	Negligible distance - assumes soil is adjacent building foundataion
SCS Soil Type:				Sand and gravel (<12% fines)			Conservative assumption for mixed fill.
Fraction of organic carbon	unitless	0.01		0.002	OC	0.002	
Soil bulk density	g/cm3	1.7		1.66	sbd	1.66	
Air-filled porosity (volumetric)	cm3/cm3	0.26		0.321	VACS	0.321	
Water-filled porosity (volumetric)	cm3/cm3	0.12		0.054	vwcvz	0.054	
Total soil porosity	cm3/cm3	0.38		0.375	TPOR	0.375	
Vapour phase source partitioning adjustment	unitless	1		10	VPPA	10	Adjustment for vapour partitioning; see text.
Vadose zone biodegradation adjustment	unitless	1		1	BioA	1	Conservatively assumes no soil vapour biodegradation
Vadose Zone Layer 2 (lens)							
Thickness	cm				Hvtwo		
SCS Soil Type:							
Air-filled porosity (volumetric)	cm3/cm3	NA			VACS2	NA	
Water-filled porosity (volumetric)	cm3/cm3	NA			vwcvz2	NA	
Total soil porosity	cm3/cm3	NA			TPOR2	NA	
Vadose Zone Layer 3 (lens)							
Thickness	cm				Hvthree		
SCS Soil Type:							
Air-filled porosity (volumetric)	cm3/cm3	NA			VACS3	NA	
Water-filled porosity (volumetric)	cm3/cm3	NA			Vwcvz3	NA	
Total soil porosity	cm3/cm3	NA			TPOR3	NA	
Building Characteristics							
Enclosed-space volume/infiltration area (ratio)	cm	300	(a)	5625	LB	5625	Assumes 50 m by 50 m by 4.5 m high basement section, with soil vapour infiltration through upper 2m of 2 of 4 walls only (no floor), ie volume = 11250 m3 and infilatration area = 200 m2. See text.
Enclosed-space foundation or wall thickness	cm	15		15	Lcrack	15	Conservative default
Enclosed-space air exchange rate	1/s	0.000555556		0.00088	ENCAER	8.80E-04	assumed to be 3.17 air exchanges per hour- as per information provided by Lend Lease
Areal fraction of cracks in foundations/walls	cm^2-cracks/cm^2-total area	0.0019	(b)	0.0002	NU	0.0002	USEPA (2004) default for basement foundation.
Volumetric air content in found./wall cracks	cc/cc	0.26		0.321	VACF	0.321	Assumes cracks in concrete are filled with sand
Volumetric water content in found./wall cracks	cc/cc	0.12		0.054	vwcfnd	0.054	Assumes cracks in concrete are filled with sand
Convective vapour flow term							
Calculate convective flow term?		Y		Y	Conv	Y	
Convective flow rate (if specified directly)	cm3/sec						
Convective flow through slab (calculated)	cm3/sec	10.88		380.3828744	Qs	380.38	
Slab Area	cm2	700000		2.70E+07	Ab	27000000	Area through which vapours may enter (conservatively includes floor and two walls)
Areal fraction of cracks in foundations/walls	cm^2-cracks/cm^2-total area	0.0019		0.0002	Nuc		
Soil vapour permeability	cm^2	1.00E-08		1.00E-07	kv	1.00E-07	Conservative default for coarse sand/gravel
Indoor-outdoor pressure differential	g/cm-s^2	40		40	dP	40	USEPA (2004b) default
Slab perimeter	cm	3400		20000	Xcrack	20000	Perimeter of basement footprint.
Depth below ground to bottom of slab	cm	15		200	Zcrack	200	Advection occurring to max depth of 2 m.
Viscosity of air	g/cm-s	1.81E-04		1.81E-04	uair	1.81E-04	Viscosity of air at 20 C

(a) Building Code of Australia minimum ceiling height for habitable dwelling.
(b) USEPA (2004) upper limit of range for slab on grade foundation.
(c) If receptor is construction/excavation worker, wind speed is default wind speed of 225 cm/s reduced by factor of 10 to account for reduced wind circulation within excavation. For other receptors, wind speed is default of 225 cm/s.
(d) For construction/excavation worker, default is 400 cm (assumes trench is 2 m long and 2 m deep, and vapours enter through both walls and floor). For other receptors, Shell (2007) default of 4500 cm is assumed.
(e) Equals exposure duration for selected receptor. For residential scenario, shortest (child) exposure duration is selected for conservative purposes.
(f) USEPA (2002) default (0.5 acre).

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

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B. Chemical-Specific Fate and Transport Parameters

CHEMICAL	Koc	Kd	H'	S	D^{air}	D^{wat}	MW	VP	Volatile?
	(cm^3/g)	(cm^3/g)	($cc\text{-}H_20$ / cc-air)	(mg/l-water)	(cm^2/s)	(cm^2/s)	(g/mol)	(mmHg)	
Acenaphthene	5.03E+03	1.01E+01	7.52E-03	3.90E+00	5.06E-02	8.33E-06	1.54E+02	2.15E-03	Y
Acenaphthylene	5.03E+03	1.01E+01	4.66E-03	1.61E+01	4.50E-02	6.98E-06	1.52E+02	6.68E-03	Y
Ammonia	3.10E+00	6.20E-03	6.58E-04	4.82E+05	2.28E-01	1.10E-05	1.70E+01	-	Y
Aniline	7.02E+01	1.40E-01	8.26E-05	3.60E+04	8.30E-02	1.01E-05	9.31E+01	4.90E-01	N
Anthracene	1.64E+04	3.28E+01	2.27E-03	4.34E-02	3.90E-02	7.85E-06	1.78E+02	6.53E-06	Y
Arsenic, Inorganic	-	#VALUE!	-		-	-	7.80E+01	-	N
Barium	-	#VALUE!	-		-	-	1.37E+02	-	N
Benz(a)anthracene	1.77E+05	3.54E+02	1.37E-04	9.40E-03	5.10E-02	9.00E-06	2.28E+02	2.10E-07	N
Benzene	1.46E+02	2.92E-01	2.27E-01	1.79E+03	8.95E-02	1.03E-05	7.81E+01	9.48E+01	Y
Benzo(a)pyrene	5.87E+05	1.17E+03	1.87E-05	1.62E-03	4.30E-02	9.00E-06	2.52E+02	5.49E-09	N
Benzo(b)fluoranthene	5.99E+05	1.20E+03	2.69E-05	1.50E-03	2.26E-02	5.56E-06	2.52E+02	5.00E-07	N
Benzo(g,h,i)perylene	1.95E+06	3.90E+03	1.35E-05	2.60E-04	4.90E-02	5.56E-06	2.76E+02	1.00E-10	N
Benzo(k)fluoranthene	5.87E+05	1.17E+03	2.39E-05	8.00E-04	2.26E-02	5.56E-06	2.52E+02	9.65E-10	N
Bis(2-ethylhexyl)phalate	1.20E+05	2.40E+02	1.10E-05	2.70E-01	3.51E-02	3.66E-06	3.91E+02	1.42E-07	N
Cadmium (Water)	-	#VALUE!	-		-	-	1.12E+02		N
Chromium(III), Insoluble Salts	-	#VALUE!	-		-	-	5.20E+01	-	N
Chromium(VI)	-	#VALUE!	-	1.69E+06	-	-	5.20E+01	-	N
Chrysene	1.81E+05	3.62E+02	2.14E-04	2.00E-03	2.48E-02	6.21E-06	2.28E+02	6.23E-09	N
Cobalt	-	#VALUE!	-		-	-	5.89E+01		N
Cresol, m-&p-	3.00E+02	6.00E-01	3.50E-05	2.27E+04	7.29E-02	9.32E-06	1.08E+02	1.10E-01	N
Cresol, o-	3.07E+02	6.14E-01	4.91E-05	2.59E+04	7.28E-02	9.32E-06	1.08E+02	1.70E-01	N
Dibenz(a,h)anthracene	1.91E+06	3.82E+03	5.76E-06	2.49E-03	2.00E-02	5.24E-06	2.78E+02	9.55E-10	N
Dibenzofuran	9.16E+03	1.83E+01	8.71E-03	3.10E+00	4.10E-02	7.38E-06	1.68E+02	2.48E-03	Y
Dimethylphenol, 2,4-	4.92E+02	9.84E-01	3.89E-05	7.87E+03	6.22E-02	8.31E-06	1.22E+02	1.02E-01	N
Ethylbenzene	4.46E+02	8.92E-01	3.22E-01	1.69E+02	6.85E-02	8.46E-06	1.06E+02	9.60E+00	Y
Fluoranthene	5.55E+04	1.11E+02	3.62E-04	2.60E-01	3.02E-02	6.35E-06	2.02E+02	9.22E-06	N
Fluorene	9.16E+03	1.83E+01	3.93E-03	1.69E+00	4.40E-02	7.89E-06	1.66E+02	6.00E-04	Y
Indeno(1,2,3-cd)pyrene	1.95E+06	3.90E+03	1.42E-05	1.90E-04	2.30E-02	4.41E-06	2.76E+02	1.25E-10	N
Iron	-	#VALUE!	-		-	-	5.59E+01		N
Lead and Compounds	-	#VALUE!	-		-	-	2.07E+02		N
Manganese	-	#VALUE!	-		-	-	5.49E+01	-	N
Methylnaphthalene, 2-	2.48E+03	4.96E+00	2.12E-02	2.46E+01	5.24E-02	7.78E-06	1.42E+02	5.50E-02	Y
Naphthalene	1.54E+03	3.08E+00	1.80E-02	3.10E+01	6.05E-02	8.38E-06	1.28E+02	8.50E-02	Y
Nickel Soluble Salts	-	#VALUE!	-		-	-	5.87E+01		N
Phenanthrene	1.67E+04	3.34E+01	1.73E-03	1.15E+00	3.45E-02	6.69E-06	1.78E+02	1.21E-04	Y
Phenol	1.87E+02	3.74E-01	1.36E-05	8.28E+04	8.34E-02	1.03E-05	9.41E+01	3.50E-01	N
Pyrene	5.43E+04	1.09E+02	4.87E-04	1.35E-01	2.78E-02	7.25E-06	2.02E+02	4.50E-06	Y
Styrene	4.46E+02	8.92E-01	1.12E-01	3.10E+02	7.11E-02	8.78E-06	1.04E+02	6.40E+00	Y
Toluene	2.34E+02	4.68E-01	2.71E-01	5.26E+02	7.78E-02	9.20E-06	9.21E+01	2.84E+01	Y
TPH C06-C09 aliphatic	4.47E+03	8.94E+00	5.05E+01	1.18E+01	1.00E-01	1.00E-05	1.03E+02	9.16E+01	Y
TPH C10-C14 aliphatic	5.50E+05	1.10E+03	6.26E+01	9.99E-02	1.00E-01	1.00E-05	1.70E+02	1.16E+00	Y
TPH C10-C14 aromatic	3.02E+03	6.04E+00	1.41E-01	2.53E+01	1.00E-01	1.00E-05	1.36E+02	1.16E+00	Y
TPH C15-C28 aliphatic	3.16E+08	6.32E+05	8.27E+01	1.11E-04	1.00E-01	1.00E-05	2.60E+02	5.93E-03	N
TPH C15-C28 aromatic	3.79E+04	7.58E+01	4.90E-03	1.06E+00	1.00E-01	1.00E-05	2.09E+02	5.51E-03	N
TPH C29-C36 aliphatic	6.31E+08	1.26E+06	8.50E+01	2.50E-06	1.00E-01	1.00E-05	2.70E+02	8.36E-04	N
TPH C29-C36 aromatic	1.26E+05	2.52E+02	1.70E-05	6.60E-03	1.00E-01	1.00E-05	2.40E+02	3.34E-07	N
Trimethylbenzene, 1,2,4-	6.14E+02	1.23E+00	2.52E-01	5.70E+01	6.07E-02	7.92E-06	1.20E+02	2.10E+00	Y
Vanadium and compounds	-	#VALUE!	-	-	-	-	5.09E+01	-	N
Xylenes (total)	3.83E+02	7.66E-01	2.12E-01	1.06E+01	8.47E-02	9.90E-06	1.06E+02	7.99E+00	Y
	-	-	-	-	-	-	-	-	-

Definition of Parameters

Koc	Organic carbon partition coefficient	D^{air}	Diffusion coefficient in air
Kd	Soil-water partition coefficient	D^{wat}	Diffusion coefficient in water
H'	Dimensionless Henry's Law Constant	MW	Molecular weight
S	Solubility	VP	Vapopur pressure

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

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C. Chemical-Specific Diffusion Coefficients

CHEMICAL	D_{s1}	D_{s2}	D_{s3}	D_{stot}	D_{crack}	C_{sat}	Convective Factor	D_a	M_{excav}
	(cm^2/s)	(cm^2/s)	(cm^2/s)	(cm^2/s)	(cm^2/s)	(mg/kg)	(unitless)	(cm^2/s)	(g)
Acenaphthene	8.18E-03	-	-	8.18E-03	8.18E-03	3.94E+01	1.29E+02	3.66E-06	7.25E+04
Acenaphthylene	7.28E-03	-	-	7.28E-03	7.28E-03	1.63E+02	1.45E+02	2.02E-06	5.38E+04
Ammonia	3.69E-02	-	-	3.69E-02	3.69E-02	1.87E+04	2.87E+01	3.75E-04	7.34E+05
Aniline	NV	NV	NV	NV	NV	6.23E+03	NV	NV	NV
Anthracene	6.31E-03	-	-	6.31E-03	6.31E-03	1.42E+00	1.68E+02	2.62E-07	1.94E+04
Arsenic, Inorganic	NV	NV	NV	NV	NV		NV	NV	NV
Barium	NV	NV	NV	NV	NV		NV	NV	NV
Benz(a)anthracene	NV	NV	NV	NV	NV	3.33E+00	NV	NV	NV
Benzene	1.45E-02	-	-	1.45E-02	1.45E-02	6.59E+02	7.30E+01	5.35E-03	2.77E+06
Benzo(a)pyrene	NV	NV	NV	NV	NV	1.90E+00	NV	NV	NV
Benzo(b)fluoranthene	NV	NV	NV	NV	NV	1.80E+00	NV	NV	NV
Benzo(g,h,i)perylene	NV	NV	NV	NV	NV	1.01E+00	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	NV	NV	NV	9.39E-01	NV	NV	NV
Bis(2-ethylhexyl)phalate	NV	NV	NV	NV	NV	6.48E+01	NV	NV	NV
Cadmium (Water)	NV	NV	NV	NV	NV		NV	NV	NV
Chromium(III), Insoluble Salts	NV	NV	NV	NV	NV		NV	NV	NV
Chromium(VI)	NV	NV	NV	NV	NV		NV	NV	NV
Chrysene	NV	NV	NV	NV	NV	7.24E-01	NV	NV	NV
Cobalt	NV	NV	NV	NV	NV		NV	NV	NV
Cresol, m-&p-	NV	NV	NV	NV	NV	1.44E+04	NV	NV	NV
Cresol, o-	NV	NV	NV	NV	NV	1.67E+04	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	NV	NV	NV	9.51E+00	NV	NV	NV
Dibenzofuran	6.63E-03	-	-	6.63E-03	6.63E-03	5.69E+01	1.59E+02	1.89E-06	5.21E+04
Dimethylphenol, 2,4-	NV	NV	NV	NV	NV	8.00E+03	NV	NV	NV
Ethylbenzene	1.11E-02	-	-	1.11E-02	1.11E-02	1.67E+02	9.54E+01	2.17E-03	1.77E+06
Fluoranthene	NV	NV	NV	NV	NV	2.89E+01	NV	NV	NV
Fluorene	7.11E-03	-	-	7.11E-03	7.11E-03	3.10E+01	1.49E+02	9.14E-07	3.62E+04
Indeno(1,2,3-cd)pyrene	NV	NV	NV	NV	NV	7.41E-01	NV	NV	NV
Iron	NV	NV	NV	NV	NV		NV	NV	NV
Lead and Compounds	NV	NV	NV	NV	NV		NV	NV	NV
Manganese	NV	NV	NV	NV	NV		NV	NV	NV
Methylnaphthalene, 2-	8.47E-03	-	-	8.47E-03	8.47E-03	1.23E+02	1.25E+02	2.16E-05	1.76E+05
Naphthalene	9.78E-03	-	-	9.78E-03	9.78E-03	9.66E+01	1.08E+02	3.39E-05	2.21E+05
Nickel Soluble Salts	NV	NV	NV	NV	NV		NV	NV	NV
Phenanthrene	5.58E-03	-	-	5.58E-03	5.58E-03	3.84E+01	1.89E+02	1.73E-07	1.58E+04
Phenol	NV	NV	NV	NV	NV	3.37E+04	NV	NV	NV
Pyrene	4.50E-03	-	-	4.50E-03	4.50E-03	1.47E+01	2.35E+02	1.21E-08	4.17E+03
Styrene	1.15E-02	-	-	1.15E-02	1.15E-02	2.93E+02	9.19E+01	8.17E-04	1.08E+06
Toluene	1.26E-02	-	-	1.26E-02	1.26E-02	2.91E+02	8.40E+01	3.70E-03	2.31E+06
TPH C06-C09 aliphatic	1.62E-02	-	-	1.62E-02	1.62E-02	2.21E+02	6.54E+01	2.61E-02	6.13E+06
TPH C10-C14 aliphatic	1.62E-02	-	-	1.62E-02	1.62E-02	1.11E+02	6.54E+01	5.46E-04	8.86E+05
TPH C10-C14 aromatic	1.62E-02	-	-	1.62E-02	1.62E-02	1.54E+02	6.54E+01	2.24E-04	5.68E+05
TPH C15-C28 aliphatic	NV	NV	NV	NV	NV	7.02E+01	NV	NV	NV
TPH C15-C28 aromatic	NV	NV	NV	NV	NV	8.04E+01	NV	NV	NV
TPH C29-C36 aliphatic	NV	NV	NV	NV	NV	3.16E+00	NV	NV	NV
TPH C29-C36 aromatic	NV	NV	NV	NV	NV	1.66E+00	NV	NV	NV
Trimethylbenzene, 1,2,4-	9.81E-03	-	-	9.81E-03	9.81E-03	7.46E+01	1.08E+02	1.13E-03	1.28E+06
Vanadium and compounds	NV	NV	NV	NV	NV		NV	NV	NV
Xylenes (total)	1.37E-02	-	-	1.37E-02	1.37E-02	8.90E+00	7.72E+01	2.08E-03	1.73E+06

Definition of Parameters

D_s Effective diffusion coefficient in soil based on vapor-phase concentration

D_{crack} Effective diffusion coefficient through foundation cracks

C_{sat} Soil concentration at which dissolved pore-water and vapor phases become saturated

D_a = Apparent diffusivity (for construction scenario Volatilisation Factor)

M_{excav} = Cumulative unit mass emitted from excavation (Eq E-13 in USEPA, 2002).

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Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

D. Chemical-Specific Volatilisation Factors

CHEMICAL	VF_{as1}	VF_{as2}	$VF_{p\ (indoor)}$	$VF_{p\ (outdoor)}$	VF_{samb}	VF_{sesp}	VF_{excav}
	(mg/m^3-air / mg/kg-soil)	(mg/m^3-air / mg/kg-soil)	(mg/m^3-air / mg/kg-soil)	(mg/m^3-air / mg/kg-soil	(mg/m^3-air / mg/kg-soil)	(mg/m^3-air / mg/kg-soil)	(mg/m^3-air / mg/kg-soil)
Acenaphthene	1.17E-05	1.75E-05	-	-	3.35E-01	2.12E-06	-3.12E+08
Acenaphthylene	8.66E-06	1.75E-05	-	-	1.94E-01	1.31E-06	-2.32E+08
Ammonia	1.18E-04	1.75E-05	-	-	1.33E+01	4.82E-05	-3.16E+09
Aniline	NV	NV	-	-	NV	NV	NV
Anthracene	3.12E-06	1.75E-05	-	-	2.67E-02	1.97E-07	-8.35E+07
Arsenic, Inorganic	NV	NV	-	-	NV	NV	NV
Barium	NV	NV	-	-	NV	NV	NV
Benz(a)anthracene	NV	NV	-	-	NV	NV	NV
Benzene	4.46E-05	1.75E-05	-	-	3.64E+01	1.75E-04	-1.19E+10
Benzo(a)pyrene	NV	NV	-	-	NV	NV	NV
Benzo(b)fluoranthene	NV	NV	-	-	NV	NV	NV
Benzo(g,h,i)perylene	NV	NV	-	-	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	-	-	NV	NV	NV
Bis(2-ethylhexyl)phalate	NV	NV	-	-	NV	NV	NV
Cadmium (Water)	NV	NV	-	-	NV	NV	NV
Chromium(III), Insoluble Salts	NV	NV	-	-	NV	NV	NV
Chromium(VI)	NV	NV	-	-	NV	NV	NV
Chrysene	NV	NV	-	-	NV	NV	NV
Cobalt	NV	NV	-	-	NV	NV	NV
Cresol, m-&p-	NV	NV	-	-	NV	NV	NV
Cresol, o-	NV	NV	-	-	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	-	-	NV	NV	NV
Dibenzofuran	8.38E-06	1.75E-05	-	-	1.89E-01	1.35E-06	-2.24E+08
Dimethylphenol, 2,4-	NV	NV	-	-	NV	NV	NV
Ethylbenzene	2.84E-05	1.75E-05	-	-	1.71E+01	9.29E-05	-7.61E+09
Fluoranthene	NV	NV	-	-	NV	NV	NV
Fluorene	5.84E-06	1.75E-05	-	-	8.90E-02	6.09E-07	-1.56E+08
Indeno(1,2,3-cd)pyrene	NV	NV	-	-	NV	NV	NV
Iron	NV	NV	-	-	NV	NV	NV
Lead and Compounds	NV	NV	-	-	NV	NV	NV
Manganese	NV	NV	-	-	NV	NV	NV
Methylnaphthalene, 2-	2.83E-05	1.75E-05	-	-	1.95E+00	1.21E-05	-7.59E+08
Naphthalene	3.55E-05	1.75E-05	-	-	3.14E+01	1.64E-05	-9.51E+08
Nickel Soluble Salts	NV	NV	-	-	NV	NV	NV
Phenanthrene	2.54E-06	1.75E-05	-	-	1.85E-02	1.47E-07	-6.80E+07
Phenol	NV	NV	-	-	NV	NV	NV
Pyrene	6.72E-07	1.75E-05	-	-	1.39E-03	1.28E-08	-1.80E+07
Styrene	1.74E-04	1.75E-05	-	-	6.33E+01	3.37E-04	-4.67E+09
Toluene	3.71E-05	1.75E-05	-	-	2.73E+01	1.39E-04	-9.93E+09
TPH C06-C09 aliphatic	9.87E-05	1.75E-05	-	-	1.67E+02	7.67E-04	-2.64E+10
TPH C10-C14 aliphatic	1.43E-05	1.75E-05	-	-	3.48E+00	1.60E-05	-3.82E+09
TPH C10-C14 aromatic	9.14E-06	1.75E-05	-	-	1.43E+00	6.58E-06	-2.45E+09
TPH C15-C28 aliphatic	NV	NV	-	-	NV	NV	NV
TPH C15-C28 aromatic	NV	NV	-	-	NV	NV	NV
TPH C29-C36 aliphatic	NV	NV	-	-	NV	NV	NV
TPH C29-C36 aromatic	NV	NV	-	-	NV	NV	NV
Trimethylbenzene, 1,2,4-	2.05E-04	1.75E-05	-	-	1.05E+03	5.48E-04	-5.50E+09
Vanadium and compounds	NV	NV	-	-	NV	NV	NV
Xylenes (total)	2.78E-05	1.75E-05	-	-	1.46E+01	7.19E-05	-7.44E+09

Definition of Parameters

VF_{as}	Volatilization factor from surficial soils to ambient air (vapors) - use lower of two values
VF_{p}	Volatilization factor from surficial soils to ambient air (particulates)
VF_{samb}	Volatilization factor from subsurface soils to ambient air
VF_{sesp}	Volatilization factor from soil to enclosed-space vapors
VF_{excav}	Volatilisation factor from subsurface soil to trench air (where soil contamination is below base of trench)

Calculation of Vapour Emissions from Water with Flow
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

PARAMETERS

Concrete permeability	(select from drop down list)	High permeability
Permeability Rate (m/day)		8.6.E-02
Water Temperature (deg. C)		18.0
Dimensions of Basement / Impoundment		
Height (m)		4.5
Width (m)		50.0
Depth (m)		50.0
Volume total basement/ impoundment (m3)		11250

Dimensions of Wet Section of Basement/ Impoundment	
Length (m)	25.0
Width (m)	5.0
Depth of Water (m)	0.01
Fetch/ Depth (m) ratio of Wet Basement Section	500
Volume of wet basement/ impoundment (m3)	1.2500
Area covered in water (m2)	125
Effective diameter of impoundment/ basement) (m)	12.6
Volume of water entering basement (m^3/sec)	1.25E-06

Air exchange rate (exchanges/day)		7.60E+01
Windspeed (m/s)	if < 3.5 m/sec	3.00E-02
	if = or > 3.5 m/sec	

Parameter Definition	Volatile	Chemical Concentration in Water (mg/L)	Molecular weight (g/mol)	Vapour Pressure (mmHg)	Vapour Pressure (atm)	Henry's Law Coefficient (unitless)	Henry's Law Coefficient (calculated)	Equilibrium Coefficient (at 25 deg C)	Diffusivity in Water (cm^2/sec)	Schmidt Number on Gas Side (*)	Gas Phase Mass Transfer Coefficient (m/sec)	Schmidt Number on Liquid Side #	Liquid Phase Mass Transfer Coefficient (m/s) <3.5 m/s	Overall Mass Transfer Coefficient (m/s) (windspeed <3.5 m/s)	Adopted Liquid Mass Transfer Coefficient (m/s)	Overall Mass Transfer Coefficient (m/s)	Diffusivity in Air (cm2/sec)	Equilibrium Concentration of water in Basement/ Impoundment (g/m^3)	Air Emission Rate from Liquid Surface (g/sec)	Air Emission Rate from Liquid Surface (mg/day)	Adjusted Concentration in Basement Air (includes air exchange) (mg/m3)
		C	MW	Vap	Vap	unitless	atm.m3/g mol	K_{eq}	D_{water}	Sc_G	k_G	Sc_L	K_L	K	K_L	K	D_{air}	C_L	E	E	
Acenaphthene	Y	4.48	154	2.15E-03	2.83E-06	7.52E-03	1.80E-04	7.345E-03	8.33E-06	3.0E+00	1.138E-04	1.08E+03	2.7E-07	2.1E-07	2.7E-07	2.1E-07	0.0506	1.6E-01	4.07E-06	3.52E+02	4.11E-04
Acenaphthylene	Y	43.2	152	6.68E-03	8.79E-06	4.66E-03	1.11E-04	4.551E-03	6.98E-06	3.4E+00	1.052E-04	1.29E+03	2.4E-07	1.6E-07	2.4E-07	1.6E-07	0.045	1.7E+00	3.44E-05	2.97E+03	3.47E-03
Ammonia	Y	348	17	-	-	6.58E-04	1.57E-05	6.427E-04	1.10E-05	6.6E-01	3.121E-04	8.18E+02	3.3E-07	1.2E-07	3.3E-07	1.2E-07	0.228	1.0E+01	1.60E-04	1.38E+04	1.61E-02
Aniline	N	0.212	93.1		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	Y	15.4	178	6.53E-06	8.59E-09	2.27E-03	5.42E-05	2.217E-03	7.85E-06	3.9E+00	9.561E-05	1.15E+03	2.6E-07	1.2E-07	2.6E-07	1.2E-07	0.039	5.6E-01	8.27E-06	7.14E+02	8.35E-04
Arsenic, Inorganic	N	0.024	78		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	N	2.23	137		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	N	12.6	228		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	Y	40.2	78.1	9.48E+01	1.25E-01	2.27E-01	5.42E-03	2.217E-01	1.03E-05	1.7E+00	1.668E-04	8.74E+02	3.2E-07	3.1E-07	3.2E-07	3.1E-07	0.0895	1.2E+00	4.83E-05	4.17E+03	4.88E-03
Benzo(a)pyrene	N	9.26	252		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	N	8.33	252		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	N	4.22	276		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	N	2.93	252		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	N	0.03	391		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	N	0.108	112		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	N	0.102	52		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	N	0.102	52		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	N	9.78	228		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	N	0.057	58.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	N	436	108		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	N	182	108		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	N	0.822	278		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	Y	10.2	168	2.48E-03	3.26E-06	8.71E-03	2.08E-04	8.507E-03	7.38E-06	3.7E+00	9.887E-05	1.22E+03	2.5E-07	1.9E-07	2.5E-07	1.9E-07	0.041	3.9E-01	9.43E-06	8.15E+02	9.53E-04
Dimethylphenol, 2,4-	N	38	122		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	Y	3.02	106	9.60E+00	1.26E-02	3.22E-01	7.69E-03	3.145E-01	8.46E-06	2.2E+00	1.395E-04	1.06E+03	2.8E-07	2.8E-07	2.8E-07	2.8E-07	0.0685	1.1E-01	3.62E-06	3.13E+02	3.66E-04
Fluoranthene	N	25.9	202		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	Y	21.1	166	6.00E-04	7.90E-07	3.93E-03	9.38E-05	3.838E-03	7.89E-06	3.4E+00	1.037E-04	1.14E+03	2.6E-07	1.6E-07	2.6E-07	1.6E-07	0.044	7.7E-01	1.53E-05	1.32E+03	1.54E-03
Indeno(1,2,3-cd)pyrene	N	3.05	276		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	N	187	55.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	N	0.555	207		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	N	4.89	54.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	Y	105	142	5.50E-02	7.24E-05	2.12E-02	5.06E-04	2.071E-02	7.78E-06	2.9E+00	1.165E-04	1.16E+03	2.6E-07	2.4E-07	2.6E-07	2.4E-07	0.0524	3.9E+00	1.14E-04	9.85E+03	1.15E-02
Naphthalene	Y	283	128	8.50E-02	1.12E-04	1.80E-02	4.30E-04	1.758E-02	8.38E-06	2.5E+00	1.283E-04	1.07E+03	2.8E-07	2.5E-07	2.8E-07	2.5E-07	0.0605	9.9E+00	3.04E-04	2.63E+04	3.07E-02
Nickel Soluble Salts	N	0.303	58.7		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	Y	74.1	178	1.21E-04	1.59E-07	1.73E-03	4.13E-05	1.690E-03	6.69E-06	4.4E+00	8.807E-05	1.35E+03	2.4E-07	9.1E-08	2.4E-07	9.1E-08	0.0345	3.0E+00	3.43E-05	2.96E+03	3.46E-03
Phenol	N	249	94.1		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	Y	27.9	202	4.50E-06	5.92E-09	4.87E-04	1.16E-05	4.756E-04	7.25E-06	5.4E+00	7.621E-05	1.24E+03	2.5E-07	3.2E-08	2.5E-07	3.2E-08	0.0278	1.1E+00	4.25E-06	3.67E+02	4.29E-04
Styrene	Y	0.194	104	6.40E+00	8.42E-03	1.12E-01	2.67E-03	1.094E-01	8.78E-06	2.1E+00	1.430E-04	1.03E+03	2.8E-07	2.8E-07	2.8E-07	2.8E-07	0.0711	6.6E-03	2.30E-07	1.99E+01	2.32E-05
Toluene	Y	17.6	92.1	2.84E+01	3.74E-02	2.71E-01	6.47E-03	2.647E-01	9.20E-06	1.9E+00	1.519E-04	9.78E+02	2.9E-07	2.9E-07	2.9E-07	2.9E-07	0.0778	5.8E-01	2.11E-05	1.82E+03	2.13E-03
TPH C06-C09 aliphatic	Y	6.08	103	9.16E+01	1.21E-01	5.05E+01	1.21E+00	4.932E+01	1.00E-05	1.5E+00	1.797E-04	9.00E+02	3.1E-07	3.1E-07	3.1E-07	3.1E-07	0.1	1.9E-01	7.36E-06	6.36E+02	7.44E-04
TPH C10-C14 aliphatic	Y	1730	170	1.16E+00	1.53E-03	6.26E+01	1.49E+00	6.114E+01	1.00E-05	1.5E+00	1.797E-04	9.00E+02	3.1E-07	3.1E-07	3.1E-07	3.1E-07	0.1	5.4E+01	2.09E-03	1.81E+05	2.12E-01
TPH C10-C14 aromatic	Y	1730	136	1.16E+00	1.53E-03	1.41E-01	3.37E-03	1.377E-01	1.00E-05	1.5E+00	1.797E-04	9.00E+02	3.1E-07	3.1E-07	3.1E-07	3.1E-07	0.1	5.4E+01	2.07E-03	1.79E+05	2.09E-01
TPH C15-C28 aliphatic	N	1520	260		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	N	1520	209		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	N	332	270		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	N	332	240		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	Y	0.92	120	2.10E+00	2.76E-03	2.52E-01	6.02E-03	2.461E-01	7.92E-06	2.5E+00	1.286E-04	1.14E+03	2.7E-07	2.6E-07	2.7E-07	2.6E-07	0.0607	3.3E-02	1.10E-06	9.50E+01	1.11E-04
Vanadium and compounds	N	0.0228	50.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	Y	6.7	106	7.99E+00	1.05E-02	2.12E-01	5.06E-03	2.071E-01	9.90E-06	1.8E+00	1.608E-04	9.09E+02	3.1E-07	3.0E-07	3.1E-07	3.0E-07	0.0847	2.1E-01	8.04E-06	6.94E+02	8.12E-04

Notes:
Assumes viscosity of air at 25 deg C
(*) Adopted density and viscosity of air values are those published in USEPA Air Emissions for Wast and Waste Water Nov 1994. (viscosity = 1.81×10^{-4}, density = 1.2×10^{-3})
** where windspeeds are greater than 3.25 m/s, F/D ratios greater than 51.2 and diffusivity of ether is 8.5 x 10-5
# where viscosity of water is assumed to be 9×10^{-3} g/cm per sec and density of water 1g/cm^3.
Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Summary of Derived RBSLs
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical	Soil RBSLs (mg/kg)						Groundwater RBSLs (mg/L)					
	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Saturation Limited?	Site Concentration	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Solubility Limited?	Site Concentration
Acenaphthene	9.04E+04	-	-	9.04E+04	>Sat	5.11E+02	1.82E+03	-	-	1.82E+03	>Sol	4.48E+00
Acenaphthylene	1.46E+05	-	-	1.46E+05	>Sat	1.70E+03	8.88E+02	-	-	8.88E+02	>Sol	4.32E+01
Ammonia	-	-	-	-	-	-	6.84E+03	-	-	6.84E+03	-	3.48E+02
Aniline	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	4.87E+06	-	-	4.87E+06	>Sat	2.15E+03	4.98E+01	-	-	4.98E+01	>Sol	1.54E+01
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	6.24E+01	-	1.01E+02	6.24E+01	-	1.51E+03	9.02E+01	-	1.46E+02	9.02E+01	-	4.02E+01
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	7.09E+05	-	-	7.09E+05	>Sat	2.77E+02	3.12E+03	-	-	3.12E+03	>Sol	1.02E+01
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	1.60E+04	-	-	1.60E+04	>Sat	2.61E+02	1.22E+04	-	-	1.22E+04	>Sol	3.02E+00
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	2.10E+05	-	-	2.10E+05	>Sat	2.10E+03	1.40E+02	-	-	1.40E+02	>Sol	2.11E+01
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	1.06E+04	-	-	1.06E+04	>Sat	7.65E+03	2.73E+02	-	-	2.73E+02	>Sol	1.05E+02
Naphthalene	1.67E+02	-	-	1.67E+02	>Sat	1.02E+04	2.76E+00	-	-	2.76E+00	-	2.83E+02
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	1.30E+06	-	-	1.30E+06	>Sat	5.18E+03	6.36E+01	-	-	6.36E+01	>Sol	7.41E+01
Phenol	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	7.51E+06	-	-	7.51E+06	>Sat	2.64E+03	3.01E+01	-	-	3.01E+01	>Sol	2.79E+01
Styrene	-	-	-	-	-	-	9.90E+03	-	-	9.90E+03	>Sol	1.94E-01
Toluene	4.09E+04	-	-	4.09E+04	>Sat	2.65E+03	4.70E+04	-	-	4.70E+04	>Sol	1.76E+01
TPH C06-C09 aliphatic	1.37E+04	-	-	1.37E+04	>Sat	5.93E+02	8.58E+04	-	-	8.58E+04	>Sol	6.08E+00
TPH C10-C14 aliphatic	3.56E+04	-	-	3.56E+04	>Sat	6.94E+04	5.70E-01	-	-	5.70E-01	>Sol	1.73E+03
TPH C10-C14 aromatic	1.73E+04	-	-	1.73E+04	>Sat	6.94E+04	1.38E+01	-	-	1.38E+01	-	1.73E+03
TPH C15-C28 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	5.83E+01	-	-	5.83E+01	-	2.20E+02	2.65E+02	-	-	2.65E+02	>Sol	9.20E-01
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	3.49E+03	-	-	3.49E+03	>Sat	2.57E+03	2.07E+03	-	-	2.07E+03	>Sol	6.70E+00
	-	-	-	-	-	-	-	-	-	-	-	-

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Health Risk Calculations - Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

					Threshold Intake and Risk Calculations				Non-Threshold Intake and Risk Calculations				
Chemical	Soil Conc. (mg/kg)	Csat (mg/kg)	Volatilisation Factor from Subsurface Soil to Indoor Air (mg/m3)/(mg/kg)	Vapour Concentration in Indoor Air (From Subsurface Soil) (mg/m3)	Inhalation RfC (mg/m3)	Adult Exposure Factor (threshold) (kg/m3)	Adult Exposure Adjusted Air Concentration (threshold) (mg/m3)	Hazard Index (Adult) (unitless)	Inhalation Unit Risk (ug/m3)-1	Adult Exposure Factor (non-threshold) (kg/m3)	Lifetime Exposure Factor (non-threshold) (kg/m3)	Lifetime Exposure Adjusted Air Concentration (non-threshold) (mg/m3)	Lifetime Excess Cancer Risk (unitless)
Acenaphthene	511	3.94E+01	2.12E-06	8.35E-05	2.10E-01	4.65E-07	1.83E-05	8.71E-05	-	-	-	-	-
Acenaphthylene	1700	1.63E+02	1.31E-06	2.14E-04	2.10E-01	2.88E-07	4.68E-05	2.23E-04	-	-	-	-	-
Ammonia	-	-	-	-	-	-	-	-	-	-	-	-	-
Aniline	-	-	NV	-	-	-	-	-	-	-	-	-	-
Anthracene	2150	1.42E+00	1.97E-07	2.80E-07	1.05E+00	4.31E-08	6.15E-08	5.85E-08	-	-	-	-	-
Arsenic, Inorganic	-	-	NV	-	-	-	-	-	-	-	-	-	-
Barium	-	-	NV	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	1470	3.33E+00	NV	-	-	-	-	-	8.70E-03	-	-	-	-
Benzene	1510	6.59E+02	1.75E-04	1.16E-01	9.60E-03	3.84E-05	2.53E-02	2.64E+00	6.00E-06	1.65E-05	1.65E-05	1.09E-02	6.52E-05
Benzo(a)pyrene	652	1.90E+00	NV	-	-	-	-	-	8.70E-02	-	-	-	-
Benzo(b)fluoranthene	587	1.80E+00	NV	-	-	-	-	-	8.70E-03	-	-	-	-
Benzo(g,h,i)perylene	305	1.01E+00	NV	-	-	-	-	-	8.70E-04	-	-	-	-
Benzo(k)fluoranthene	231	9.39E-01	NV	-	-	-	-	-	8.70E-03	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	NV	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	NV	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	210		NV	-	1.00E-04	-	-	-	-	-	-	-	-
Chromium(VI)	2.3		NV	-	1.00E-04	-	-	-	3.85E-02	-	-	-	-
Chrysene	771	7.24E-01	NV	-	--	-	-	-	8.70E-04	-	-	-	-
Cobalt	-	-	NV	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	2290	1.44E+04	NV	-	5.95E-01	-	-	-	-	-	-	-	-
Cresol, o-	-	-	NV	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	71.4	9.51E+00	NV	-	--	-	-	-	8.70E-02	-	-	-	-
Dibenzofuran	277	5.69E+01	1.35E-06	7.68E-05	2.10E-01	2.96E-07	1.68E-05	8.02E-05	-	-	-	-	-
Dimethylphenol, 2,4-	-	-	NV	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	261	1.67E+02	9.29E-05	1.55E-02	1.30E+00	2.04E-05	3.39E-03	2.61E-03	-	-	-	-	-
Fluoranthene	2440	2.89E+01	NV	-	1.40E-01	-	-	-	-	-	-	-	-
Fluorene	2100	3.10E+01	6.09E-07	1.89E-05	1.40E-01	1.34E-07	4.14E-06	2.96E-05	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	247	7.41E-01	NV	-	--	-	-	-	8.70E-03	-	-	-	-
Iron	60600		NV	-	2.80E+00	-	-	-	-	-	-	-	-
Lead and Compounds	13600		NV	-	5.00E-04	-	-	-	-	-	-	-	-
Manganese	-	-	NV	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	7650	1.23E+02	1.21E-05	1.48E-03	1.40E-01	2.65E-06	3.25E-04	2.32E-03	-	-	-	-	-
Naphthalene	10200	9.66E+01	1.64E-05	1.59E-03	3.00E-03	3.60E-06	3.48E-04	1.16E-01	-	-	-	-	-
Nickel Soluble Salts	-	-	NV	-	-	-	-	-	-	-	-	-	-
Phenanthrene	5180	3.84E+01	1.47E-07	5.66E-06	2.10E-01	3.23E-08	1.24E-06	5.91E-06	-	-	-	-	-
Phenol	-	-	NV	-	-	-	-	-	-	-	-	-	-
Pyrene	2640	1.47E+01	1.28E-08	1.87E-07	1.05E-01	2.80E-09	4.10E-08	3.91E-07	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	2650	2.91E+02	1.39E-04	4.06E-02	5.00E+00	3.06E-05	8.89E-03	1.78E-03	-	-	-	-	-
TPH C06-C09 aliphatic	593	2.21E+02	7.67E-04	1.70E-01	1.84E+01	1.68E-04	3.72E-02	2.02E-03	-	-	-	-	-
TPH C10-C14 aliphatic	69400	1.11E+02	1.60E-05	1.78E-03	1.00E+00	3.51E-06	3.90E-04	3.90E-04	-	-	-	-	-
TPH C10-C14 aromatic	69400	1.54E+02	6.58E-06	1.02E-03	2.00E-01	1.44E-06	2.23E-04	1.11E-03	-	-	-	-	-
TPH C15-C28 aliphatic	93200	7.02E+01	NV	-	7.00E+00	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	93200	8.04E+01	NV	-	1.05E-01	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	20600	3.16E+00	NV	-	7.00E+00	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	20600	1.66E+00	NV	-	1.05E-01	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	220	7.46E+01	5.48E-04	4.09E-02	7.00E-03	1.20E-04	8.96E-03	1.28E+00	-	-	-	-	-
Vanadium and compounds	248		NV	-	1.00E-03	-	-	-	-	-	-	-	-
Xylenes (total)	2567	8.90E+00	7.19E-05	6.40E-04	2.20E-01	1.58E-05	1.40E-04	6.37E-04	-	-	-	-	-
TOTAL								**4.05E+00**					**6.52E-05**

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Health Risk Calculations - Vapours from Flowing Water
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

			Threshold Intake and Risk Calculations				Non-Threshold Intake Risk Calculations				
Chemical	Vapour Concentration in Basement/ Impoundment	Aqueous Solubility	Inhalation RfC	Adult Exposure Factor (threshold)	Adult Exposure Adjusted Air Concentration (threshold)	Hazard Index (Adult)	Inhalation Unit Risk	Adult Exposure Factor (non-threshold)	Lifetime Exposure Factor (non-threshold)	Lifetime Exposure Adjusted Air Concentration (non-threshold)	Lifetime Excess Cancer Risk
	mg/m^3	(mg/L)	(mg/m3)	(L/m3)	(mg/m3)	(unitless)	(ug/m3)-1	(L/m3)	(L/m3)	(mg/m3)	(unitless)
Acenaphthene	4.11E-04	3.90E+00	2.10E-01	2.19E-01	9.01E-05	4.29E-04	-	-	-	-	-
Acenaphthylene	3.47E-03	1.61E+01	2.10E-01	2.19E-01	7.61E-04	3.63E-03	-	-	-	-	-
Ammonia	1.61E-02	4.82E+05	6.95E-02	2.19E-01	3.53E-03	5.09E-02	-	-	-	-	-
Aniline	-	3.60E+04	-	-	-	-	-	-	-	-	-
Anthracene	8.35E-04	4.34E-02	1.05E+00	2.19E-01	1.83E-04	1.74E-04	-	-	-	-	-
Arsenic, Inorganic	-	0.00E+00	-	-	-	-	-	-	-	-	-
Barium	-	0.00E+00	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	9.40E-03	-	-	-	-	-	-	-	-	-
Benzene	4.88E-03	1.79E+03	9.60E-03	2.19E-01	1.07E-03	1.11E-01	6.00E-06	9.39E-02	9.39E-02	4.58E-04	2.75E-06
Benzo(a)pyrene	-	1.62E-03	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	1.50E-03	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	2.60E-04	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	8.00E-04	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	2.70E-01	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	0.00E+00	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	0.00E+00	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	1.69E+06	-	-	-	-	-	-	-	-	-
Chrysene	-	2.00E-03	-	-	-	-	-	-	-	-	-
Cobalt	-	0.00E+00	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	-	2.27E+04	-	-	-	-	-	-	-	-	-
Cresol, o-	-	2.59E+04	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	2.49E-03	-	-	-	-	-	-	-	-	-
Dibenzofuran	9.53E-04	3.10E+00	2.10E-01	2.19E-01	2.09E-04	9.94E-04	-	-	-	-	-
Dimethylphenol, 2,4-	-	7.87E+03	-	-	-	-	-	-	-	-	-
Ethylbenzene	3.66E-04	1.69E+02	1.30E+00	2.19E-01	8.02E-05	6.17E-05	-	-	-	-	-
Fluoranthene	-	2.60E-01	-	-	-	-	-	-	-	-	-
Fluorene	1.54E-03	1.69E+00	1.40E-01	2.19E-01	3.38E-04	2.42E-03	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	1.90E-04	-	-	-	-	-	-	-	-	-
Iron	-	0.00E+00	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	0.00E+00	-	-	-	-	-	-	-	-	-
Manganese	-	0.00E+00	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	1.15E-02	2.46E+01	1.40E-01	2.19E-01	2.53E-03	1.80E-02	-	-	-	-	-
Naphthalene	3.07E-02	3.10E+01	3.00E-03	2.19E-01	6.74E-03	2.25E+00	-	-	-	-	-
Nickel Soluble Salts	-	0.00E+00	-	-	-	-	-	-	-	-	-
Phenanthrene	3.46E-03	1.15E+00	2.10E-01	2.19E-01	7.59E-04	3.62E-03	-	-	-	-	-
Phenol	-	8.28E+04	-	-	-	-	-	-	-	-	-
Pyrene	4.29E-04	1.35E-01	1.05E-01	2.19E-01	9.40E-05	8.96E-04	-	-	-	-	-
Styrene	2.32E-05	3.10E+02	2.60E-01	2.19E-01	5.10E-06	1.96E-05	-	-	-	-	-
Toluene	2.13E-03	5.26E+02	5.00E+00	2.19E-01	4.68E-04	9.36E-05	-	-	-	-	-
TPH C06-C09 aliphatic	7.44E-04	1.18E+01	1.84E+01	2.19E-01	1.63E-04	8.86E-06	-	-	-	-	-
TPH C10-C14 aliphatic	2.12E-01	9.99E-02	1.00E+00	2.19E-01	2.19E-02	2.19E-02	-	-	-	-	-
TPH C10-C14 aromatic	2.09E-01	2.53E+01	2.00E-01	2.19E-01	4.58E-02	2.29E-01	-	-	-	-	-
TPH C15-C28 aliphatic	-	1.11E-04	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	1.06E+00	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	2.50E-06	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	6.60E-03	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	1.11E-04	5.70E+01	7.00E-03	2.19E-01	2.43E-05	3.48E-03	-	-	-	-	-
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	8.12E-04	1.06E+01	2.20E-01	2.19E-01	1.78E-04	8.09E-04	-	-	-	-	-
TOTAL						**2.69E+00**					**2.75E-06**

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Soil RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical	Csoil	Csat	Risk at Input Soil Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity) (kg/mg)			RBSL (assumes no sat limit)	Risk at RBSL (with sat)	Vapour Only Risk at Csat (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			Vapours from Subsurface Soil Indoors	TOTAL (All Pathways)	Vapours from Subsurface Soil Indoors	Total Vapour Pathways	TOTAL (All Pathways)					Vapours from Subsurface Soil Indoors	TOTAL
	mg/kg	mg/kg	unitless	unitless	kg/mg	kg/mg	kg/mg	mg/kg			mg/kg	%	%
Acenaphthene	511	3.94E+01	8.71E-05	8.71E-05	2.21E-06	2.21E-06	2.21E-06	9.04E+04	8.71E-05	8.71E-05	**9.04E+04**	0.04%	0.04%
Acenaphthylene	1700	1.63E+02	2.23E-04	2.23E-04	1.37E-06	1.37E-06	1.37E-06	1.46E+05	2.23E-04	2.23E-04	**1.46E+05**	0.11%	0.11%
Ammonia	-	-	-	-	-		-	-	-	-	**-**	-	
Aniline	-	-	-	-	-		-	-	-	-	**-**	-	
Anthracene	2150	1.42E+00	5.85E-08	5.85E-08	4.11E-08	4.11E-08	4.11E-08	4.87E+06	5.85E-08	5.85E-08	**4.87E+06**	0.00%	0.00%
Arsenic, Inorganic	-	-	-	-	-		-	-	-	-	**-**	-	
Barium	-	-	-	-	-		-	-	-	-	**-**	-	
Benz(a)anthracene	1470	3.33E+00	-	-	-		-	-	-	-	**-**	-	
Benzene	1510	6.59E+02	2.64E+00	2.64E+00	4.00E-03	4.00E-03	4.00E-03	6.24E+01	2.50E-01	-	**6.24E+01**	100.00%	100.00%
Benzo(a)pyrene	652	1.90E+00	-	-	-		-	-	-	-	**-**	-	
Benzo(b)fluoranthene	587	1.80E+00	-	-	-		-	-	-	-	**-**	-	
Benzo(g,h,i)perylene	305	1.01E+00	-	-	-		-	-	-	-	**-**	-	
Benzo(k)fluoranthene	231	9.39E-01	-	-	-		-	-	-	-	**-**	-	
Bis(2-ethylhexyl)phalate	-	-	-	-	-		-	-	-	-	**-**	-	
Cadmium (Water)	-	-	-	-	-		-	-	-	-	**-**	-	
Chromium(III), Insoluble Salts	210		-	-	-		-	-	-	-	**-**	-	
Chromium(VI)	2.3		-	-	-		-	-	-	-	**-**	-	
Chrysene	771	7.24E-01	-	-	-		-	-	-	-	**-**	-	
Cobalt	-	-	-	-	-		-	-	-	-	**-**	-	
Cresol, m-&p-	2290	1.44E+04	-	-	-		-	-	-	-	**-**	-	
Cresol, o-	-	-	-	-	-		-	-	-	-	**-**	-	
Dibenz(a,h)anthracene	71.4	9.51E+00	-	-	-		-	-	-	-	**-**	-	
Dibenzofuran	277	5.69E+01	8.02E-05	8.02E-05	1.41E-06	1.41E-06	1.41E-06	7.09E+05	8.02E-05	8.02E-05	**7.09E+05**	0.01%	0.01%
Dimethylphenol, 2,4-	-	-	-	-	-		-	-	-	-	**-**	-	
Ethylbenzene	261	1.67E+02	2.61E-03	2.61E-03	1.57E-05	1.57E-05	1.57E-05	1.60E+04	2.61E-03	2.61E-03	**1.60E+04**	1.04%	1.04%
Fluoranthene	2440	2.89E+01	-	-	-		-	-	-	-	**-**	-	
Fluorene	2100	3.10E+01	2.96E-05	2.96E-05	9.54E-07	9.54E-07	9.54E-07	2.10E+05	2.96E-05	2.96E-05	**2.10E+05**	0.01%	0.01%
Indeno(1,2,3-cd)pyrene	247	7.41E-01	-	-	-		-	-	-	-	**-**	-	
Iron	60600		-	-	-		-	-	-	-	**-**	-	
Lead and Compounds	13600		-	-	-		-	-	-	-	**-**	-	
Manganese	-	-	-	-	-		-	-	-	-	**-**	-	
Methylnaphthalene, 2-	7650	1.23E+02	2.32E-03	2.32E-03	1.89E-05	1.89E-05	1.89E-05	1.06E+04	2.32E-03	2.32E-03	**1.06E+04**	1.16%	1.16%
Naphthalene	10200	9.66E+01	1.16E-01	1.16E-01	1.20E-03	1.20E-03	1.20E-03	1.67E+02	1.16E-01	1.16E-01	**1.67E+02**	58.01%	58.01%
Nickel Soluble Salts	-	-	-	-	-		-	-	-	-	**-**	-	
Phenanthrene	5180	3.84E+01	5.91E-06	5.91E-06	1.54E-07	1.54E-07	1.54E-07	1.30E+06	5.91E-06	5.91E-06	**1.30E+06**	0.00%	0.00%
Phenol	-	-	-	-	-		-	-	-	-	**-**	-	
Pyrene	2640	1.47E+01	3.91E-07	3.91E-07	2.66E-08	2.66E-08	2.66E-08	7.51E+06	3.91E-07	3.91E-07	**7.51E+06**	0.00%	0.00%
Styrene	-	-	-	-	-		-	-	-	-	**-**	-	
Toluene	2650	2.91E+02	1.78E-03	1.78E-03	6.11E-06	6.11E-06	6.11E-06	4.09E+04	1.78E-03	1.78E-03	**4.09E+04**	0.71%	0.71%
TPH C06-C09 aliphatic	593	2.21E+02	2.02E-03	2.02E-03	9.14E-06	9.14E-06	9.14E-06	1.37E+04	2.02E-03	2.02E-03	**1.37E+04**	1.62%	1.62%
TPH C10-C14 aliphatic	69400	1.11E+02	3.90E-04	3.90E-04	3.51E-06	3.51E-06	3.51E-06	3.56E+04	3.90E-04	3.90E-04	**3.56E+04**	0.31%	0.31%
TPH C10-C14 aromatic	69400	1.54E+02	1.11E-03	1.11E-03	7.21E-06	7.21E-06	7.21E-06	1.73E+04	1.11E-03	1.11E-03	**1.73E+04**	0.89%	0.89%
TPH C15-C28 aliphatic	93200	7.02E+01	-	-	-		-	-	-	-	**-**	-	
TPH C15-C28 aromatic	93200	8.04E+01	-	-	-		-	-	-	-	**-**	-	
TPH C29-C36 aliphatic	20600	3.16E+00	-	-	-		-	-	-	-	**-**	-	
TPH C29-C36 aromatic	20600	1.66E+00	-	-	-		-	-	-	-	**-**	-	
Trimethylbenzene, 1,2,4-	220	7.46E+01	1.28E+00	1.28E+00	1.72E-02	1.72E-02	1.72E-02	5.83E+01	1.00E+00	-	**5.83E+01**	100.00%	100.00%
Vanadium and compounds	248		-	-	-		-	-	-	-	**-**	-	
Xylenes (total)	2567	8.90E+00	6.37E-04	6.37E-04	7.16E-05	7.16E-05	7.16E-05	3.49E+03	6.37E-04	6.37E-04	**3.49E+03**	0.25%	0.25%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Soil RBSL Derivation - Non-Threshold Lifetime Health Effects (Adult and Child)
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical	Csoil	Csat	Risk at Input Soil Concentration (ILCR)		Risk/Soil Concentration (i.e., exposure and toxicity factor)			RBSL (assumes no sat limit)	Risk at RBSL (with sat)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			Vapours from Subsurface Soil Indoors	TOTAL	Vapours from Subsurface Soil Indoors	Total Vapour Pathways	TOTAL				Vapours from Subsurface Soil Indoors	TOTAL
	mg/kg	mg/kg	unitless	unitless	kg/mg	kg/mg	kg/mg	mg/kg		mg/kg	%	%
Acenaphthene	511	3.94E+01	-	-	-		-	-	-	-	-	-
Acenaphthylene	1700	1.63E+02	-	-	-		-	-	-	-	-	-
Ammonia	-	-	-	-	-		-	-	-	-	-	-
Aniline	-	-	-	-	-		-	-	-	-	-	-
Anthracene	2150	1.42E+00	-	-	-		-	-	-	-	-	-
Arsenic, Inorganic	-	-	-	-	-		-	-	-	-	-	-
Barium	-	-	-	-	-		-	-	-	-	-	-
Benz(a)anthracene	1470	3.33E+00	-	-	-		-	-	-	-	-	-
Benzene	1510	6.59E+02	6.52E-05	6.52E-05	9.88E-08	9.88E-08	9.88E-08	1.01E+02	1.00E-05	**1.01E+02**	100.00%	100.00%
Benzo(a)pyrene	652	1.90E+00	-	-	-		-	-	-	-	-	-
Benzo(b)fluoranthene	587	1.80E+00	-	-	-		-	-	-	-	-	-
Benzo(g,h,i)perylene	305	1.01E+00	-	-	-		-	-	-	-	-	-
Benzo(k)fluoranthene	231	9.39E-01	-	-	-		-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-		-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-		-	-	-	-	-	-
Chromium(III), Insoluble Salts	210		-	-	-		-	-	-	-	-	-
Chromium(VI)	2.3		-	-	-		-	-	-	-	-	-
Chrysene	771	7.24E-01	-	-	-		-	-	-	-	-	-
Cobalt	-	-	-	-	-		-	-	-	-	-	-
Cresol, m-&p-	2290	1.44E+04	-	-	-		-	-	-	-	-	-
Cresol, o-	-	-	-	-	-		-	-	-	-	-	-
Dibenz(a,h)anthracene	71.4	9.51E+00	-	-	-		-	-	-	-	-	-
Dibenzofuran	277	5.69E+01	-	-	-		-	-	-	-	-	-
Dimethylphenol, 2,4-	-	-	-	-	-		-	-	-	-	-	-
Ethylbenzene	261	1.67E+02	-	-	-		-	-	-	-	-	-
Fluoranthene	2440	2.89E+01	-	-	-		-	-	-	-	-	-
Fluorene	2100	3.10E+01	-	-	-		-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	247	7.41E-01	-	-	-		-	-	-	-	-	-
Iron	60600		-	-	-		-	-	-	-	-	-
Lead and Compounds	13600		-	-	-		-	-	-	-	-	-
Manganese	-	-	-	-	-		-	-	-	-	-	-
Methylnaphthalene, 2-	7650	1.23E+02	-	-	-		-	-	-	-	-	-
Naphthalene	10200	9.66E+01	-	-	-		-	-	-	-	-	-
Phenol	-	-	-	-	-		-	-	-	-	-	-
Pyrene	2640	3.84E+01	-	-	-		-	-	-	-	-	-
Styrene	-	-	-	-	-		-	-	-	-	-	-
Toluene	2650	1.47E+01	-	-	-		-	-	-	-	-	-
TPH C06-C09 aliphatic	593	2.93E+02	-	-	-		-	-	-	-	-	-
TPH C10-C14 aliphatic	69400	2.91E+02	-	-	-		-	-	-	-	-	-
TPH C10-C14 aromatic	69400	2.21E+02	-	-	-		-	-	-	-	-	-
TPH C15-C28 aliphatic	93200	1.11E+02	-	-	-		-	-	-	-	-	-
TPH C15-C28 aromatic	93200	1.54E+02	-	-	-		-	-	-	-	-	-
TPH C29-C36 aliphatic	20600	7.02E+01	-	-	-		-	-	-	-	-	-
TPH C29-C36 aromatic	20600	8.04E+01	-	-	-		-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	220	3.16E+00	-	-	-		-	-	-	-	-	-
Vanadium and compounds	248	1.66E+00	-	-	-		-	-	-	-	-	-
Xylenes (total)	2567	7.46E+01	-	-	-		-	-	-	-	-	-
	-	-	-	-	-		-	-	-	-	-	-
	-	-	-	-	-		-	-	-	-	-	-

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

			Risk at Input Groundwater Concentration (ILCR)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)							Pathway Contributions to Total Estimated Risk at RBSL	
Chemical	Cgw	Solubility	GW vapours from flowing water	TOTAL (All Pathways)	GW vapours from flowing water	Total Vapour Pathways	TOTAL (All Pathways)	RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL	GW vapours from flowing water	TOTAL
	mg/L	mg/L	unitless	unitless	unitless	L/mg	L/mg	mg/L			mg/L	%	%
Acenaphthene	4.48	3.90E+00	4.29E-04	4.29E-04	1.10E-04	1.10E-04	1.10E-04	1.82E+03	4.29E-04	4.29E-04	**1.82E+03**	0.2%	0.21%
Acenaphthylene	43.2	1.61E+01	3.63E-03	3.63E-03	2.25E-04	2.25E-04	2.25E-04	8.88E+02	3.63E-03	3.63E-03	**8.88E+02**	1.8%	1.81%
Ammonia	348	4.82E+05	5.09E-02	5.09E-02	1.46E-04	1.46E-04	1.46E-04	6.84E+03	1.00E+00	-	**6.84E+03**	100.0%	100.00%
Aniline	0.212	3.60E+04	-	-	-		-	-	-	-	**-**	-	-
Anthracene	15.4	4.34E-02	1.74E-04	1.74E-04	4.02E-03	4.02E-03	4.02E-03	4.98E+01	1.74E-04	1.74E-04	**4.98E+01**	0.1%	0.09%
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	**-**	-	-
Barium	2.23		-	-	-		-	-	-	-	**-**	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	**-**	-	-
Benzene	40.2	1.79E+03	1.11E-01	1.11E-01	2.77E-03	2.77E-03	2.77E-03	9.02E+01	2.50E-01	-	**9.02E+01**	100.0%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	**-**	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	**-**	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	**-**	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	**-**	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	**-**	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	**-**	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	**-**	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	**-**	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	**-**	-	-
Cobalt	0.057		-	-	-		-	-	-	-	**-**	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-		-	-	-	-	**-**	-	-
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	**-**	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	**-**	-	-
Dibenzofuran	10.2	3.10E+00	9.94E-04	9.94E-04	3.21E-04	3.21E-04	3.21E-04	3.12E+03	9.94E-04	9.94E-04	**3.12E+03**	0.1%	0.10%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	**-**	-	-
Ethylbenzene	3.02	1.69E+02	6.17E-05	6.17E-05	2.04E-05	2.04E-05	2.04E-05	1.22E+04	3.45E-03	3.45E-03	**1.22E+04**	1.4%	1.38%
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	**-**	-	-
Fluorene	21.1	1.69E+00	2.42E-03	2.42E-03	1.43E-03	1.43E-03	1.43E-03	1.40E+02	2.42E-03	2.42E-03	**1.40E+02**	1.2%	1.21%
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	**-**	-	-
Iron	187		-	-	-		-	-	-	-	**-**	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	**-**	-	-
Manganese	4.89		-	-	-		-	-	-	-	**-**	-	-
Methylnaphthalene, 2-	105	2.46E+01	1.80E-02	1.80E-02	7.33E-04	7.33E-04	7.33E-04	2.73E+02	1.80E-02	1.80E-02	**2.73E+02**	9.0%	9.02%
Naphthalene	283	3.10E+01	2.25E+00	2.25E+00	7.25E-02	7.25E-02	7.25E-02	2.76E+00	2.00E-01	-	**2.76E+00**	100.0%	100.00%
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	**-**	-	-
Phenanthrene	74.1	1.15E+00	3.62E-03	3.62E-03	3.14E-03	3.14E-03	3.14E-03	6.36E+01	3.62E-03	3.62E-03	**6.36E+01**	1.8%	1.81%
Phenol	249	8.28E+04	-	-	-		-	-	-	-	**-**	-	-
Pyrene	27.9	1.35E-01	8.96E-04	8.96E-04	6.63E-03	6.63E-03	6.63E-03	3.01E+01	8.96E-04	8.96E-04	**3.01E+01**	0.4%	0.45%
Styrene	0.194	3.10E+02	1.96E-05	1.96E-05	1.01E-04	1.01E-04	1.01E-04	9.90E+03	3.13E-02	3.13E-02	**9.90E+03**	3.1%	3.13%
Toluene	17.6	5.26E+02	9.36E-05	9.36E-05	5.32E-06	5.32E-06	5.32E-06	4.70E+04	2.80E-03	2.80E-03	**4.70E+04**	1.1%	1.12%
TPH C06-C09 aliphatic	6.08	1.18E+01	8.86E-06	8.86E-06	1.46E-06	1.46E-06	1.46E-06	8.58E+04	1.72E-05	1.72E-05	**8.58E+04**	0.0%	0.01%
TPH C10-C14 aliphatic	1730	9.99E-02	2.19E-02	2.19E-02	2.19E-01	2.19E-01	2.19E-01	5.70E-01	2.19E-02	2.19E-02	**5.70E-01**	17.5%	17.52%
TPH C10-C14 aromatic	1730	2.53E+01	2.29E-01	2.29E-01	9.06E-03	9.06E-03	9.06E-03	1.38E+01	1.25E-01	-	**1.38E+01**	100.0%	100.00%
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	**-**	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	**-**	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	**-**	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	**-**	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	3.48E-03	3.48E-03	3.78E-03	3.78E-03	3.78E-03	2.65E+02	2.15E-01	2.15E-01	**2.65E+02**	21.5%	21.54%
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	**-**	-	-
Xylenes (total)	6.7	1.06E+01	8.09E-04	8.09E-04	1.21E-04	1.21E-04	1.21E-04	2.07E+03	1.28E-03	1.28E-03	**2.07E+03**	0.5%	0.51%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Non-Threshold Health Effects
Barangaroo Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - (Risk Based Calculations) Scenario

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (ILCR)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW Vapours from Flowing Water	TOTAL (All Pathways)	GW Vapours from Flowing Water	Total Vapour Pathways	TOTAL (All Pathways)				GW Vapours from Flowing Water	TOTAL
	mg/L	mg/L	unitless	unitless	L/mg	L/mg	L/mg	mg/L		mg/L	%	%
Acenaphthene	4.48	3.90E+00	-	-	-		-	-	-	-	-	-
Acenaphthylene	43.2	1.61E+01	-	-	-		-	-	-	-	-	-
Ammonia	348	4.82E+05	-	-	-		-	-	-	-	-	-
Aniline	0.212	3.60E+04	-	-	-		-	-	-	-	-	-
Anthracene	15.4	4.34E-02	-	-	-		-	-	-	-	-	-
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	-	-
Barium	2.23		-	-	-		-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	-	-
Benzene	40.2	1.79E+03	2.75E-06	2.75E-06	6.84E-08	6.84E-08	6.84E-08	1.46E+02	1.00E-05	**1.46E+02**	100.00%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	-	-
Cobalt	0.057		-	-	-		-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-		-	-	-	-	-	-
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	-	-	-		-	-	-	-	-	-
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	-	-	-		-	-	-	-	-	-
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	-	-
Fluorene	21.1	1.69E+00	-	-	-		-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	-	-
Iron	187		-	-	-		-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	-	-
Manganese	4.89		-	-	-		-	-	-	-	-	-
Methylnaphthalene, 2-	105	2.46E+01	-	-	-		-	-	-	-	-	-
Naphthalene	283	3.10E+01	-	-	-		-	-	-	-	-	-
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	-	-	-		-	-	-	-	-	-
Phenol	249	8.28E+04	-	-	-		-	-	-	-	-	-
Pyrene	27.9	1.35E-01	-	-	-		-	-	-	-	-	-
Styrene	0.194	3.10E+02	-	-	-		-	-	-	-	-	-
Toluene	17.6	5.26E+02	-	-	-		-	-	-	-	-	-
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-		-	-	-	-	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-		-	-	-	-	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-		-	-	-	-	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	-	-	-		-	-	-	-	-	-
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+01	-	-	-		-	-	-	-	-	-

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

1. General Information:

Site:	Barangaroo
Address:	Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Client:	Lend Lease
Scenario:	Scenario 1 - Lower Basement (Odour Based Calculations)

Header Colour (Defaults = Blue):

Blue

2. Select Receptor:

Commercial/Industrial

3. Select Exposure Pathways to Include:

Enter "x" in box, or select from dropdown box.

Soil Pathways

	Incidental Ingestion of Soil
	Dermal Contact with Soil
	Inhalation of Surface Soil-Derived Dust in Indoor Air
	Inhalation of Surface Soil-Derived Dust in Outdoor Air
	Inhalation of Surface Soil-Derived Vapours in Outdoor Air
	Inhalation of Soil-Derived Vapours From Excavation (USEPA 2002 method)
	Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
	Inhalation of Subsurface Soil-Derived Vapours in Outdoor Air

Groundwater Pathways

	Inhalation of Groundwater-Derived Vapours in Indoor Air
	Inhalation of Groundwater-Derived Vapours in Outdoor Air
	Ingestion of Potable Groundwater
	Incidental Ingestion of Groundwater (Bathing or Excavation)
	Dermal Contact with Groundwater (Bathing or Excavation)
	Inhalation of Groundwater Vapours during Irrigation/ Showering
	Ingestion of Vegetables Irrigated with Groundwater
	Inhalation of Groundwater Vapours (Where GW Enters Trench)
x	Inhalation of vapour emissions from flowing water (groundwater in basement)
	Inhalation of Soil Vapour-Derived Vapours in Indoor Air
	Inhalation of Soil Vapour-Derived Vapours in Outdoor Air

Y	Soil RBSLs saturation limited?
Y	Groundwater RBSLs solubility limited?

4. Select Chemicals for Quantitative Assessment:	Target Hazard Index	Target Cancer Risk	5. Enter Chemical Concentrations (if only calculating RBSLs, enter 1 for media for which you want RBSLs):	
	default = 1 (or manually overwrite)	default = $1x10^{-5}$ (or manually overwrite)	Soil (mg/kg)	Groundwater (mg/L)
Acenaphthene	0.2	1.00E-05	511	4.48
Acenaphthylene	0.2	1.00E-05	1700	43.2
Ammonia	1	1.00E-05		348
Aniline	1	1.00E-05		0.212
Anthracene	0.2	1.00E-05	2150	15.4
Arsenic, Inorganic	1	1.00E-05		0.024
Barium	1	1.00E-05		2.23
Benz(a)anthracene		1.00E-05	1470	12.6
Benzene	0.25	1.00E-05	1510	40.2
Benzo(a)pyrene		1.00E-05	652	9.26
Benzo(b)fluoranthene		1.00E-05	587	8.33
Benzo(g,h,i)perylene		1.00E-05	305	4.22
Benzo(k)fluoranthene		1.00E-05	231	2.93
Bis(2-ethylhexyl)phalate	1	1.00E-05		0.03
Cadmium (Water)	1	1.00E-05		0.108
Chromium(III), Insoluble Salt	1	1.00E-05	210	0.102
Chromium(VI)	1	1.00E-05	2.3	0.102
Chrysene		1.00E-05	771	9.78
Cobalt	1	1.00E-05		0.057
Cresol, m-&p-	1	1.00E-05	2290	436
Cresol, o-	1	1.00E-05		182
	Blank			
Dibenz(a,h)anthracene		1.00E-05	71.4	0.822
Dibenzofuran	1	1.00E-05	277	10.2
Dimethylphenol, 2,4-	1	1.00E-05		38
Ethylbenzene	0.25	1.00E-05	261	3.02
Fluoranthene		1.00E-05	2440	25.9
Fluorene	0.2	1.00E-05	2100	21.1
Indeno(1,2,3-cd)pyrene		1.00E-05	247	3.05
Iron	1	1.00E-05	60600	187
Lead and Compounds	1	1.00E-05	13600	0.555
Manganese	1	1.00E-05		4.89
Methylnaphthalene, 2-	0.2	1.00E-05	7650	105
Naphthalene	0.2	1.00E-05	10200	283
Nickel Soluble Salts	1	1.00E-05		0.303
Phenanthrene	0.2	1.00E-05	5180	74.1
Phenol	1	1.00E-05		249
Pyrene	0.2	1.00E-05	2640	27.9
Styrene	1	1.00E-05		0.194
Toluene	0.25	1.00E-05	2650	17.6
TPH C06-C09 aliphatic	0.125	1.00E-05	593	6.08
TPH C10-C14 aliphatic	0.125	1.00E-05	69400	1730
TPH C10-C14 aromatic	0.125	1.00E-05	69400	1730
TPH C15-C28 aliphatic	0.125	1.00E-05	93200	1520
TPH C15-C28 aromatic	0.125	1.00E-05	93200	1520
TPH C29-C36 aliphatic	0.125	1.00E-05	20600	332
TPH C29-C36 aromatic	0.125	1.00E-05	20600	332
Trimethylbenzene, 1,2,4-	1	1.00E-05	220	0.92
Vanadium and compounds	1	1.00E-05	248	0.0228
Xylenes (total)	0.25	1.00E-05	2576	6.7

6. Confirm/Modify Exposure Parameters:

		Site-Specific Value (leave blank to use default value)		Value Used in Calculations	
General receptor parameters:	**Units**	**Adult**	**Child**	**Adult**	**Child**
Body weight	kg	70	13	70	13
Exposure duration	yr	64	6	64	6
Averaging time (carcinogens)	yr	70	70	70	70
Averaging time (non-carcinogens)	yr	30	6	30	6
Incidental Soil Ingestion					
Daily soil ingestion rate	mg/day				
Exposure frequency for soil ingestion	days/yr				
Fraction of daily soil intake from site	unitless				
Dermal Absorption of Soil					
Exposed skin surface area for soil contact	cm2				
Soil to skin adherence factor	mg/cm2				
Exposure frequency for dermal contact with soil	days/yr				
Indoor Inhalation					
Exposure time (indoor air)	hrs/day				
Exposure frequency (indoor air)	days/yr				
Particulate emission factor (indoor air)	m3/kg				
Outdoor Inhalation					
Exposure time (outdoor air)	hrs/day				
Exposure frequency (outdoor air)	days/yr				
Particulate emission factor (outdoor air)	m3/kg				
Potable Water Ingestion					
Potable water intake rate	L/day				
Exposure frequency for potable water intake	days/yr				
Incidental Water Ingestion					
Incidental ingestion rate	L/day				
Exposure frequency for incidental water ingestion	days/yr				
Dermal Contact with Water					
Exposed skin surface for water contact	cm2				
Exposure time for dermal water contact	hr/day				
Exposure frequency for dermal water contact	days/yr				
Vapour Inhalation Shower/ Sprinkler					
Exposure frequency	days/yr				
Exposure time	min/ day				
Inhalation rate	m3/hr				
Inhalation Absorption Adjustment Factor	mg/mg				
Lung retention factor	unitless				
Ingestion of Home Grown Produce					
Proportion of homegrown produce ingested					
Exposure frequency	days/year				
Inhalation of Vapours from Flowing Water					
Exposure time	hrs/day	8	1	8	1
Exposure frequency	days/year	240	350	240	350

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Calculation of Vapour Emissions from Water with Flow
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Odour Based Calculations) Scenario

PARAMETERS

Concrete permeability	(select from drop down list)	High permeability
Permeability Rate (m/day)		8.6.E-02
Water Temperature (deg. C)		18.0
Dimensions of Basement / Impoundment		
Height (m)		4.5
Width (m)		50.0
Depth (m)		50.0
Volume total basement/ impoundment (m3)		11250

Dimensions of Wet Section of Basement/ Impoundment	
Length (m)	59.0
Width (m)	25.0
Depth of Water (m)	0.01
Fetch/ Depth (m) ratio of Wet Basement Section	2500
Volume of wet basement/ impoundment (m3)	14.7500
Area covered in water (m2)	1475
Effective diameter of impoundment/ basement) (m)	43.3
Volume of water entering basement (m^3/sec)	1.48E-05

Air exchange rate (exchanges/day)		7.60E+01
Windspeed (m/s)	if < 3.5m/sec	3.00E-02
	if = or > 3.5m/sec	

Parameter Definition	Volatile	Chemical Concentration in Water (mg/L)	Molecular weight (g/mol)	Vapour Pressure (mmHg)	Vapour Pressure (atm)	Henry's Law Coefficient (unitless)	Henry's Law Coefficient (calculated)	Equilibrium Coefficient (at 25 deg C)	Diffusivity in Water (cm^2/sec)	Schmidt Number on Gas Side (*)	Gas Phase Mass Transfer Coefficient (m/sec)	Schmidt Number on Liquid Side #	Liquid Phase Mass Transfer Coefficient (m/sec) **	Overall Mass Transfer Coefficient (m/s) (windspeed <3.5 m/s)	Diffusivity in Air (cm2/sec)	Equilibrium Concentration of water in Basement/ Impoundment (g/m^3)	Air Emission Rate from Liquid Surface (g/sec)	Air Emission Rate from Liquid Surface (mg/day)	Adjusted Concentration in Basement Air (includes air exchange) (mg/m3)
		C	MW	Vap	Vap	unitless	atm.m3/g mol	K_{eq}	D_{water}	Sc_G	k_G	Sc_L	k_L	K	D_{air}	C_L		E	
Acenaphthene	Y	4.48	154	2.15E-03	2.83E-06	7.52E-03	1.80E-04	7.345E-03	8.33E-06	3.0E+00	9.939E-05	1.08E+03	2.74E-07	2.0E-07	0.0506	1.6E-01	4.63E-05	4.00E+03	4.68E-03
Acenaphthylene	Y	43.2	152	6.68E-03	8.79E-06	4.66E-03	1.11E-04	4.551E-03	6.98E-06	3.4E+00	9.188E-05	1.29E+03	2.44E-07	1.5E-07	0.045	1.7E+00	3.87E-04	3.34E+04	3.91E-02
Ammonia	Y	348	17	-	-	6.58E-04	1.57E-05	6.427E-04	1.10E-05	6.6E-01	2.725E-04	8.18E+02	3.30E-07	1.1E-07	0.228	1.0E+01	1.73E-03	1.49E+05	1.74E-01
Aniline	Y	0.212	93.1	4.90E-01	6.45E-04	8.26E-05	1.97E-06	8.067E-05	1.01E-05	1.8E+00	1.385E-04	8.91E+02	3.12E-07	1.1E-08	0.083	6.6E-03	1.05E-07	9.05E+00	1.06E-05
Anthracene	Y	15.4	178	6.53E-06	8.59E-09	2.27E-03	5.42E-05	2.217E-03	7.85E-06	3.9E+00	8.348E-05	1.15E+03	2.64E-07	1.1E-07	0.039	5.6E-01	9.03E-05	7.80E+03	9.12E-03
Arsenic, Inorganic	N	0.024	78		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	N	2.23	137		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	N	12.6	228		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	Y	40.2	78.1	9.48E+01	1.25E-01	2.27E-01	5.42E-03	2.217E-01	1.03E-05	1.7E+00	1.456E-04	8.74E+02	3.16E-07	3.1E-07	0.0895	1.2E+00	5.69E-04	4.92E+04	5.75E-02
Benzo(a)pyrene	N	9.26	252		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	N	8.33	252		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	N	4.22	276		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	N	2.93	252		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	N	0.03	391		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	N	0.108	112		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	N	0.102	52		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	N	0.102	52		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	N	9.78	228		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	N	0.057	58.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	Y	436	108	1.10E-01	1.45E-04	3.50E-05	8.36E-07	3.418E-05	9.32E-06	2.1E+00	1.269E-04	9.66E+02	2.96E-07	4.3E-09	0.0729	1.4E+01	9.00E-05	7.78E+03	9.09E-03
Cresol, o-	N	182	108		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	N	0.822	278		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	Y	10.2	168	2.48E-03	3.26E-06	8.71E-03	2.08E-04	8.507E-03	7.38E-06	3.7E+00	8.632E-05	1.22E+03	2.53E-07	1.9E-07	0.041	3.9E-01	1.08E-04	9.30E+03	1.09E-02
Dimethylphenol, 2,4-	Y	38	122	1.02E-01	1.34E-04	3.89E-05	9.29E-07	3.799E-05	8.31E-06	2.4E+00	1.141E-04	1.08E+03	2.74E-07	4.3E-09	0.0622	1.3E+00	8.43E-06	7.28E+02	8.52E-04
Ethylbenzene	Y	3.02	106	9.60E+00	1.26E-02	3.22E-01	7.69E-03	3.145E-01	8.46E-06	2.2E+00	1.217E-04	1.06E+03	2.77E-07	2.8E-07	0.0685	1.1E-01	4.27E-05	3.69E+03	4.31E-03
Fluoranthene	N	25.9	202		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	Y	21.1	166	6.00E-04	7.90E-07	3.93E-03	9.38E-05	3.838E-03	7.89E-06	3.4E+00	9.050E-05	1.14E+03	2.65E-07	1.5E-07	0.044	7.7E-01	1.70E-04	1.47E+04	1.72E-02
Indeno(1,2,3-cd)pyrene	N	3.05	276		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	N	187	55.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	N	0.555	207		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	N	4.89	54.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	Y	105	142	5.50E-02	7.24E-05	2.12E-02	5.06E-04	2.071E-02	7.78E-06	2.9E+00	1.017E-04	1.16E+03	2.62E-07	2.3E-07	0.0524	3.9E+00	1.33E-03	1.15E+05	1.34E-01
Naphthalene	Y	283	128	8.50E-02	1.12E-04	1.80E-02	4.30E-04	1.758E-02	8.38E-06	2.5E+00	1.120E-04	1.07E+03	2.75E-07	2.4E-07	0.0605	9.9E+00	3.53E-03	3.05E+05	3.57E-01
Nickel Soluble Salts	N	0.303	58.7		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	Y	74.1	178	1.21E-04	1.59E-07	1.73E-03	4.13E-05	1.690E-03	6.69E-06	4.4E+00	7.689E-05	1.35E+03	2.37E-07	8.4E-08	0.0345	3.0E+00	3.71E-04	3.21E+04	3.75E-02
Phenol	Y	249	94.1	3.50E-01	4.61E-04	1.36E-05	3.25E-07	1.328E-05	1.03E-05	1.8E+00	1.389E-04	8.74E+02	3.16E-07	1.8E-09	0.0834	7.6E+00	2.07E-05	1.79E+03	2.09E-03
Pyrene	Y	27.9	202	4.50E-06	5.92E-09	4.87E-04	1.16E-05	4.756E-04	7.25E-06	5.4E+00	6.654E-05	1.24E+03	2.50E-07	2.8E-08	0.0278	1.1E+00	4.45E-05	3.84E+03	4.49E-03
Styrene	Y	0.194	104	6.40E+00	8.42E-03	1.12E-01	2.67E-03	1.094E-01	8.78E-06	2.1E+00	1.248E-04	1.03E+03	2.84E-07	2.8E-07	0.0711	6.6E-03	2.71E-06	2.34E+02	2.74E-04
Toluene	Y	17.6	92.1	2.84E+01	3.74E-02	2.71E-01	6.47E-03	2.647E-01	9.20E-06	1.9E+00	1.326E-04	9.78E+02	2.93E-07	2.9E-07	0.0778	5.8E-01	2.49E-04	2.15E+04	2.52E-02
TPH C06-C09 aliphatic	Y	6.08	103	9.16E+01	1.21E-01	5.05E+01	1.21E+00	4.932E+01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.10E-07	3.1E-07	0.1	1.9E-01	8.69E-05	7.51E+03	8.78E-03
TPH C10-C14 aliphatic	Y	1730	170	1.16E+00	1.53E-03	6.26E+01	1.49E+00	6.114E+01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.10E-07	3.1E-07	0.1	5.4E+01	2.47E-02	2.14E+06	2.50E+00
TPH C10-C14 aromatic	Y	1730	136	1.16E+00	1.53E-03	1.41E-01	3.37E-03	1.377E-01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.10E-07	3.1E-07	0.1	5.4E+01	2.44E-02	2.11E+06	2.46E+00
TPH C15-C28 aliphatic	n	1520	260		-		-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	n	1520	209		-		-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	n	332	270		-		-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	N	332	240		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	Y	0.92	120	2.10E+00	2.76E-03	2.52E-01	6.02E-03	2.461E-01	7.92E-06	2.5E+00	1.123E-04	1.14E+03	2.65E-07	2.6E-07	0.0607	3.3E-02	1.30E-05	1.12E+03	1.31E-03
Vanadium and compounds	N	0.0228	50.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	Y	6.7	106	7.99E+00	1.05E-02	2.12E-01	5.06E-03	2.071E-01	9.90E-06	1.8E+00	1.404E-04	9.09E+02	3.08E-07	3.0E-07	0.0847	2.1E-01	9.47E-05	8.18E+03	9.57E-03

Notes:
Assumes viscosity of air at 25 deg C
(*) Adopted density and viscosity of air values are those published in USEPA Air Emissions for Wast and Waste Water Nov 1994. (viscosity = 1.81 x 10^{-4}, density = 1.2 x 10^{-3})
** where windspeeds are greater than 3.25 m/s, F/D ratios greater than 51.2 and diffusivity of ether is 8.5 x 10-5
Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Summary of Derived RBSLs
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Odour Based Calculations) Scenario

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Chemical	Soil RBSLs (mg/kg)						Groundwater RBSLs (mg/L)					
	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Saturation Limited?	Site Concentration	Adult Threshold	2.58E+01	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Solubility Limited?	Site Concentration
Acenaphthene	-	-	-	-	-	-	1.79E+02	2.10E+03	-	1.79E+02	>Sol	4.48E+00
Acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia	-	-	-	-	-	-	7.68E+04	8.98E+05	-	7.68E+04	-	3.48E+02
Aniline	-	-	-	-	-	-	1.79E+05	2.10E+06	-	1.79E+05	>Sol	2.12E-01
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	-	-	-	-	-	4.07E+04	4.77E+05	-	4.07E+04	>Sol	4.02E+01
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	-	-	-	-	-	-	1.27E+02	1.49E+03	-	1.27E+02	-	4.36E+02
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	-	-	-	-	-	-	6.10E+02	7.13E+03	-	6.10E+02	>Sol	1.02E+01
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	7.49E+02	8.76E+03	-	7.49E+02	>Sol	3.02E+00
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	-	-	-	-	-	-	4.56E+00	5.34E+01	-	4.56E+00	-	1.05E+02
Naphthalene	-	-	-	-	-	-	1.63E+01	1.91E+02	-	1.63E+01	-	2.83E+02
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	3.93E+04	4.59E+05	-	3.93E+04	-	2.49E+02
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	2.06E+03	2.41E+04	-	2.06E+03	>Sol	1.94E-01
Toluene	-	-	-	-	-	-	1.13E+04	1.32E+05	-	1.13E+04	>Sol	1.76E+01
TPH C06-C09 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	-	-	-	-	-	-	2.95E+03	3.45E+04	-	2.95E+03	>Sol	9.20E-01
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	-	-	-	-	-	-	1.62E+03	1.90E+04	-	1.62E+03	>Sol	6.70E+00

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Pathways included in derivation of Soil RBSL:

Pathways included in derivation of Soil Vapour RBSL:

Pathways included in derivation of Groundwater RBSL:

Health Risk Calculations - Vapours from Flowing Water
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement A (Odour Based Calculations) Scenario

Chemical	Vapour Concentration in Basement/ Impoundment	Aqueous Solubility	Threshold Intake and Risk Calculations						
			Inhalation RfC	Adult Exposure Factor (threshold)	Adult Exposure Adjusted Air Concentration (threshold)	Hazard Index (Adult)	Child Exposure Factor (threshold)	Child Exposure Adjusted Air Concentration (threshold)	Hazard Index (Child)
	mg/m^3	(mg/L)	(mg/m3)	(L/m3)	(mg/m3)	(unitless)	(L/m3)	(mg/m3)	(unitless)
Acenaphthene	4.68E-03	3.90E+00	5.04E-01	4.68E-01	2.19E-03	4.35E-03	4.00E-02	1.87E-04	3.71E-04
Acenaphthylene	3.91E-02	1.61E+01	-	4.68E-01	-	-	4.00E-02	-	-
Ammonia	1.74E-01	4.82E+05	1.80E+01	4.68E-01	8.16E-02	4.53E-03	4.00E-02	6.97E-03	3.87E-04
Aniline	1.06E-05	3.60E+04	4.19E+00	4.68E-01	4.95E-06	1.18E-06	4.00E-02	4.23E-07	1.01E-07
Anthracene	9.12E-03	4.34E-02	-	4.68E-01	-	-	4.00E-02	-	-
Arsenic, Inorganic	-	0.00E+00	-	-	-	-	-	-	-
Barium	-	0.00E+00	-	-	-	-	-	-	-
Benz(a)anthracene	-	9.40E-03	-	-	-	-	-	-	-
Benzene	5.75E-02	1.79E+03	1.09E+02	4.68E-01	2.69E-02	2.47E-04	4.00E-02	2.30E-03	2.11E-05
Benzo(a)pyrene	-	1.62E-03	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	1.50E-03	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	2.60E-04	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	8.00E-04	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	2.70E-01	-	-	-	-	-	-	-
Cadmium (Water)	-	0.00E+00	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	0.00E+00	-	-	-	-	-	-	-
Chromium(VI)	-	1.69E+06	-	-	-	-	-	-	-
Chrysene	-	2.00E-03	-	-	-	-	-	-	-
Cobalt	-	0.00E+00	-	-	-	-	-	-	-
Cresol, m-&p-	9.09E-03	2.27E+04	1.24E-03	4.68E-01	4.25E-03	3.43E+00	4.00E-02	3.63E-04	2.93E-01
Cresol, o-	-	2.59E+04	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	2.49E-03	-	-	-	-	-	-	-
Dibenzofuran	1.09E-02	3.10E+00	1.00E+00	4.68E-01	5.09E-03	5.09E-03	4.00E-02	4.35E-04	4.35E-04
Dimethylphenol, 2,4-	8.52E-04	7.87E+03	-	4.68E-01	-	-	4.00E-02	-	-
Ethylbenzene	4.31E-03	1.69E+02	2.00E+00	4.68E-01	2.02E-03	1.01E-03	4.00E-02	1.72E-04	8.62E-05
Fluoranthene	-	2.60E-01	-	-	-	-	-	-	-
Fluorene	1.72E-02	1.69E+00	-	4.68E-01	-	-	4.00E-02	-	-
Indeno(1,2,3-cd)pyrene	-	1.90E-04	-	-	-	-	-	-	-
Iron	-	0.00E+00	-	-	-	-	-	-	-
Lead and Compounds	-	0.00E+00	-	-	-	-	-	-	-
Manganese	-	0.00E+00	-	-	-	-	-	-	-
Methylnaphthalene, 2-	1.34E-01	2.46E+01	5.81E-02	4.68E-01	6.27E-02	1.08E+00	4.00E-02	5.36E-03	9.22E-02
Naphthalene	3.57E-01	3.10E+01	4.40E-01	4.68E-01	1.67E-01	3.79E-01	4.00E-02	1.43E-02	3.24E-02
Nickel Soluble Salts	-	0.00E+00	-	-	-	-	-	-	-
Phenanthrene	3.75E-02	1.15E+00	-	4.68E-01	-	-	4.00E-02	-	-
Phenol	2.09E-03	8.28E+04	1.54E-01	4.68E-01	9.77E-04	6.34E-03	4.00E-02	8.34E-05	5.42E-04
Pyrene	4.49E-03	1.35E-01	-	4.68E-01	-	-	4.00E-02	-	-
Styrene	2.74E-04	3.10E+02	1.36E+00	4.68E-01	1.28E-04	9.41E-05	4.00E-02	1.09E-05	8.04E-06
Toluene	2.52E-02	5.26E+02	3.01E+01	4.68E-01	1.18E-02	3.90E-04	4.00E-02	1.01E-03	3.34E-05
TPH C06-C09 aliphatic	8.78E-03	1.18E+01	-	4.68E-01	-	-	4.00E-02	-	-
TPH C10-C14 aliphatic	2.50E+00	9.99E-02	-	4.68E-01	-	-	4.00E-02	-	-
TPH C10-C14 aromatic	2.46E+00	2.53E+01	-	4.68E-01	-	-	4.00E-02	-	-
TPH C15-C28 aliphatic	-	1.11E-04	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	1.06E+00	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	2.50E-06	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	6.60E-03	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	1.31E-03	5.70E+01	1.96E+00	4.68E-01	6.12E-04	3.12E-04	4.00E-02	5.23E-05	2.66E-05
Vanadium and compounds	-	-	-	-	-	-	-	-	-
Xylenes (total)	9.57E-03	1.06E+02	4.34E+00	4.68E-01	4.48E-03	1.03E-03	4.00E-02	3.82E-04	8.82E-05
TOTAL						**4.92E+00**			**4.20E-01**

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement A (Odour Based Calculations) Scenario

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW vapours from flowing water	TOTAL (All Pathways)	GW vapours from flowing water	Total Vapour Pathways	TOTAL (All Pathways)					GW vapours from flowing water	TOTAL
	mg/L	mg/L	unitless	unitless	unitless	L/mg	L/mg	mg/L			mg/L	%	%
Acenaphthene	4.48	3.90E+00	4.35E-03	4.35E-03	1.11E-03	1.11E-03	1.11E-03	1.79E+02	4.35E-03	4.35E-03	**1.79E+02**	2.2%	2.17%
Acenaphthylene	43.2	1.61E+01	-	-	-		-	-	-	-	**-**	-	-
Ammonia	348	4.82E+05	4.53E-03	4.53E-03	1.30E-05	1.30E-05	1.30E-05	7.68E+04	1.00E+00	-	**7.68E+04**	100.0%	100.00%
Aniline	0.212	3.60E+04	1.18E-06	1.18E-06	5.57E-06	5.57E-06	5.57E-06	1.79E+05	2.01E-01	2.01E-01	**1.79E+05**	20.1%	20.06%
Anthracene	15.4	4.34E-02	-	-	-		-	-	-	-	**-**	-	-
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	**-**	-	-
Barium	2.23		-	-	-		-	-	-	-	**-**	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	**-**	-	-
Benzene	40.2	1.79E+03	2.47E-04	2.47E-04	6.14E-06	6.14E-06	6.14E-06	4.07E+04	1.10E-02	1.10E-02	**4.07E+04**	4.4%	4.39%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	**-**	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	**-**	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	**-**	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	**-**	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	**-**	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	**-**	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	**-**	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	**-**	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	**-**	-	-
Cobalt	0.057		-	-	-		-	-	-	-	**-**	-	-
Cresol, m-&p-	436	2.27E+04	3.43E+00	3.43E+00	7.87E-03	7.87E-03	7.87E-03	1.27E+02	1.00E+00	-	**1.27E+02**	100.0%	100.00%
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	**-**	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	**-**	-	-
Dibenzofuran	10.2	3.10E+00	5.09E-03	5.09E-03	1.64E-03	1.64E-03	1.64E-03	6.10E+02	5.09E-03	5.09E-03	**6.10E+02**	0.5%	0.51%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	**-**	-	-
Ethylbenzene	3.02	1.69E+02	1.01E-03	1.01E-03	3.34E-04	3.34E-04	3.34E-04	7.49E+02	5.64E-02	5.64E-02	**7.49E+02**	22.6%	22.57%
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	**-**	-	-
Fluorene	21.1	1.69E+00	-	-	-		-	-	-	-	**-**	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	**-**	-	-
Iron	187		-	-	-		-	-	-	-	**-**	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	**-**	-	-
Manganese	4.89		-	-	-		-	-	-	-	**-**	-	-
Methylnaphthalene, 2-	105	2.46E+01	1.08E+00	1.08E+00	4.39E-02	4.39E-02	4.39E-02	4.56E+00	2.00E-01	-	**4.56E+00**	100.0%	100.00%
Naphthalene	283	3.10E+01	3.79E-01	3.79E-01	1.22E-02	1.22E-02	1.22E-02	1.63E+01	2.00E-01	-	**1.63E+01**	100.0%	100.00%
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	**-**	-	-
Phenanthrene	74.1	1.15E+00	-	-	-		-	-	-	-	**-**	-	-
Phenol	249	8.28E+04	6.34E-03	6.34E-03	2.55E-05	2.55E-05	2.55E-05	3.93E+04	1.00E+00	-	**3.93E+04**	100.0%	100.00%
Pyrene	27.9	1.35E-01	-	-	-		-	-	-	-	**-**	-	-
Styrene	0.194	3.10E+02	9.41E-05	9.41E-05	4.85E-04	4.85E-04	4.85E-04	2.06E+03	1.50E-01	1.50E-01	**2.06E+03**	15.0%	15.03%
Toluene	17.6	5.26E+02	3.90E-04	3.90E-04	2.22E-05	2.22E-05	2.22E-05	1.13E+04	1.17E-02	1.17E-02	**1.13E+04**	4.7%	4.67%
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-		-	-	-	-	**-**	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-		-	-	-	-	**-**	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-		-	-	-	-	**-**	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	**-**	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	**-**	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	**-**	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	**-**	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	3.12E-04	3.12E-04	3.39E-04	3.39E-04	3.39E-04	2.95E+03	1.93E-02	1.93E-02	**2.95E+03**	1.9%	1.93%
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	**-**	-	-
Xylenes (total)	6.7	1.06E+02	1.03E-03	1.03E-03	1.54E-04	1.54E-04	1.54E-04	1.62E+03	1.63E-02	1.63E-02	**1.62E+03**	6.5%	6.53%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Child Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement A(Odour Based Calculations) Scenario

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW Vapurs from Flowing Water	TOTAL (All Pathways)	GW Vapour from Flowing Water	Total Vapour Pathways	TOTAL (All Pathways)					GW Vapours from Flowing Water	TOTAL
	mg/L	mg/L	unitless	unitless	unitless	L/mg	L/mg	mg/L			mg/L	%	%
Acenaphthene	4.48	3.90E+00	3.71E-04	3.71E-04	9.52E-05	9.52E-05	9.52E-05	2.10E+03	3.71E-04	3.71E-04	**2.10E+03**	0.2%	0.19%
Acenaphthylene	43.2	1.61E+01	-	-	-		-	-	-	-	**-**	-	-
Ammonia	348	4.82E+05	3.87E-04	3.87E-04	1.11E-06	1.11E-06	1.11E-06	8.98E+05	5.36E-01	5.36E-01	**8.98E+05**	53.6%	53.65%
Aniline	0.212	3.60E+04	1.01E-07	1.01E-07	4.76E-07	4.76E-07	4.76E-07	2.10E+06	1.71E-02	1.71E-02	**2.10E+06**	1.7%	1.71%
Anthracene	15.4	4.34E-02	-	-	-		-	-	-	-	**-**	-	-
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	**-**	-	-
Barium	2.23		-	-	-		-	-	-	-	**-**	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	**-**	-	-
Benzene	40.2	1.79E+03	2.11E-05	2.11E-05	5.24E-07	5.24E-07	5.24E-07	4.77E+05	9.39E-04	9.39E-04	**4.77E+05**	0.4%	0.38%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	**-**	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	**-**	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	**-**	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	**-**	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	**-**	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	**-**	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	**-**	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	**-**	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	**-**	-	-
Cobalt	0.057		-	-	-		-	-	-	-	**-**	-	-
Cresol, m-&p-	436	2.27E+04	2.93E-01	2.93E-01	6.73E-04	6.73E-04	6.73E-04	1.49E+03	1.00E+00	-	**1.49E+03**	100.0%	100.00%
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	**-**	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	**-**	-	-
Dibenzofuran	10.2	3.10E+00	4.35E-04	4.35E-04	1.40E-04	1.40E-04	1.40E-04	7.13E+03	4.35E-04	4.35E-04	**7.13E+03**	0.0%	0.04%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	**-**	-	-
Ethylbenzene	3.02	1.69E+02	8.62E-05	8.62E-05	2.85E-05	2.85E-05	2.85E-05	8.76E+03	4.82E-03	4.82E-03	**8.76E+03**	1.9%	1.93%
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	**-**	-	-
Fluorene	21.1	1.69E+00	-	-	-		-	-	-	-	**-**	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	**-**	-	-
Iron	187		-	-	-		-	-	-	-	**-**	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	**-**	-	-
Manganese	4.89		-	-	-		-	-	-	-	**-**	-	-
Methylnaphthalene, 2-	105	2.46E+01	9.22E-02	9.22E-02	3.75E-03	3.75E-03	3.75E-03	5.34E+01	9.22E-02	9.22E-02	**5.34E+01**	46.1%	46.10%
Naphthalene	283	3.10E+01	3.24E-02	3.24E-02	1.05E-03	1.05E-03	1.05E-03	1.91E+02	3.24E-02	3.24E-02	**1.91E+02**	16.2%	16.21%
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	**-**	-	-
Phenanthrene	74.1	1.15E+00	-	-	-		-	-	-	-	**-**	-	-
Phenol	249	8.28E+04	5.42E-04	5.42E-04	2.18E-06	2.18E-06	2.18E-06	4.59E+05	1.80E-01	1.80E-01	**4.59E+05**	18.0%	18.03%
Pyrene	27.9	1.35E-01	-	-	-		-	-	-	-	**-**	-	-
Styrene	0.194	3.10E+02	8.04E-06	8.04E-06	4.14E-05	4.14E-05	4.14E-05	2.41E+04	1.28E-02	1.28E-02	**2.41E+04**	1.3%	1.28%
Toluene	17.6	5.26E+02	3.34E-05	3.34E-05	1.90E-06	1.90E-06	1.90E-06	1.32E+05	9.97E-04	9.97E-04	**1.32E+05**	0.4%	0.40%
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-		-	-	-	-	**-**	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-		-	-	-	-	**-**	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-		-	-	-	-	**-**	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	**-**	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	**-**	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	**-**	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	**-**	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	2.66E-05	2.66E-05	2.90E-05	2.90E-05	2.90E-05	3.45E+04	1.65E-03	1.65E-03	**3.45E+04**	0.2%	0.17%
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	**-**	-	-
Xylenes (total)	6.7	1.06E+02	8.82E-05	8.82E-05	1.32E-05	1.32E-05	1.32E-05	1.90E+04	1.40E-03	1.40E-03	**1.90E+04**	0.6%	0.56%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

1. General Information:

Site:	Barangaroo
Address:	Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Client:	Lend Lease
Scenario:	Scenario 2 - Upper Basement (Odour Based Calculations)

Header Colour (Defaults = Blue):

Blue

2. Select Receptor:

Commercial/Industrial

3. Select Exposure Pathways to Include:

Enter "x" in box, or select from dropdown box.

Soil Pathways

	Incidental Ingestion of Soil
	Dermal Contact with Soil
	Inhalation of Surface Soil-Derived Dust in Indoor Air
	Inhalation of Surface Soil-Derived Dust in Outdoor Air
	Inhalation of Surface Soil-Derived Vapours in Outdoor Air
	Inhalation of Soil-Derived Vapours From Excavation (USEPA 2002 method)
x	Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
	Inhalation of Subsurface Soil-Derived Vapours in Outdoor Air

Groundwater Pathways

	Inhalation of Groundwater-Derived Vapours in Indoor Air
	Inhalation of Groundwater-Derived Vapours in Outdoor Air
	Ingestion of Potable Groundwater
	Incidental Ingestion of Groundwater (Bathing or Excavation)
	Dermal Contact with Groundwater (Bathing or Excavation)
	Inhalation of Groundwater Vapours during Irrigation/ Showering
	Ingestion of Vegetables Irrigated with Groundwater
	Inhalation of Groundwater Vapours (Where GW Enters Trench)
x	Inhalation of vapour emissions from flowing water (groundwater in basement)
	Inhalation of Soil Vapour-Derived Vapours in Indoor Air
	Inhalation of Soil Vapour-Derived Vapours in Outdoor Air

Y	Soil RBSLs saturation limited?
Y	Groundwater RBSLs solubility limited?

4. Select Chemicals for Quantitative Assessment:	Target Hazard Index	Target Cancer Risk	5. Enter Chemical Concentrations (if only calculating RBSLs, enter 1 for media for which you want RBSLs):	
	default = 1 (or manually overwrite)	default = $1x10^{-5}$ (or manually overwrite)	Soil (mg/kg)	Groundwater (mg/L)
Acenaphthene	0.2	1.00E-05	511	4.48
Acenaphthylene	0.2	1.00E-05	1700	43.2
Ammonia	1	1.00E-05		348
Aniline	1	1.00E-05		0.212
Anthracene	0.2	1.00E-05	2150	15.4
Arsenic, Inorganic	1	1.00E-05		0.024
Barium	1	1.00E-05		2.23
Benz(a)anthracene		1.00E-05	1470	12.6
Benzene	0.25	1.00E-05	1510	40.2
Benzo(a)pyrene		1.00E-05	652	9.26
Benzo(b)fluoranthene		1.00E-05	587	8.33
Benzo(g,h,i)perylene		1.00E-05	305	4.22
Benzo(k)fluoranthene		1.00E-05	231	2.93
Bis(2-ethylhexyl)phalate	1	1.00E-05		0.03
Cadmium (Water)	1	1.00E-05		0.108
Chromium(III), Insoluble Salt	1	1.00E-05	210	0.102
Chromium(VI)	1	1.00E-05	2.3	0.102
Chrysene		1.00E-05	771	9.78
Cobalt	1	1.00E-05		0.057
Cresol, m-&p-	1	1.00E-05	2290	436
Cresol, o-	1	1.00E-05		182
Blank				
Dibenz(a,h)anthracene		1.00E-05	71.4	0.822
Dibenzofuran	1	1.00E-05	277	10.2
Dimethylphenol, 2,4-	1	1.00E-05		38
Ethylbenzene	0.25	1.00E-05	261	3.02
Fluoranthene		1.00E-05	2440	25.9
Fluorene	0.2	1.00E-05	2100	21.1
Indeno(1,2,3-cd)pyrene		1.00E-05	247	3.05
Iron	1	1.00E-05	60600	187
Lead and Compounds	1	1.00E-05	13600	0.555
Manganese	1	1.00E-05		4.89
Methylnaphthalene, 2-	0.2	1.00E-05	7650	105
Naphthalene	0.2	1.00E-05	10200	283
Nickel Soluble Salts	1	1.00E-05		0.303
Phenanthrene	0.2	1.00E-05	5180	74.1
Phenol	1	1.00E-05		249
Pyrene	0.2	1.00E-05	2640	27.9
Styrene	1	1.00E-05		0.194
Toluene	0.25	1.00E-05	2650	17.6
TPH C06-C09 aliphatic	0.125	1.00E-05	593	6.08
TPH C10-C14 aliphatic	0.125	1.00E-05	69400	1730
TPH C10-C14 aromatic	0.125	1.00E-05	69400	1730
TPH C15-C28 aliphatic	0.125	1.00E-05	93200	1520
TPH C15-C28 aromatic	0.125	1.00E-05	93200	1520
TPH C29-C36 aliphatic	0.125	1.00E-05	20600	332
TPH C29-C36 aromatic	0.125	1.00E-05	20600	332
Trimethylbenzene, 1,2,4-	1	1.00E-05	220	0.92
Vanadium and compounds	1	1.00E-05	248	0.0228
Xylenes (total)	0.25	1.00E-05	2576	6.7

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

6. Confirm/Modify Exposure Parameters:

		Site-Specific Value (leave blank to use default value)		Value Used in Calculations	
		Adult	Child	Adult	Child
General receptor parameters:	**Units**				
Body weight	kg	70	na	70	
Exposure duration	yr	30	na	30	
Averaging time (carcinogens)	yr	70	na	70	
Averaging time (non-carcinogens)	yr	30	na	30	
Incidental Soil Ingestion					
Daily soil ingestion rate	mg/day				
Exposure frequency for soil ingestion	days/yr				
Fraction of daily soil intake from site	unitless				
Dermal Absorption of Soil					
Exposed skin surface area for soil contact	cm2				
Soil to skin adherence factor	mg/cm2				
Exposure frequency for dermal contact with soil	days/yr				
Indoor Inhalation					
Exposure time (indoor air)	hrs/day	8		8	
Exposure frequency (indoor air)	days/yr	240		240	
Particulate emission factor (indoor air)	m3/kg				
Outdoor Inhalation					
Exposure time (outdoor air)	hrs/day				
Exposure frequency (outdoor air)	days/yr				
Particulate emission factor (outdoor air)	m3/kg				
Potable Water Ingestion					
Potable water intake rate	L/day				
Exposure frequency for potable water intake	days/yr				
Incidental Water Ingestion					
Incidental ingestion rate	L/day				
Exposure frequency for incidental water ingestion	days/yr				
Dermal Contact with Water					
Exposed skin surface for water contact	cm2				
Exposure time for dermal water contact	hr/day				
Exposure frequency for dermal water contact	days/yr				
Vapour Inhalation Shower/ Sprinkler					
Exposure frequency	days/yr				
Exposure time	min/ day				
Inhalation rate	m3/hr				
Inhalation Absorption Adjustment Factor	mg/mg				
Lung retention factor	unitless				
Ingestion of Home Grown Produce					
Proportion of homegrown produce ingested					
Exposure frequency	days/year				
Inhalation of Vapours from Flowing Water					
Exposure time	hrs/day	8	8	8	8
Exposure frequency	days/year	240	240	240	240

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A. Model Input Parameters

Parameter Definition	Units	Default Value (Shell 2007 unless otherwise noted)	Notes	Site-Specific Value (leave blank if adopting Shell default)	Label	Adopted Value for Model	Justification for Site-specific value, if applicable
Lower depth of surficial soil zone	cm	100			LDSSZ	100	
Depth to subsurface soil sources (below building, ground surface or trench	cm	100			LS	0.001	Autocalculates from layer thicknesses
Vadose Zone Layer 1 (soil type where source is)							
Thickness	cm	100		0.001	HV	0.001	Negligible distance - assumes soil is adjacent building foundataion.
SCS Soil Type:				Sand and gravel (<12% fines)			Conservative assumption for mixed fill.
Fraction of organic carbon	unitless	0.01		0.002	OC	0.002	
Soil bulk density	g/cm3	1.7		1.66	sbd	1.66	
Air-filled porosity (volumetric)	cm3/cm3	0.26		0.321	VACS	0.321	
Water-filled porosity (volumetric)	cm3/cm3	0.12		0.054	vwcvz	0.054	
Total soil porosity	cm3/cm3	0.38		0.375	TPOR	0.375	
Vapour phase source partitioning adjustment	unitless	1		10	VPPA	10	Adjustment for vapour partitioning; see text.
Vadose zone biodegradation adjustment	unitless	1		1	BioA	1	Conservatively assumes no soil vapour biodegradation
Building Characteristics							
Enclosed-space volume/infiltration area (ratio)	cm	300	(a)	5625	LB	5625	Assumes 25 m by 25 m by 4.5 m high basement section, with soil vapour infiltration through upper 2 m of 2 of 4 walls only, ie volume = 11250 m3 and infilatration area = 200 m2. See text.
Enclosed-space foundation or wall thickness	cm	15		15	Lcrack	15	600 mm diaphragm outer wall assumed, as per LLD
Enclosed-space air exchange rate	1/s	0.000555556		0.00088	ENCAER	8.80E-04	4 per hour, in accordance with AS1668.2
Areal fraction of cracks in foundations/walls	cm^2-cracks/cm^2-total area	0.0019	(b)	0.0002	NU	0.0002	USEPA (2004) default for basement foundation.
Volumetric air content in found./wall cracks	cc/cc	0.26		0.321	VACF	0.321	Assumes cracks in concrete are filled with sand.
Volumetric water content in found./wall cracks	cc/cc	0.12		0.054	vwcfnd	0.054	Assumes cracks in concrete are filled with sand.
Convective vapour flow term							
Calculate convective flow term?		Y		y	Conv	y	
Convective flow rate (if specified directly)	cm3/sec			0.001			Negligible rate to account for assumption that advective flow not likely. Air flow will not be possible with wetted wall.
Convective flow through slab (calculated)	cm3/sec	10.88		380.3828744	Qs	380.38	
Slab Area	cm2	700000		2.70E+07	Ab	27000000	Conservatively assumes area of 2 walls and floor
Areal fraction of cracks in foundations/walls	cm^2-cracks/cm^2-total area	0.0019		0.0002	Nuc		
Soil vapour permeability	cm^2	1.00E-08		1.00E-07	kv	1.00E-07	
Indoor-outdoor pressure differential	g/cm-s^2	40		4.00E+01	dP	40	
Slab perimeter	cm	3400		2.00E+04	Xcrack	20000	
Depth below ground to bottom of slab	cm	15		2.00E+02	Zcrack	200	
Viscosity of air	g/cm-s	1.81E-04		1.81E-04	uair	1.81E-04	

(a) Building Code of Australia minimum ceiling height for habitable dwelling.
(b) USEPA (2004) upper limit of range for slab on grade foundation.
(c) If receptor is construction/excavation worker, wind speed is default wind speed of 225 cm/s reduced by factor of 10 to account for reduced wind circulation within excavation. For other receptors, wind speed is default of 225 cm/s.
(d) For construction/excavation worker, default is 400 cm (assumes trench is 2 m long and 2 m deep, and vapours enter through both walls and floor). For other receptors, Shell (2007) default of 4500 cm is assumed.
(e) Equals exposure duration for selected receptor. For residential scenario, shortest (child) exposure duration is selected for conservative purposes.
(f) USEPA (2002) default (0.5 acre).

B. Chemical-Specific Fate and Transport Parameters

CHEMICAL	Koc	Kd	H'	S	D^{air}	D^{wat}	MW	VP	Volatile?
	(cm^3/g)	(cm^3/g)	(cc-$H_2$0 / cc-air)	(mg/l-water)	(cm^2/s)	(cm^2/s)	(g/mol)	(mmHg)	
Acenaphthene	5.03E+03	1.01E+01	7.52E-03	3.90E+00	5.06E-02	8.33E-06	1.54E+02	2.15E-03	Y
Acenaphthylene	5.03E+03	1.01E+01	4.66E-03	1.61E+01	4.50E-02	6.98E-06	1.52E+02	6.68E-03	Y
Ammonia	3.10E+00	6.20E-03	6.58E-04	4.82E+05	2.28E-01	1.10E-05	1.70E+01	-	Y
Aniline	7.02E+01	1.40E-01	8.26E-05	3.60E+04	8.30E-02	1.01E-05	9.31E+01	4.90E-01	Y
Anthracene	1.64E+04	3.28E+01	2.27E-03	4.34E-02	3.90E-02	7.85E-06	1.78E+02	6.53E-06	Y
Arsenic, Inorganic	-	-	-		-	-	7.80E+01	-	N
Barium	-	-	-		-	-	1.37E+02	-	N
Benz(a)anthracene	1.77E+05	3.54E+02	1.37E-04	9.40E-03	5.10E-02	9.00E-06	2.28E+02	2.10E-07	N
Benzene	1.46E+02	2.92E-01	2.27E-01	1.79E+03	8.95E-02	1.03E-05	7.81E+01	9.48E+01	Y
Benzo(a)pyrene	5.87E+05	1.17E+03	1.87E-05	1.62E-03	4.30E-02	9.00E-06	2.52E+02	5.49E-09	N
Benzo(b)fluoranthene	5.99E+05	1.20E+03	2.69E-05	1.50E-03	2.26E-02	5.56E-06	2.52E+02	5.00E-07	N
Benzo(g,h,i)perylene	1.95E+06	3.90E+03	1.35E-05	2.60E-04	4.90E-02	5.56E-06	2.76E+02	1.00E-10	N
Benzo(k)fluoranthene	5.87E+05	1.17E+03	2.39E-05	8.00E-04	2.26E-02	5.56E-06	2.52E+02	9.65E-10	N
Bis(2-ethylhexyl)phalate	1.20E+05	2.40E+02	1.10E-05	2.70E-01	3.51E-02	3.66E-06	3.91E+02	1.42E-07	N
Cadmium (Water)	-	-	-		-	-	1.12E+02		N
Chromium(III), Insoluble Salts	-	-	-		-	-	5.20E+01	-	N
Chromium(VI)	-	-	-	1.69E+06	-	-	5.20E+01	-	N
Chrysene	1.81E+05	3.62E+02	2.14E-04	2.00E-03	2.48E-02	6.21E-06	2.28E+02	6.23E-09	N
Cobalt	-	-	-		-	-	5.89E+01		N
Cresol, m-&p-	3.00E+02	6.00E-01	3.50E-05	2.27E+04	7.29E-02	9.32E-06	1.08E+02	1.10E-01	Y
Cresol, o-	3.07E+02	6.14E-01	4.91E-05	2.59E+04	7.28E-02	9.32E-06	1.08E+02	1.70E-01	N
Dibenz(a,h)anthracene	1.91E+06	3.82E+03	5.76E-06	2.49E-03	2.00E-02	5.24E-06	2.78E+02	9.55E-10	N

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Dibenzofuran	9.16E+03	1.83E+01	8.71E-03	3.10E+00	4.10E-02	7.38E-06	1.68E+02	2.48E-03	Y
Dimethylphenol, 2,4-	4.92E+02	9.84E-01	3.89E-05	7.87E+03	6.22E-02	8.31E-06	1.22E+02	1.02E-01	Y
Ethylbenzene	4.46E+02	8.92E-01	3.22E-01	1.69E+02	6.85E-02	8.46E-06	1.06E+02	9.60E+00	Y
Fluoranthene	5.55E+04	1.11E+02	3.62E-04	2.60E-01	3.02E-02	6.35E-06	2.02E+02	9.22E-06	N
Fluorene	9.16E+03	1.83E+01	3.93E-03	1.69E+00	4.40E-02	7.89E-06	1.66E+02	6.00E-04	Y
Indeno(1,2,3-cd)pyrene	1.95E+06	3.90E+03	1.42E-05	1.90E-04	2.30E-02	4.41E-06	2.76E+02	1.25E-10	N
Iron	-	-	-		-	-	5.59E+01		N
Lead and Compounds	-	-	-		-	-	2.07E+02		N
Manganese	-	-	-		-	-	5.49E+01	-	N
Methylnaphthalene, 2-	2.48E+03	4.96E+00	2.12E-02	2.46E+01	5.24E-02	7.78E-06	1.42E+02	5.50E-02	Y
Naphthalene	1.54E+03	3.08E+00	1.80E-02	3.10E+01	6.05E-02	8.38E-06	1.28E+02	8.50E-02	Y
Nickel Soluble Salts	-	-	-		-	-	5.87E+01		N
Phenanthrene	1.67E+04	3.34E+01	1.73E-03	1.15E+00	3.45E-02	6.69E-06	1.78E+02	1.21E-04	Y
Phenol	1.87E+02	3.74E-01	1.36E-05	8.28E+04	8.34E-02	1.03E-05	9.41E+01	3.50E-01	Y
Pyrene	5.43E+04	1.09E+02	4.87E-04	1.35E-01	2.78E-02	7.25E-06	2.02E+02	4.50E-06	Y
Styrene	4.46E+02	8.92E-01	1.12E-01	3.10E+02	7.11E-02	8.78E-06	1.04E+02	6.40E+00	Y
Toluene	2.34E+02	4.68E-01	2.71E-01	5.26E+02	7.78E-02	9.20E-06	9.21E+01	2.84E+01	Y
TPH C06-C09 aliphatic	4.47E+03	8.94E+00	5.05E+01	1.18E+01	1.00E-01	1.00E-05	1.03E+02	9.16E+01	Y
TPH C10-C14 aliphatic	5.50E+05	1.10E+03	6.26E+01	9.99E-02	1.00E-01	1.00E-05	1.70E+02	1.16E+00	Y
TPH C10-C14 aromatic	3.02E+03	6.04E+00	1.41E-01	2.53E+01	1.00E-01	1.00E-05	1.36E+02	1.16E+00	Y
TPH C15-C28 aliphatic	3.16E+08	6.32E+05	8.27E+01	1.11E-04	1.00E-01	1.00E-05	2.60E+02	5.93E-03	n
TPH C15-C28 aromatic	3.79E+04	7.58E+01	4.90E-03	1.06E+00	1.00E-01	1.00E-05	2.09E+02	5.51E-03	N
TPH C29-C36 aliphatic	6.31E+08	1.26E+06	8.50E+01	2.50E-06	1.00E-01	1.00E-05	2.70E+02	8.36E-04	N
TPH C29-C36 aromatic	1.26E+05	2.52E+02	1.70E-05	6.60E-03	1.00E-01	1.00E-05	2.40E+02	3.34E-07	N
Trimethylbenzene, 1,2,4-	6.14E+02	1.23E+00	2.52E-01	5.70E+01	6.07E-02	7.92E-06	1.20E+02	2.10E+00	Y
Vanadium and compounds	-	-	-	-	-	-	5.09E+01	-	N
Xylenes (total)	3.83E+02	7.66E-01	2.12E-01	1.06E+02	8.47E-02	9.90E-06	1.06E+02	7.99E+00	Y

Definition of Parameters

Koc	Organic carbon partition coefficient	D^{air}	Diffusion coefficient in air
Kd	Soil-water partition coefficient	D^{wat}	Diffusion coefficient in water
H'	Dimensionless Henry's Law Constant	MW	Molecular weight
S	Solubility	VP	Vapopur pressure

C. Chemical-Specific Diffusion Coefficients

CHEMICAL	D_{s1}	D_{s2}	D_{s3}	D_{stot}	D_{crack}	C_{sat}	Convective Factor	D_a	M_{excav}
	(cm^2/s)	(cm^2/s)	(cm^2/s)	(cm^2/s)	(cm^2/s)	(mg/kg)	(unitless)	(cm^2/s)	(g)
Acenaphthene	8.18E-03	-	-	8.18E-03	8.18E-03	3.94E+01	1.29E+02	3.66E-06	7.25E+04
Acenaphthylene	7.28E-03	-	-	7.28E-03	7.28E-03	1.63E+02	1.45E+02	2.02E-06	5.38E+04
Ammonia	3.69E-02	-	-	3.69E-02	3.69E-02	1.87E+04	2.87E+01	3.75E-04	7.34E+05
Aniline	1.35E-02	-	-	1.35E-02	1.35E-02	6.23E+03	7.84E+01	3.86E-06	7.45E+04
Anthracene	6.31E-03	-	-	6.31E-03	6.31E-03	1.42E+00	1.68E+02	2.62E-07	1.94E+04
Arsenic, Inorganic	NV	NV	NV	NV	NV	-	NV	NV	NV
Barium	NV	NV	NV	NV	NV	-	NV	NV	NV
Benz(a)anthracene	NV	NV	NV	NV	NV	3.33E+00	NV	NV	NV
Benzene	1.45E-02	-	-	1.45E-02	1.45E-02	6.59E+02	7.30E+01	5.35E-03	2.77E+06
Benzo(a)pyrene	NV	NV	NV	NV	NV	1.90E+00	NV	NV	NV
Benzo(b)fluoranthene	NV	NV	NV	NV	NV	1.80E+00	NV	NV	NV
Benzo(g,h,i)perylene	NV	NV	NV	NV	NV	1.01E+00	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	NV	NV	NV	9.39E-01	NV	NV	NV
Bis(2-ethylhexyl)phalate	NV	NV	NV	NV	NV	6.48E+01	NV	NV	NV
Cadmium (Water)	NV	NV	NV	NV	NV	-	NV	NV	NV
Chromium(III), Insoluble Salts	NV	NV	NV	NV	NV	-	NV	NV	NV
Chromium(VI)	NV	NV	NV	NV	NV	-	NV	NV	NV
Chrysene	NV	NV	NV	NV	NV	7.24E-01	NV	NV	NV
Cobalt	NV	NV	NV	NV	NV	-	NV	NV	NV
Cresol, m-&p-	1.19E-02	-	-	1.19E-02	1.19E-02	1.44E+04	8.88E+01	3.95E-07	2.38E+04
Cresol, o-	NV	NV	NV	NV	NV	1.67E+04	NV	NV	NV
Blank	NV	NV	NV	NV	NV	6.48E+01	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	NV	NV	NV	9.51E+00	NV	NV	NV
Dibenzofuran	6.63E-03	-	-	6.63E-03	6.63E-03	5.69E+01	1.59E+02	1.89E-06	5.21E+04
Dimethylphenol, 2,4-	1.01E-02	-	-	1.01E-02	1.01E-02	8.00E+03	1.04E+02	2.33E-07	1.83E+04
Ethylbenzene	1.11E-02	-	-	1.11E-02	1.11E-02	1.67E+02	9.54E+01	2.17E-03	1.77E+06
Fluoranthene	NV	NV	NV	NV	NV	2.89E+01	NV	NV	NV
Fluorene	7.11E-03	-	-	7.11E-03	7.11E-03	3.10E+01	1.49E+02	9.14E-07	3.62E+04
Indeno(1,2,3-cd)pyrene	NV	NV	NV	NV	NV	7.41E-01	NV	NV	NV
Iron	NV	NV	NV	NV	NV	-	NV	NV	NV
Lead and Compounds	NV	NV	NV	NV	NV	-	NV	NV	NV
Manganese	NV	NV	NV	NV	NV	-	NV	NV	NV
Methylnaphthalene, 2-	8.47E-03	-	-	8.47E-03	8.47E-03	1.23E+02	1.25E+02	2.16E-05	1.76E+05
Naphthalene	9.78E-03	-	-	9.78E-03	9.78E-03	9.66E+01	1.08E+02	3.39E-05	2.21E+05
Nickel Soluble Salts	NV	NV	NV	NV	NV	-	NV	NV	NV
Phenanthrene	5.58E-03	-	-	5.58E-03	5.58E-03	3.84E+01	1.89E+02	1.73E-07	1.58E+04
Phenol	1.38E-02	-	-	1.38E-02	1.38E-02	3.37E+04	7.65E+01	2.77E-07	2.00E+04
Pyrene	4.50E-03	-	-	4.50E-03	4.50E-03	1.47E+01	2.35E+02	1.21E-08	4.17E+03
Styrene	1.15E-02	-	-	1.15E-02	1.15E-02	2.93E+02	9.19E+01	8.17E-04	1.08E+06
Toluene	1.26E-02	-	-	1.26E-02	1.26E-02	2.91E+02	8.40E+01	3.70E-03	2.31E+06
TPH C06-C09 aliphatic	1.62E-02	-	-	1.62E-02	1.62E-02	2.21E+02	6.54E+01	2.61E-02	6.13E+06
TPH C10-C14 aliphatic	1.62E-02	-	-	1.62E-02	1.62E-02	1.11E+02	6.54E+01	5.46E-04	8.86E+05
TPH C10-C14 aromatic	1.62E-02	-	-	1.62E-02	1.62E-02	1.54E+02	6.54E+01	2.24E-04	5.68E+05
TPH C15-C28 aliphatic	NV	NV	NV	NV	NV	7.02E+01	NV	NV	NV
TPH C15-C28 aromatic	NV	NV	NV	NV	NV	8.04E+01	NV	NV	NV
TPH C29-C36 aliphatic	NV	NV	NV	NV	NV	3.16E+00	NV	NV	NV
TPH C29-C36 aromatic	NV	NV	NV	NV	NV	1.66E+00	NV	NV	NV

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Trimethylbenzene, 1,2,4-	9.81E-03	-	-	9.81E-03	9.81E-03	7.46E+01	1.08E+02	1.13E-03	1.28E+06
Vanadium and compounds	NV	NV	NV	NV	NV	-	NV	NV	NV
Xylenes (total)	1.37E-02	-	-	1.37E-02	1.37E-02	8.90E+01	7.72E+01	2.08E-03	1.73E+06

Definition of Parameters

D_s	Effective diffusion coefficient in soil based on vapor-phase concentration	D_a	= Apparent diffusivity (for construction scenario Volatilisation Factor)
D_{crack}	Effective diffusion coefficient through foundation cracks	M_{excav}	= Cumulative unit mass emitted from excavation (Eq E-13 in USEPA, 2002).
C_{sat}	Soil concentration at which dissolved pore-water and vapor phases become saturated		

D. Chemical-Specific Volatilisation Factors

CHEMICAL	VF_{as1} (mg/m³-air / mg/kg-soil)	VF_{as2} (mg/m³-air / mg/kg-soil)	$VF_{p\ (indoor)}$ (mg/m³-air / mg/kg-soil)	$VF_{p\ (outdoor)}$ (m³-air / mg/kg-s	VF_{samb} (mg/m³-air / mg/kg-soil)	VF_{sesp} (mg/m³-air / mg/kg-soil)	VF_{excav} (mg/m³-air / mg/kg-soil)
Acenaphthene	1.17E-05	1.75E-05	-	-	3.35E-01	2.12E-06	-3.12E+08
Acenaphthylene	8.66E-06	1.75E-05	-	-	1.94E-01	1.31E-06	-2.32E+08
Ammonia	1.18E-04	1.75E-05	-	-	1.33E+01	4.82E-05	-3.16E+09
Aniline	1.20E-05	1.75E-05	-	-	2.74E-01	1.36E-06	-3.21E+08
Anthracene	3.12E-06	1.75E-05	-	-	2.67E-02	1.97E-07	-8.35E+07
Arsenic, Inorganic	NV	NV	-	-	NV	NV	NV
Barium	NV	NV	-	-	NV	NV	NV
Benz(a)anthracene	NV	NV	-	-	NV	NV	NV
Benzene	4.46E-04	1.75E-05	-	-	3.64E+02	1.75E-03	-1.19E+10
Benzo(a)pyrene	NV	NV	-	-	NV	NV	NV
Benzo(b)fluoranthene	NV	NV	-	-	NV	NV	NV
Benzo(g,h,i)perylene	NV	NV	-	-	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	-	-	NV	NV	NV
Bis(2-ethylhexyl)phalate	NV	NV	-	-	NV	NV	NV
Cadmium (Water)	NV	NV	-	-	NV	NV	NV
Chromium(III), Insoluble Salts	NV	NV	-	-	NV	NV	NV
Chromium(VI)	NV	NV	-	-	NV	NV	NV
Chrysene	NV	NV	-	-	NV	NV	NV
Cobalt	NV	NV	-	-	NV	NV	NV
Cresol, m-&p-	3.84E-06	1.75E-05	-	-	3.01E-02	1.57E-07	-1.03E+08
Cresol, o-	NV	NV	-	-	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	-	-	NV	NV	NV
Dibenzofuran	8.38E-06	1.75E-05	-	-	1.89E-01	1.35E-06	-2.24E+08
Dimethylphenol, 2,4-	2.95E-06	1.75E-05	-	-	1.93E-02	1.09E-07	-7.88E+07
Ethylbenzene	2.84E-04	1.75E-05	-	-	1.71E+02	9.29E-04	-7.61E+09
Fluoranthene	NV	NV	-	-	NV	NV	NV
Fluorene	5.84E-06	1.75E-05	-	-	8.90E-02	6.09E-07	-1.56E+08
Indeno(1,2,3-cd)pyrene	NV	NV	-	-	NV	NV	NV
Iron	NV	NV	-	-	NV	NV	NV
Lead and Compounds	NV	NV	-	-	NV	NV	NV
Manganese	NV	NV	-	-	NV	NV	NV
Methylnaphthalene, 2-	2.83E-05	1.75E-05	-	-	1.95E+00	1.21E-05	-7.59E+08
Naphthalene	3.55E-05	1.75E-05	-	-	2.86E+00	1.64E-05	-9.51E+08
Nickel Soluble Salts	NV	NV	-	-	NV	NV	NV
Phenanthrene	2.54E-06	1.75E-05	-	-	1.85E-02	1.47E-07	-6.80E+07
Phenol	3.21E-06	1.75E-05	-	-	1.94E-02	9.52E-08	-8.60E+07
Pyrene	6.72E-07	1.75E-05	-	-	1.39E-03	1.28E-08	-1.80E+07
Styrene	1.74E-04	1.75E-05	-	-	6.33E+01	3.37E-04	-4.67E+09
Toluene	3.71E-04	1.75E-05	-	-	2.73E+02	1.39E-03	-9.93E+09
TPH C06-C09 aliphatic	9.87E-04	1.75E-05	-	-	1.67E+03	7.67E-03	-2.64E+10
TPH C10-C14 aliphatic	1.43E-04	1.75E-05	-	-	3.48E+01	1.60E-04	-3.82E+09
TPH C10-C14 aromatic	9.14E-05	1.75E-05	-	-	1.43E+01	6.58E-05	-2.45E+09
TPH C15-C28 aliphatic	NV	NV	-	-	NV	NV	NV
TPH C15-C28 aromatic	NV	NV	-	-	NV	NV	NV
TPH C29-C36 aliphatic	NV	NV	-	-	NV	NV	NV
TPH C29-C36 aromatic	NV	NV	-	-	NV	NV	NV
Trimethylbenzene, 1,2,4-	2.05E-04	1.75E-05	-	-	9.53E+01	5.48E-04	-5.50E+09
Vanadium and compounds	NV	NV	-	-	NV	NV	NV
Xylenes (total)	2.78E-05	1.75E-05	-	-	1.46E+01	7.19E-05	-7.44E+09

Definition of Parameters

VF_{as}	Volatilization factor from surficial soils to ambient air (vapors) - use lower of two values
VF_p	Volatilization factor from surficial soils to ambient air (particulates)
VF_{samb}	Volatilization factor from subsurface soils to ambient air
VF_{sesp}	Volatilization factor from soil to enclosed-space vapors
VF_{excav}	Volatilisation factor from subsurface soil to trench air (where soil contamination is below base of trench)

Calculation of Vapour Emissions from Water with Flow
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

PARAMETERS

Concrete permeability	(select from drop down list)	High permeability
Permeability Rate (m/day)		8.6.E-02
Water Temperature (deg. C)		18.0
Dimensions of Basement / Impoundment		
Height (m)		4.5
Width (m)		50.0
Depth (m)		50.0
Volume total basement/ impoundment (m3)		11250

Dimensions of Wet Section of Basement/ Impoundment	
Length (m)	25.00
Width (m)	5.0
Depth of Water (m)	0.01
Fetch/ Depth (m) ratio of Wet Basement Section	500
Volume of wet basement/ impoundment (m3)	1.2500
Area covered in water (m2)	125
Effective diameter of impoundment/ basement) (m)	12.6
Volume of water entering basement (m^3/sec)	1.25E-06

Air exchange rate (exchanges/day)		7.60E+01
Windspeed (m/s)	if < 3.5m/sec	3.00E-02
	if = or > 3.5m/sec	

Parameter Definition	Volatile	Chemical Concentration in Water (mg/L)	Molecular weight (g/mol)	Vapour Pressure (mmHg)	Vapour Pressure (atm)	Henry's Law Coefficient (unitless)	Henry's Law Coefficient (calculated)	Equilibrium Coefficient (at 25 deg C)	Diffusivity in Water (cm^2/sec)	Schmidt Number on Gas Side (*)	Gas Phase Mass Transfer Coefficient (m/sec)	Schmidt Number on Liquid Side #	Liquid Phase Mass Transfer Coefficient (m/sec) **	Overall Mass Transfer Coefficient (m/s) (windspeed <3.5 m/s)	Diffusivity in Air (cm2/sec)	Equilibrium Concentration of water in Basement/ Impoundment (g/m^3)	Air Emission Rate from Liquid Surface (g/sec)	Air Emission Rate from Liquid Surface (mg/day)	Adjusted Concentration in Basement Air (includes air exchange) (mg/m3)
		C	MW	Vap	Vap	unitless	atm.m3/g mol	K_{eq}	D_{water}	Sc_G	k_G	Sc_L	k_L	K	D_{air}	C_L		E	
Acenaphthene	Y	4.48	154	2.15E-03	2.83E-06	7.52E-03	1.80E-04	7.345E-03	8.33E-06	3.0E+00	1.138E-04	1.08E+03	2.74E-07	2.1E-07	0.0506	1.6E-01	4.07E-06	3.52E+02	4.11E-04
Acenaphthylene	Y	43.2	152	6.68E-03	8.79E-06	4.66E-03	1.11E-04	4.551E-03	6.98E-06	3.4E+00	1.052E-04	1.29E+03	2.44E-07	1.6E-07	0.045	1.7E+00	3.44E-05	2.97E+03	3.47E-03
Ammonia	Y	348	17	-	-	6.58E-04	1.57E-05	6.427E-04	1.10E-05	6.6E-01	3.121E-04	8.18E+02	3.30E-07	1.2E-07	0.228	1.0E+01	1.60E-04	1.38E+04	1.61E-02
Aniline	Y	0.212	93.1	4.90E-01	6.45E-04	8.26E-05	1.97E-06	8.067E-05	1.01E-05	1.8E+00	1.586E-04	8.91E+02	3.12E-07	1.2E-08	0.083	6.6E-03	1.01E-08	8.74E-01	1.02E-06
Anthracene	Y	15.4	178	6.53E-06	8.59E-09	2.27E-03	5.42E-05	2.217E-03	7.85E-06	3.9E+00	9.561E-05	1.15E+03	2.64E-07	1.2E-07	0.039	5.6E-01	8.27E-06	7.14E+02	8.35E-04
Arsenic, Inorganic	N	0.024	78		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	N	2.23	137		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	N	12.6	228		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	Y	40.2	78.1	9.48E+01	1.25E-01	2.27E-01	5.42E-03	2.217E-01	1.03E-05	1.7E+00	1.668E-04	8.74E+02	3.16E-07	3.1E-07	0.0895	1.2E+00	4.83E-05	4.17E+03	4.88E-03
Benzo(a)pyrene	N	9.26	252		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	N	8.33	252		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	N	4.22	276		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	N	2.93	252		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	N	0.03	391		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	N	0.108	112		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	N	0.102	52		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	N	0.102	52		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	N	9.78	228		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	N	0.057	58.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	Y	436	108	1.10E-01	1.45E-04	3.50E-05	8.36E-07	3.418E-05	9.32E-06	2.1E+00	1.454E-04	9.66E+02	2.96E-07	4.9E-09	0.0729	1.4E+01	8.72E-06	7.53E+02	8.81E-04
Cresol, o-	N	182	108		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	N	0.822	278		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	Y	10.2	168	2.48E-03	3.26E-06	8.71E-03	2.08E-04	8.507E-03	7.38E-06	3.7E+00	9.887E-05	1.22E+03	2.53E-07	1.9E-07	0.041	3.9E-01	9.43E-06	8.15E+02	9.53E-04
Dimethylphenol, 2,4-	Y	38	122	1.02E-01	1.34E-04	3.89E-05	9.29E-07	3.799E-05	8.31E-06	2.4E+00	1.307E-04	1.08E+03	2.74E-07	4.9E-09	0.0622	1.3E+00	8.16E-07	7.05E+01	8.25E-05
Ethylbenzene	Y	3.02	106	9.60E+00	1.26E-02	3.22E-01	7.69E-03	3.145E-01	8.46E-06	2.2E+00	1.395E-04	1.06E+03	2.77E-07	2.8E-07	0.0685	1.1E-01	3.62E-06	3.13E+02	3.66E-04
Fluoranthene	N	25.9	202		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	Y	21.1	166	6.00E-04	7.90E-07	3.93E-03	9.38E-05	3.838E-03	7.89E-06	3.4E+00	1.037E-04	1.14E+03	2.65E-07	1.6E-07	0.044	7.7E-01	1.53E-05	1.32E+03	1.54E-03
Indeno(1,2,3-cd)pyrene	N	3.05	276		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	N	187	55.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	N	0.555	207		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	N	4.89	54.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	Y	105	142	5.50E-02	7.24E-05	2.12E-02	5.06E-04	2.071E-02	7.78E-06	2.9E+00	1.165E-04	1.16E+03	2.62E-07	2.4E-07	0.0524	3.9E+00	1.14E-04	9.85E+03	1.15E-02
Naphthalene	Y	283	128	8.50E-02	1.12E-04	1.80E-02	4.30E-04	1.758E-02	8.38E-06	2.5E+00	1.283E-04	1.07E+03	2.75E-07	2.5E-07	0.0605	9.9E+00	3.04E-04	2.63E+04	3.07E-02
Nickel Soluble Salts	N	0.303	58.7		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	Y	74.1	178	1.21E-04	1.59E-07	1.73E-03	4.13E-05	1.690E-03	6.69E-06	4.4E+00	8.807E-05	1.35E+03	2.37E-07	9.1E-08	0.0345	3.0E+00	3.43E-05	2.96E+03	3.46E-03
Phenol	Y	249	94.1	3.50E-01	4.61E-04	1.36E-05	3.25E-07	1.328E-05	1.03E-05	1.8E+00	1.591E-04	8.74E+02	3.16E-07	2.1E-09	0.0834	7.6E+00	2.00E-06	1.73E+02	2.03E-04
Pyrene	Y	27.9	202	4.50E-06	5.92E-09	4.87E-04	1.16E-05	4.756E-04	7.25E-06	5.4E+00	7.621E-05	1.24E+03	2.50E-07	3.2E-08	0.0278	1.1E+00	4.25E-06	3.67E+02	4.29E-04
Styrene	Y	0.194	104	6.40E+00	8.42E-03	1.12E-01	2.67E-03	1.094E-01	8.78E-06	2.1E+00	1.430E-04	1.03E+03	2.84E-07	2.8E-07	0.0711	6.6E-03	2.30E-07	1.99E+01	2.32E-05
Toluene	Y	17.6	92.1	2.84E+01	3.74E-02	2.71E-01	6.47E-03	2.647E-01	9.20E-06	1.9E+00	1.519E-04	9.78E+02	2.93E-07	2.9E-07	0.0778	5.8E-01	2.11E-05	1.82E+03	2.13E-03
TPH C06-C09 aliphatic	Y	6.08	103	9.16E+01	1.21E-01	5.05E+01	1.21E+00	4.932E+01	1.00E-05	1.5E+00	1.797E-04	9.00E+02	3.10E-07	3.1E-07	0.1	1.9E-01	7.36E-06	6.36E+02	7.44E-04
TPH C10-C14 aliphatic	Y	1730	170	1.16E+00	1.53E-03	6.26E+01	1.49E+00	6.114E+01	1.00E-05	1.5E+00	1.797E-04	9.00E+02	3.10E-07	3.1E-07	0.1	5.4E+01	2.09E-03	1.81E+05	2.12E-01
TPH C10-C14 aromatic	Y	1730	136	1.16E+00	1.53E-03	1.41E-01	3.37E-03	1.377E-01	1.00E-05	1.5E+00	1.797E-04	9.00E+02	3.10E-07	3.1E-07	0.1	5.4E+01	2.07E-03	1.79E+05	2.09E-01
TPH C15-C28 aliphatic	N	1520	260		-		-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	N	1520	209		-		-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	N	332	270		-		-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	N	332	240		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	Y	0.92	120	2.10E+00	2.76E-03	2.52E-01	6.02E-03	2.461E-01	7.92E-06	2.5E+00	1.286E-04	1.14E+03	2.65E-07	2.6E-07	0.0607	3.3E-02	1.10E-06	9.50E+01	1.11E-04
Vanadium and compounds	N	0.0228	50.9		-		-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	Y	6.7	106	7.99E+00	1.05E-02	2.12E-01	5.06E-03	2.071E-01	9.90E-06	1.8E+00	1.608E-04	9.09E+02	3.08E-07	3.0E-07	0.0847	2.1E-01	8.04E-06	6.94E+02	8.12E-04

Notes:
Assumes viscosity of air at 25 deg C
(*) Adopted density and viscosity of air values are those published in USEPA Air Emissions for Wast and Waste Water Nov 1994. (viscosity = 1.81 x 10^{-4}, density = 1.2 x 10^{-3})
** where windspeeds are greater than 3.25 m/s, F/D ratios greater than 51.2 and diffusivity of ether is 8.5 x 10-5
Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Summary of Derived RBSLs
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

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Chemical	Soil RBSLs (mg/kg)						Groundwater RBSLs (mg/L)					
	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Saturation Limited?	Site Concentration	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Solubility Limited?	Site Concentration
Acenaphthene	2.17E+05	-	-	2.17E+05	>Sat	5.11E+02	4.36E+03	-	-	4.36E+03	>Sol	4.48E+00
Acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia	-	-	-	-	-	-	1.77E+06	-	-	1.77E+06	>Sol	3.48E+02
Aniline	-	-	-	-	-	-	3.96E+06	-	-	3.96E+06	>Sol	2.12E-01
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	7.09E+04	-	-	7.09E+04	>Sat	1.51E+03	1.02E+06	-	-	1.02E+06	>Sol	4.02E+01
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	3.59E+04	-	-	3.59E+04	>Sat	2.29E+03	2.80E+03	-	-	2.80E+03	-	4.36E+02
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	3.38E+06	-	-	3.38E+06	>Sat	2.77E+02	1.48E+04	-	-	1.48E+04	>Sol	1.02E+01
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	2.46E+03	-	-	2.46E+03	>Sat	2.61E+02	1.88E+04	-	-	1.88E+04	>Sol	3.02E+00
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	4.39E+03	-	-	4.39E+03	>Sat	7.65E+03	1.13E+02	-	-	1.13E+02	>Sol	1.05E+02
Naphthalene	2.44E+04	-	-	2.44E+04	>Sat	1.02E+04	4.05E+02	-	-	4.05E+02	>Sol	2.83E+02
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	8.63E+05	-	-	8.63E+05	>Sol	2.49E+02
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	5.18E+04	-	-	5.18E+04	>Sol	1.94E-01
Toluene	2.46E+04	-	-	2.46E+04	>Sat	2.65E+03	2.83E+05	-	-	2.83E+05	>Sol	1.76E+01
TPH C06-C09 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	1.64E+04	-	-	1.64E+04	>Sat	2.20E+02	7.42E+04	-	-	7.42E+04	>Sol	9.20E-01
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	6.88E+04	-	-	6.88E+04	>Sat	2.58E+03	4.08E+04	-	-	4.08E+04	>Sol	6.70E+00

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Pathways included in derivation of Soil RBSL:

Pathways included in derivation of Soil Vapour RBSL:

Pathways included in derivation of Groundwater RBSL:

Health Risk Calculations - Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

Chemical	Soil Conc. (mg/kg)	Csat (mg/kg)	Volatilisation Factor from Subsurface Soil to Indoor Air (mg/m3)/(mg/kg)	Vapour Concentration in Indoor Air (From Subsurface Soil) (mg/m3)	Threshold Intake and Risk Calculations: Inhalation RfC (mg/m3)	Adult Exposure Factor (threshold) (kg/m3)	Adult Exposure Adjusted Air Concentration (threshold) (mg/m3)	Hazard Index (Adult) (unitless)
Acenaphthene	511	3.94E+01	2.12E-06	8.35E-05	5.04E-01	4.65E-07	1.83E-05	3.63E-05
Acenaphthylene	1700	1.63E+02	1.31E-06	2.14E-04	-	-	-	-
Ammonia	-	-	-	-	-	-	-	-
Aniline	-	-	-	-	-	-	-	-
Anthracene	2150	1.42E+00	1.97E-07	2.80E-07	-	-	-	-
Arsenic, Inorganic	-	-	NV	-	-	-	-	-
Barium	-	-	NV	-	-	-	-	-
Benz(a)anthracene	1470	3.33E+00	NV	-	-	-	-	-
Benzene	1510	6.59E+02	1.75E-03	1.16E+00	1.09E+02	3.84E-04	2.53E-01	2.33E-03
Benzo(a)pyrene	652	1.90E+00	NV	-	-	-	-	-
Benzo(b)fluoranthene	587	1.80E+00	NV	-	-	-	-	-
Benzo(g,h,i)perylene	305	1.01E+00	NV	-	-	-	-	-
Benzo(k)fluoranthene	231	9.39E-01	NV	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	NV	-	-	-	-	-
Cadmium (Water)	-	-	NV	-	-	-	-	-
Chromium(III), Insoluble Salts	210	-	NV	-	-	-	-	-
Chromium(VI)	2.3	-	NV	-	-	-	-	-
Chrysene	771	7.24E-01	NV	-	-	-	-	-
Cobalt	-	-	NV	-	-	-	-	-
Cresol, m-&p-	2290	1.44E+04	1.57E-07	3.61E-04	1.24E-03	3.45E-08	7.90E-05	6.38E-02
Cresol, o-	-	-	NV	-	-	-	-	-
Blank	-	-	NV	-	-	-	-	-
Dibenz(a,h)anthracene	71.4	9.51E+00	NV	-	-	-	-	-
Dibenzofuran	277	5.69E+01	1.35E-06	7.68E-05	1.00E+00	2.96E-07	1.68E-05	1.68E-05
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-
Ethylbenzene	261	1.67E+02	9.29E-04	1.55E-01	2.00E+00	2.04E-04	3.39E-02	1.70E-02
Fluoranthene	2440	2.89E+01	NV	-	-	-	-	-
Fluorene	2100	3.10E+01	6.09E-07	1.89E-05	-	-	-	-
Indeno(1,2,3-cd)pyrene	247	7.41E-01	NV	-	-	-	-	-
Iron	60600	-	NV	-	-	-	-	-
Lead and Compounds	13600	-	NV	-	-	-	-	-
Manganese	-	-	NV	-	-	-	-	-
Methylnaphthalene, 2-	7650	1.23E+02	1.21E-05	1.48E-03	5.81E-02	2.65E-06	3.25E-04	5.60E-03
Naphthalene	10200	9.66E+01	1.64E-05	1.59E-03	4.40E-01	3.60E-06	3.48E-04	7.91E-04
Nickel Soluble Salts	-	-	NV	-	-	-	-	-
Phenanthrene	5180	3.84E+01	1.47E-07	5.66E-06	-	-	-	-
Phenol	-	-	-	-	-	-	-	-
Pyrene	2640	1.47E+01	1.28E-08	1.87E-07	-	-	-	-
Styrene	-	-	-	-	-	-	-	-
Toluene	2650	2.91E+02	1.39E-03	4.06E-01	3.01E+01	3.06E-04	8.89E-02	2.95E-03
TPH C06-C09 aliphatic	593	2.21E+02	7.67E-03	1.70E+00	-	-	-	-
TPH C10-C14 aliphatic	69400	1.11E+02	1.60E-04	1.78E-02	-	-	-	-
TPH C10-C14 aromatic	69400	1.54E+02	6.58E-05	1.02E-02	-	-	-	-
TPH C15-C28 aliphatic	93200	7.02E+01	NV	-	-	-	-	-
TPH C15-C28 aromatic	93200	8.04E+01	NV	-	-	-	-	-
TPH C29-C36 aliphatic	20600	3.16E+00	NV	-	-	-	-	-
TPH C29-C36 aromatic	20600	1.66E+00	NV	-	-	-	-	-
Trimethylbenzene, 1,2,4-	220	7.46E+01	5.48E-04	4.09E-02	1.96E+00	1.20E-04	8.96E-03	4.56E-03
Vanadium and compounds	248	-	NV	-	-	-	-	-
Xylenes (total)	2576	8.90E+01	7.19E-05	6.40E-03	4.34E+00	1.58E-05	1.40E-03	3.23E-04
TOTAL								**9.74E-02**

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Health Risk Calculations - Vapours from Flowing Water
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Residential Receptor) (Odour Based Calculations) Scenario

Chemical	Vapour Concentration in Basement/ Impoundment	Aqueous Solubility	Threshold Intake and Risk Calculations			
			Inhalation RfC	Adult Exposure Factor (threshold)	Adult Exposure Adjusted Air Concentration (threshold)	Hazard Index (Adult)
	mg/m^3	(mg/L)	(mg/m3)	(L/m3)	(mg/m3)	(unitless)
Acenaphthene	4.11E-04	3.90E+00	5.04E-01	2.19E-01	9.01E-05	1.79E-04
Acenaphthylene	3.47E-03	1.61E+01	-	2.19E-01	7.61E-04	-
Ammonia	1.61E-02	4.82E+05	1.80E+01	2.19E-01	3.53E-03	1.96E-04
Aniline	1.02E-06	3.60E+04	4.19E+00	2.19E-01	2.24E-07	5.35E-08
Anthracene	8.35E-04	4.34E-02	-	2.19E-01	1.83E-04	-
Arsenic, Inorganic	-	0.00E+00	-	-	-	-
Barium	-	0.00E+00	-	-	-	-
Benz(a)anthracene	-	9.40E-03	-	-	-	-
Benzene	4.88E-03	1.79E+03	1.09E+02	2.19E-01	1.07E-03	9.81E-06
Benzo(a)pyrene	-	1.62E-03	-	-	-	-
Benzo(b)fluoranthene	-	1.50E-03	-	-	-	-
Benzo(g,h,i)perylene	-	2.60E-04	-	-	-	-
Benzo(k)fluoranthene	-	8.00E-04	-	-	-	-
Bis(2-ethylhexyl)phalate	-	2.70E-01	-	-	-	-
Cadmium (Water)	-	0.00E+00	-	-	-	-
Chromium(III), Insoluble Salts	-	0.00E+00	-	-	-	-
Chromium(VI)	-	1.69E+06	-	-	-	-
Chrysene	-	2.00E-03	-	-	-	-
Cobalt	-	0.00E+00	-	-	-	-
Cresol, m-&p-	8.81E-04	2.27E+04	1.24E-03	2.19E-01	1.93E-04	1.56E-01
Cresol, o-	-	2.59E+04	-	-	-	-
Dibenz(a,h)anthracene	-	2.49E-03	-	-	-	-
Dibenzofuran	9.53E-04	3.10E+00	1.00E+00	2.19E-01	2.09E-04	2.09E-04
Dimethylphenol, 2,4-	8.25E-05	7.87E+03	-	2.19E-01	1.81E-05	-
Ethylbenzene	3.66E-04	1.69E+02	2.00E+00	2.19E-01	8.02E-05	4.01E-05
Fluoranthene	-	2.60E-01	-	-	-	-
Fluorene	1.54E-03	1.69E+00	-	2.19E-01	3.38E-04	-
Indeno(1,2,3-cd)pyrene	-	1.90E-04	-	-	-	-
Iron	-	0.00E+00	-	-	-	-
Lead and Compounds	-	0.00E+00	-	-	-	-
Manganese	-	0.00E+00	-	-	-	-
Methylnaphthalene, 2-	1.15E-02	2.46E+01	5.81E-02	2.19E-01	2.53E-03	4.35E-02
Naphthalene	3.07E-02	3.10E+01	4.40E-01	2.19E-01	6.74E-03	1.53E-02
Nickel Soluble Salts	-	0.00E+00	-	-	-	-
Phenanthrene	3.46E-03	1.15E+00	-	2.19E-01	7.59E-04	-
Phenol	2.03E-04	8.28E+04	1.54E-01	2.19E-01	4.44E-05	2.88E-04
Pyrene	4.29E-04	1.35E-01	-	2.19E-01	9.40E-05	-
Styrene	2.32E-05	3.10E+02	1.36E+00	2.19E-01	5.10E-06	3.75E-06
Toluene	2.13E-03	5.26E+02	3.01E+01	2.19E-01	4.68E-04	1.55E-05
TPH C06-C09 aliphatic	7.44E-04	1.18E+01	-	2.19E-01	1.63E-04	-
TPH C10-C14 aliphatic	2.12E-01	9.99E-02	-	2.19E-01	2.19E-02	-
TPH C10-C14 aromatic	2.09E-01	2.53E+01	-	2.19E-01	4.58E-02	-
TPH C15-C28 aliphatic	-	1.11E-04	-	-	-	-
TPH C15-C28 aromatic	-	1.06E+00	-	-	-	-
TPH C29-C36 aliphatic	-	2.50E-06	-	-	-	-
TPH C29-C36 aromatic	-	6.60E-03	-	-	-	-
Trimethylbenzene, 1,2,4-	1.11E-04	5.70E+01	1.96E+00	2.19E-01	2.43E-05	1.24E-05
Vanadium and compounds	-	-	-	-	-	-
Xylenes (total)	8.12E-04	1.06E+02	4.34E+00	2.19E-01	1.78E-04	4.11E-05
TOTAL						**2.16E-01**

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Soil RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

Chemical	Csoil	Csat	Risk at Input Soil Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity) (kg/mg)			RBSL (assumes no sat limit)	Risk at RBSL (with sat)	Vapour Only Risk at Csat (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			Vapours from Subsurface Soil Indoors	TOTAL (All Pathways)	Vapours from Subsurface Soil Indoors	Total Vapour Pathways	TOTAL (All Pathways)					Vapours from Subsurface Soil Indoors	TOTAL
	mg/kg	mg/kg	unitless	unitless	kg/mg	kg/mg	kg/mg	mg/kg			mg/kg	%	%
Acenaphthene	511	3.94E+01	3.63E-05	3.63E-05	9.22E-07	9.22E-07	9.22E-07	2.17E+05	3.63E-05	3.63E-05	**2.17E+05**	0.00%	0.00%
Acenaphthylene	1700	1.63E+02	-	-	-		-	-	-	-	**-**	-	
Ammonia	-	-	-	-	-		-	-	-	-	**-**	-	
Aniline	-	-	-	-	-		-	-	-	-	**-**	-	
Anthracene	2150	1.42E+00	-	-	-		-	-	-	-	**-**	-	
Arsenic, Inorganic	-	-	-	-	-		-	-	-	-	**-**	-	
Barium	-	-	-	-	-		-	-	-	-	**-**	-	
Benz(a)anthracene	1470	3.33E+00	-	-	-		-	-	-	-	**-**	-	
Benzene	1510	6.59E+02	2.33E-03	2.33E-03	3.53E-06	3.53E-06	3.53E-06	7.09E+04	2.33E-03	2.33E-03	**7.09E+04**	0.23%	0.23%
Benzo(a)pyrene	652	1.90E+00	-	-	-		-	-	-	-	**-**	-	
Benzo(b)fluoranthene	587	1.80E+00	-	-	-		-	-	-	-	**-**	-	
Benzo(g,h,i)perylene	305	1.01E+00	-	-	-		-	-	-	-	**-**	-	
Benzo(k)fluoranthene	231	9.39E-01	-	-	-		-	-	-	-	**-**	-	
Bis(2-ethylhexyl)phalate	-	-	-	-	-		-	-	-	-	**-**	-	
Cadmium (Water)	-	-	-	-	-		-	-	-	-	**-**	-	
Chromium(III), Insoluble Salts	210	-	-	-	-		-	-	-	-	**-**	-	
Chromium(VI)	2.3	-	-	-	-		-	-	-	-	**-**	-	
Chrysene	771	7.24E-01	-	-	-		-	-	-	-	**-**	-	
Cobalt	-	-	-	-	-		-	-	-	-	**-**	-	
Cresol, m-&p-	2290	1.44E+04	6.38E-02	6.38E-02	2.79E-05	2.79E-05	2.79E-05	3.59E+04	4.00E-01	4.00E-01	**3.59E+04**	40.02%	40.02%
Cresol, o-	-	-	-	-	-		-	-	-	-	**-**	-	
Dibenz(a,h)anthracene	71.4	9.51E+00	-	-	-		-	-	-	-	**-**	-	
Dibenzofuran	277	5.69E+01	1.68E-05	1.68E-05	2.96E-07	2.96E-07	2.96E-07	3.38E+06	1.68E-05	1.68E-05	**3.38E+06**	0.00%	0.00%
Dimethylphenol, 2,4-	-	-	-	-	-		-	-	-	-	**-**	-	
Ethylbenzene	261	1.67E+02	1.70E-02	1.70E-02	1.02E-04	1.02E-04	1.02E-04	2.46E+03	1.70E-02	1.70E-02	**2.46E+03**	1.70%	1.70%
Fluoranthene	2440	2.89E+01	-	-	-		-	-	-	-	**-**	-	
Fluorene	2100	3.10E+01	-	-	-		-	-	-	-	**-**	-	
Indeno(1,2,3-cd)pyrene	247	7.41E-01	-	-	-		-	-	-	-	**-**	-	
Iron	60600	-	-	-	-		-	-	-	-	**-**	-	
Lead and Compounds	13600	-	-	-	-		-	-	-	-	**-**	-	
Manganese	-	-	-	-	-		-	-	-	-	**-**	-	
Methylnaphthalene, 2-	7650	1.23E+02	5.60E-03	5.60E-03	4.56E-05	4.56E-05	4.56E-05	4.39E+03	5.60E-03	5.60E-03	**4.39E+03**	0.56%	0.56%
Naphthalene	10200	9.66E+01	7.91E-04	7.91E-04	8.19E-06	8.19E-06	8.19E-06	2.44E+04	7.91E-04	7.91E-04	**2.44E+04**	0.08%	0.08%
Nickel Soluble Salts	-	-	-	-	-		-	-	-	-	**-**	-	
Phenanthrene	5180	3.84E+01	-	-	-		-	-	-	-	**-**	-	
Phenol	-	-	-	-	-		-	-	-	-	**-**	-	
Pyrene	2640	1.47E+01	-	-	-		-	-	-	-	**-**	-	
Styrene	-	-	-	-	-		-	-	-	-	**-**	-	
Toluene	2650	2.91E+02	2.95E-03	2.95E-03	1.01E-05	1.01E-05	1.01E-05	2.46E+04	2.95E-03	2.95E-03	**2.46E+04**	0.30%	0.30%
TPH C06-C09 aliphatic	593	2.21E+02	-	-	-		-	-	-	-	**-**	-	
TPH C10-C14 aliphatic	69400	1.11E+02	-	-	-		-	-	-	-	**-**	-	
TPH C10-C14 aromatic	69400	1.54E+02	-	-	-		-	-	-	-	**-**	-	
TPH C15-C28 aliphatic	93200	7.02E+01	-	-	-		-	-	-	-	**-**	-	
TPH C15-C28 aromatic	93200	8.04E+01	-	-	-		-	-	-	-	**-**	-	
TPH C29-C36 aliphatic	20600	3.16E+00	-	-	-		-	-	-	-	**-**	-	
TPH C29-C36 aromatic	20600	1.66E+00	-	-	-		-	-	-	-	**-**	-	
Trimethylbenzene, 1,2,4-	220	7.46E+01	4.56E-03	4.56E-03	6.12E-05	6.12E-05	6.12E-05	1.64E+04	4.56E-03	4.56E-03	**1.64E+04**	0.46%	0.46%
Vanadium and compounds	248	-	-	-	-		-	-	-	-	**-**	-	
Xylenes (total)	2576	8.90E+01	3.23E-04	3.23E-04	3.63E-06	3.63E-06	3.63E-06	6.88E+04	3.23E-04	3.23E-04	**6.88E+04**	0.03%	0.03%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW vapours from flowing water	TOTAL (All Pathways)	GW vapours from flowing water	Total Vapour Pathways	TOTAL (All Pathways)					GW vapours from flowing water	TOTAL
	mg/L	mg/L	unitless	unitless	unitless	L/mg	L/mg	mg/L			mg/L	%	%
Acenaphthene	4.48	3.90E+00	1.79E-04	1.79E-04	4.59E-05	4.59E-05	4.59E-05	4.36E+03	1.79E-04	1.79E-04	**4.36E+03**	0.1%	0.09%
Acenaphthylene	43.2	1.61E+01	-	-	-		-	-	-	-	**-**	-	-
Ammonia	348	4.82E+05	1.96E-04	1.96E-04	5.64E-07	5.64E-07	5.64E-07	1.77E+06	2.72E-01	2.72E-01	**1.77E+06**	27.2%	27.20%
Aniline	0.212	3.60E+04	5.35E-08	5.35E-08	2.52E-07	2.52E-07	2.52E-07	3.96E+06	9.08E-03	9.08E-03	**3.96E+06**	0.9%	0.91%
Anthracene	15.4	4.34E-02	-	-	-		-	-	-	-	**-**	-	-
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	**-**	-	-
Barium	2.23		-	-	-		-	-	-	-	**-**	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	**-**	-	-
Benzene	40.2	1.79E+03	9.81E-06	9.81E-06	2.44E-07	2.44E-07	2.44E-07	1.02E+06	4.37E-04	4.37E-04	**1.02E+06**	0.2%	0.17%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	**-**	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	**-**	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	**-**	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	**-**	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	**-**	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	**-**	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	**-**	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	**-**	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	**-**	-	-
Cobalt	0.057		-	-	-		-	-	-	-	**-**	-	-
Cresol, m-&p-	436	2.27E+04	1.56E-01	1.56E-01	3.58E-04	3.58E-04	3.58E-04	2.80E+03	1.00E+00	-	**2.80E+03**	100.0%	100.00%
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	**-**	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	**-**	-	-
Dibenzofuran	10.2	3.10E+00	2.09E-04	2.09E-04	6.74E-05	6.74E-05	6.74E-05	1.48E+04	2.09E-04	2.09E-04	**1.48E+04**	0.0%	0.02%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	**-**	-	-
Ethylbenzene	3.02	1.69E+02	4.01E-05	4.01E-05	1.33E-05	1.33E-05	1.33E-05	1.88E+04	2.24E-03	2.24E-03	**1.88E+04**	0.9%	0.90%
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	**-**	-	-
Fluorene	21.1	1.69E+00	-	-	-		-	-	-	-	**-**	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	**-**	-	-
Iron	187		-	-	-		-	-	-	-	**-**	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	**-**	-	-
Manganese	4.89		-	-	-		-	-	-	-	**-**	-	-
Methylnaphthalene, 2-	105	2.46E+01	4.35E-02	4.35E-02	1.77E-03	1.77E-03	1.77E-03	1.13E+02	4.35E-02	4.35E-02	**1.13E+02**	21.7%	21.74%
Naphthalene	283	3.10E+01	1.53E-02	1.53E-02	4.94E-04	4.94E-04	4.94E-04	4.05E+02	1.53E-02	1.53E-02	**4.05E+02**	7.7%	7.66%
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	**-**	-	-
Phenanthrene	74.1	1.15E+00	-	-	-		-	-	-	-	**-**	-	-
Phenol	249	8.28E+04	2.88E-04	2.88E-04	1.16E-06	1.16E-06	1.16E-06	8.63E+05	9.59E-02	9.59E-02	**8.63E+05**	9.6%	9.59%
Pyrene	27.9	1.35E-01	-	-	-		-	-	-	-	**-**	-	-
Styrene	0.194	3.10E+02	3.75E-06	3.75E-06	1.93E-05	1.93E-05	1.93E-05	5.18E+04	5.99E-03	5.99E-03	**5.18E+04**	0.6%	0.60%
Toluene	17.6	5.26E+02	1.55E-05	1.55E-05	8.82E-07	8.82E-07	8.82E-07	2.83E+05	4.64E-04	4.64E-04	**2.83E+05**	0.2%	0.19%
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-		-	-	-	-	**-**	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-		-	-	-	-	**-**	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-		-	-	-	-	**-**	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	**-**	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	**-**	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	**-**	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	**-**	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	1.24E-05	1.24E-05	1.35E-05	1.35E-05	1.35E-05	7.42E+04	7.68E-04	7.68E-04	**7.42E+04**	0.1%	0.08%
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	**-**	-	-
Xylenes (total)	6.7	1.06E+02	4.11E-05	4.11E-05	6.13E-06	6.13E-06	6.13E-06	4.08E+04	6.50E-04	6.50E-04	**4.08E+04**	0.3%	0.26%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Appendix D

Compliance with SEPP 55 (1998) and NSW EPA (2011)

Appendix D Compliance with SEPP 55 (1998) and NSW EPA (2011)

The following summary provides an assessment of compliance with the SEPP 55 (1998) *Managing Land Contamination (Remediation of Land)* and the NSW EPA (2011) *Consultants Reporting on Contaminated Sites*:

Table 21 Assessment of Compliance with SEPP 55 (1998) and NSW EPA (2011)

Legislative Requirement	Relevant Works and RAP Section
SEPP 55 (1998)	
Can the site be appropriately remediated? Consider the RAP and any statement by the proponent's consultant certifying that remediation is practical.	Refer to Section 8.0 to Section 11.0, and Table T19.
Are the proposed clean-up criteria appropriate for the future use of the site, considering possible human health and environmental impacts?	Refer to Section 7.0.
Are the proposed plans for remediation work acceptable? For example, do they include an occupational health and safety plan, community relations plan, contingency plan?	Refer to references listed against the NSW EPA (2011) criteria below
Is a site audit of the RAP necessary?	This RAP will be submitted to the NSW EPA Accredited Site Auditor, Graeme Nyland, for approval before implementation.
NSW EPA (2011)	
Environmental Summary including background; objectives; scope of works; summary of sampling results; summary of conclusions and recommendations	Refer to the Executive Summary Section
Scope of Work	Refer to Section 1.3
Site Identification including a. street number, street name and suburb; b. lot and deposited plan number; co-ordinates; locality map; c. site layout plan	Refer to: a. & b. in Table 1; c. Figure F1 and F2
Site History including a. past, present and proposed zoning; b. past, present and proposed land-use; c. summary of council rezoning, relevant development and building approvals; d. chronological list of site uses; e. aerial photograph review; f. site photographs; g. inventory and locations of waste and chemicals; h. contaminant sources and potential off-site effects; i. site layout plans showing past and present industrial processes; j. sewer and service plans; k. manufacturing processes; l. USTs and ASTs; m. product spill and loss history; n. discharges to land, water and air; o. disposal locations; p. complaint history; q. local knowledge; r. permits, licences, approvals, trade waste agreements; s. adjacent site history; t. local literature; u. local usage of ground and surface water; v. integrity assessment;	Refer to: a. Table 1; b. Section 3.2, Table 1, Section 5.0, Section 6.1, Section 6.2; c. Section 2.2, Section 3.3; d. Section 3.2; e. Section 3.2 and 6.4.1; f. Section 3.2; g. Table 2, Section 3.2; Section 3.3, Figure F2; h. Figure F2, Section 3.2; Section 3.3, Section 5.0, Section 6.6 and Section 6.7; i. Figure F2; j. Figure F9; k. Section 3.2; l. Table 2, Section 3.2, Section 5.0, Figure F2; m. to q. N/A; r. Section 3.2.3; s. Section 3.2; t. Section 3.2; u. to v. N/A.

Legislative Requirement	Relevant Works and RAP Section
Site Condition and Surrounding Environment including a. topography; b. site boundary conditions; c. visible signs of contamination; d. signs of plant stress; e. drums, wastes and fill; f. odours; g. surface water quality; h. flood potential; i. sensitive local environments	Refer to: a. Section 6.3; b. to d. N/A e. Section 3.2.3 and 6.4.2; f. Section 5.0; g. Section 5.0 and 6.3; h. N/A; i. Section 6.7.
Geology and Hydrogeology including a. soil stratigraphy; b. location and extent of fill material; c. soil bore logs; d. monitoring wells; e. springs; f. groundwater depth; g. groundwater flow rate and direction; h. surface water run-off direction; i. background water quality; j. preferential water courses; k. meteorology	Refer to: a. Section 5.0, 6.4.1 and 6.4.2; b. Section 5.0, 6.4.2 and 7.2 c. Section 5.0; d. Section 5.0, Figure F3; e. N/A; f. Section 6.5; g. Section 5.12, 6.5 7.2 and 11.5; h. Section 6.3; i. Section 6.4.1; j. Section 6.3 and 6.5; k. N/A
Basis for Assessment Criteria including a. selected assessment criteria and references; b. rationale for appropriateness of the criteria; c. assumptions of limitations of criteria	Refer to: a. Table T1 and T2; b. Section 7.0 c. Section 7.0
Results including a. summary of previous results; b summary of results in a table that show sample numbers and sampling depths, assessment criteria and highlights results exceeding the assessment criteria; c. site plan showing sampling locations, identification numbers and depths; d; site plan showing extent of soil and groundwater contamination	Refer to: a. Section 5.0; b. Table 3, Figure F4 to Figure F5, Table T3 to T16; c. Figure F3; d. Figure F4 to Figure F8
Site Characterisation including a. assessment of type of contamination; b. assessment of extent of contamination including offsite; c. assessment of chemical degradation products; d. assessment of routes of exposure	Refer to: a. Section 6.6; b. Section 7.2; c. *VMP HHERA* (AECOM, 2012b) Section 5.16; d. Section 6.7 and *VMP HHERA* (AECOM, 2012b)
Remedial Action Plan including a. remediation goal; b. extent of remediation required; c. remedial options appraisal; d. rational for selected remedial option; e. validation testing; f. contingency plan; g. interim site management plan; h. operational management plan including stormwater, soil, noise, dust, odour and OH&S plan; i. remediation schedule; j. operation hours; k. contingency plans to respond to emergencies; l. regulatory compliance requirements; m. appropriate personnel contact details; n. community relation plans; o. stages progress reporting; p. long-term site management plan	Refer to: a. Section 7.0; b. Section 7.2; c. Section 10.0 and 11.0; d. Section 11.0; e. Section 19.0; f. Section 20; g. Section 20.5; h. Section 14.0 to 17.0, 20.0 and 21.0; i. Section 12.2; j. Section 13.4.2; k. Section 1.7, 13.1 and 20; l. Section 2.0 and this Appendix; m. Section 24.0; n. Section 22.0; o. Section 19.12; p. Section 20.5;

Legislative Requirement	Relevant Works and RAP Section
Conclusions and Recommendations including a. brief summary of all findings; b. assumptions in reaching conclusions; c. extent of uncertainties in the results; d. list summarising activities and physical changes to site where remedial action has been undertaken; e. suitability of site statement; f. statement of limitations and constraints of the site use; g. recommendations	Refer to a. Section 25.0

Based on the above table, AECOM concludes that this RAP has been appropriately prepared to comply with the overall aims and principles of the SEPP 55 (1998) and the NSW EPA (2011) guidelines.

Appendix E

Environmental Protection Licence 13336

Section 58(5) Protection of the Environment Operations Act 1997

Licence Variation

Licence - 13336

NSW GOVERNMENT | Office of Environment & Heritage

BARANGAROO DELIVERY AUTHORITY (BDA)

ABN 94 567 807 277

LEVEL 21 201 KENT STREET

SYDNEY NSW 2000

Attention:

Notice Number	1500535
File Number	LIC10/940
Date	13-Dec-2011

NOTICE OF VARIATION OF LICENCE NO. 13336

BACKGROUND

A. BARANGAROO DELIVERY AUTHORITY (BDA) ("the licensee") is the holder of Environment Protection Licence No. 13336 ("the licence") issued under the *Protection of the Environment Operations Act 1997* ("the Act"). The licence authorises the carrying out of activities at and a portion of Hickson Rd (near to 30-38 Hickson Rd), MILLERS POINT, NSW, 2000.

B. On 31 May 2011 the EPA received an email transmission from the licensee's contractors requesting a variation to the licence to add relevant conditions associated with the SISCO and SEPR Pilot Trials at block 5 (Works Approved by Project Approval MP10_0087).

C. On 31 May 2011 the EPA received an application from the licensee requesting a variation to the licence to add the category of 'scheduled development works' and relevant conditions associated with the relocation of a sewer on the premises and along Towns Place and Hickson Road.

D. On 16 May 2011 the EPA received an application from the licensee requesting a variation to the licence to add the Scheduled Activities of Crushing Grinding or Separating and Extractive Industries and relevant conditions associated with works at Headland Park.

E. The EPA has sought and considered additional information from the licensee to support its applications.

1. The EPA has considered the above applications and has decided to vary the licence by:

- Adding a scheduled development works description at condition A1;
- Adding new scheduled activities at condition A1;
- Varying the premises description at A2;
- Adding air discharge points at P1;
- Adding concentration limits at L2;

Licence Variation

- Varying condition L4;
- Adding Monitoring conditions at M2;
- Adding an Operating conditions at O5;
- Varying Monitoring conditions at M2 and M8; and
- Renumbering Special conditions and adding conditions at E2, E3, E4, E5, E6 and E7.

VARIATION OF LICENCE NO. 13336

2. By this notice the EPA varies licence No. 13336. The attached licence document contains all variations that are made to the licence by this notice.
3. The following variation have been made to the licence:

•

.....

Greg Sheehy

Manager

Metropolitan - Sydney Industry

(by Delegation)

INFORMATION ABOUT THIS NOTICE

- This notice is issued under section 58(5) of the Act.
- Details provided in this notice, along with an updated version of the licence, will be available on the EPA's Public Register (http://www.environment.nsw.gov.au/prpoeo/index.htm) in accordance with section 308 of the Act.

Appeals against this decision

- You can appeal to the Land and Environment Court against this decision. The deadline for lodging the appeal is 21 days after you were given notice of this decision.

When this notice begins to operate

- The variations to the licence specified in this notice begin to operate immediately from the date of this notice, unless another date is specified in this notice.
- If an appeal is made against this decision to vary the licence and the Land and Environment Court directs that the decision is stayed the decision does not operate until the stay ceases to have effect or the Land and Environment Court confirms the decision or the appeal is withdrawn (whichever occurs first).

Environment Protection Licence

Licence - 13336

NSW GOVERNMENT | Office of Environment & Heritage

Licence Details

Number: 13336

Anniversary Date: 25-October

Licensee

BARANGAROO DELIVERY AUTHORITY (BDA)

LEVEL 21 201 KENT STREET

SYDNEY NSW 2000

Premises

BARANGAROO

AND A PORTION OF HICKSON RD (NEAR TO 30-38 HICKSON RD)

MILLERS POINT NSW 2000

Scheduled Activity

Contaminated Groundwater Treatment

Crushing, Grinding or Separating

Extractive Activities

Fee Based Activity	Scale
Contaminated groundwater treatment	Any handling capacity
Crushing, grinding or separating	> 100000-500000 T processed
Land-based extractive activity	> 100000-500000 T extracted, processed or stored

Region

Metropolitan - Sydney Industry

Level 3, NSW Govt Offices, 84 Crown Street

WOLLONGONG NSW 2500

Phone: (02) 9995 5000

Fax: (02) 9995 6900

PO Box 513 WOLLONGONG EAST

NSW 2520

Environment Protection Licence

Licence - 13336

NSW GOVERNMENT | Office of Environment & Heritage

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Environment Protection Licence

Licence - 13336

NSW GOVERNMENT | Office of Environment & Heritage

Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act); and
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

Environment Protection Licence

Licence - 13336

NSW GOVERNMENT | Office of Environment & Heritage

The EPA publication "A Guide to Licensing" contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

BARANGAROO DELIVERY AUTHORITY (BDA)

LEVEL 21 201 KENT STREET

SYDNEY NSW 2000

subject to the conditions which follow.

Environment Protection Licence

Licence - 13336

NSW GOVERNMENT | Office of Environment & Heritage

1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled development work listed below at the premises listed in A2:
Preparation for scheduled activities, other activities; and.

A1.2 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Contaminated Groundwater Treatment	Contaminated groundwater treatment	Any handling capacity
Crushing, Grinding or Separating	Crushing, grinding or separating	> 100000 - 500000 T processed
Extractive Activities	Land-based extractive activity	> 100000 - 500000 T extracted, processed or stored

A1.3 The licensee must not carry on any scheduled activities until the scheduled development works are completed, except as elsewhere provided in this licence.

A1.4 To further clarify condition A1.1 above, "other activities" means preparation for the scheduled activities to be undertaken at the premises once planning permission is granted, namely:
Preparation for Chemical storage;
Preparation for Contaminated soil treatment;
Preparation for Sewage Treatment Systems (relocation of sewer).
Other activities also means the activities associated with the SISCO and SEPR Pilot Trials.

Activities permitted by Project Approval including those approved by:
1. MP10_0023 (Bulk Excavation and Basement Car Park);
2. MP10_0025 (Commercial Building C4)
3 MP10_0047 (Headland Park Early Works); and
3. MP10_0087 (SISCO and SEPR Pilot Trials).

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details
BARANGAROO
AND A PORTION OF HICKSON RD (NEAR TO 30-38 HICKSON RD)
MILLERS POINT

Environment Protection Licence

NSW 2000
LOT 1 DP 876514, LOT 3 DP 876514, LOT 4 DP 876514, LOT 5 DP 876514, LOT 6 DP 876514
BARANGAROO SOUTH, CENTRAL AND HEADLAND PARK AND NORTHERN COVE INCLUDING STP 162 [HICKSON ROAD DECLARATION AREA 3221] BEING THE PART OF HICKSON ROAD ADJACENT TO NUMBERS: 30-34 HICKSON ROAD (LOT 11 IN DP 1065410); 36 HICKSON ROAD (BEING LOT 5 IN DP 873158 AND LOT 12 IN DP 1065410); AND 38 HICKSON ROAD (SP72797) MILLERS POINT. THE PREMISES ALSO INCLUDES THE WORK AREA AT TOWNS PLACE AND HICKSON ROAD AS SHADED AND LABELLED AS "AREA OF SEWER WORKS" IN MAP TITLED "BARANGAROO ENVIRONMENT PROTECTION LICENCE VARIATION 003 FIGURE 2.1" SUBMITTED WITH LICENCE VARIATION APPLICATION DATED 31 MAY 2011.

A3 Other activities

A3.1 This licence applies to all other activities carried on at the premises, including:

Ancillary Activity
SISCO and SEPR Pilot Trials

A4 Information supplied to the EPA

A4.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:
a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

P1.1 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

Air

EPA identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description

5	Ambient air monitoring		Location 1 as depicted on Figure 5.6, page 28 of the report supporting LVA supplied to the EPA on 10 Dec 2010.
8	Ambient air monitoring		Location 4 as depicted on Figure 5.6, page 28 of the report supporting LVA supplied to the EPA on 10 Dec 2010.
13	Ambient air monitoring		Location 9 as depicted on Figure 5.6, page 28 of the report supporting LVA supplied to the EPA on 10 Dec 2010.
14	Discharge to air - Air quality monitoring	Discharge to air - Air quality monitoring	Stack serving the MPE/SVE System titled SVE 1 as depicted in drawing titled "Block 5 and Hickson Road Pilot Trial - Block 5 System Set-up area" supplied to the EPA on 31 May 2011.
15	Discharge to air - Air quality monitoring	Discharge to air - Air quality monitoring	Stack serving the MPE/SVE System titled SVE 2 as depicted in drawing titled "Block 5 and Hickson Road Pilot Trial - Block 5 System Set-up area" supplied to the EPA on 31 May 2011.
16	Discharge to air - Air quality monitoring	Discharge to air - Air quality monitoring	Stack serving the MPE/SVE System titled SVE 3 as depicted in drawing titled "Block 5 and Hickson Road Pilot Trial - Block 5 System Set-up area" supplied to the EPA on 31 May 2011.
17	Discharge to air - Air quality monitoring.	Discharge to air - Air quality monitoring.	Vent serving the air strippers on the Wastewater Treatment Plant as depicted on drawing No EN-10 in the document titled Air Quality Impact Assessment: Water Treatment Plant supplied to the EPA on 28 July 2011.
18	Discharge to air - Air quality monitoring	Discharge to air - Air quality monitoring	Vent serving the displacement tank on the Wastewater Treatment Plant as depicted on drawing No EN-10 in the document titled Air Quality Impact Assessment: Water Treatment Plant supplied to the EPA on 28 July 2011.

P1.2 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

P1.3 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

Water and land

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1	Discharge to waters Water quality monitoring	Discharge to waters Water quality monitoring	Discharge pipe installed through existing slab as described in document titled Barangaroo South S.1 Bulk Exc & Basement Carpark EPL variation Appl. 10 Dec 2010.
2	Ambient water quality monitoring North Near Field Turbidity Monitoring		Site NF1 as generally described in Fig 5.3 in LVA supporting information supplied to the EPA on 10 Dec 2010. Final location to be agreed in writing by the EPA.

3	Ambient water quality monitoring South Near Field Turbidity Monitoring	Site NF2 as generally described in Fig 5.3 in LVA supporting information supplied to the EPA on 10 Dec 2010. Final location to be agreed in writing by the EPA.
4	Ambient water quality monitoring Reference Turbidity Monitoring Point	Site BG1 as described in Fig 5.3 in LVA supporting information supplied to the EPA on 10 Dec 2010.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2 Concentration limits

L2.1 For each monitoring/discharge point or utilisation area specified in the table\s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\s.

L2.4 Air Concentration Limits

POINT 14,15,16

Pollutant	Units of measure	100 percentile concentration limit	Reference conditions	Oxygen correction	Averaging period
volatile organic compounds as n-propane equivalent	milligrams per cubic metre	20	Dry, 273K 101.3kPa		

POINT 17,18

Pollutant	Units of measure	100 percentile concentration limit	Reference conditions	Oxygen correction	Averaging period

volatile organic compounds as n-propane equivalent	milligrams per cubic metre	20	Dry, 273K 101.3kPa	

L2.5 Water and/or Land Concentration Limits

POINT 1

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Acenaphthene	micrograms per litre				2
Acenaphthylene	micrograms per litre				2
Ammonia	micrograms per litre				910
Anthracene	micrograms per litre				2
Arsenic	micrograms per litre				2.3
Benzene	micrograms per litre				500
Benzo(a)anthracene	micrograms per litre				2
Benzo(a)pyrene	micrograms per litre				2
Benzo(b)fluoranthene	micrograms per litre				2
Benzo(k)fluoranthene	micrograms per litre				2
Benzo[ghi]perylene	micrograms per litre				2
Cadmium	micrograms per litre				0.7
Chromium (trivalent)	micrograms per litre				27
Chromium (VI) Compounds	micrograms per litre				4.4

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Chrysene	micrograms per litre	2
Copper	micrograms per litre	1.3
Cyanide	micrograms per litre	4
Dibenz[a,h]anthracene	micrograms per litre	2
Ethyl benzene	micrograms per litre	80
Fluoranthene	micrograms per litre	2
Fluorene	micrograms per litre	2
Indeno(1,2,3-cd)pyrene	micrograms per litre	2
Lead	micrograms per litre	4.4
m+p-Xylene	micrograms per litre	75
Mercury	micrograms per litre	0.1
Naphthalene	micrograms per litre	50
Nickel	micrograms per litre	7
Oil and Grease	milligrams per litre	10
o-Xylene	micrograms per litre	350
pH	pH	6.5-8.5
Phenanthrene	micrograms per litre	2
Phenol	micrograms per litre	400
Pyrene	micrograms per litre	2
Toluene	micrograms per litre	180

Total Petroleum Hydrocarbons C10-C14 Fraction	micrograms per litre	50
Total Petroleum Hydrocarbons C15-C28 Fraction	micrograms per litre	100
Total Petroleum Hydrocarbons C29-C36 Fraction	micrograms per litre	50
Total Petroleum Hydrocarbons C6-C9 Fraction	micrograms per litre	20
TSS	milligrams per litre	50
Zinc	micrograms per litre	15

L3 Volume and mass limits

L3.1 For each discharge point or utilisation area specified below (by a point number), the volume/mass of:
a) liquids discharged to water; or;
b) solids or liquids applied to the area;
must not exceed the volume/mass limit specified for that discharge point or area.

Point	Unit of Measure	Volume/Mass Limit
1	kilolitres per day	6480

L4 Hours of operation

L4.1

Bulk Excavation and Basement Car Park
For the purposes of construction permitted by project Approval MP10_0023, work at the premises must be conducted between 7am and 6pm Monday to Friday and between 7am and 5pm Saturdays and at no time on Sundays and public holidays, unless inaudible at any residential premises.

Building C4
For the purposes of construction permitted by project Approval MP10_0025, work at the premises

must be conducted between 7am and 7pm Monday to Friday and between 7am and 5pm Saturdays and at no time on Sundays and public holidays, unless inaudible at any residential premises.

SISCO and SEPR Trial
For the purposes of construction permitted by project Approval MP10_0087, work at the premises must be conducted between 7am and 7pm Monday to Friday and between 7am and 6pm Saturdays and at no time on Sundays and public holidays, unless inaudible at any residential premises.

Works outside these hours are not permitted except as explicitly specified below or in other conditions and include:

(a) the delivery of materials which is required outside these hours as requested by Police or other authorities for safety reasons;
(b) emergency work to avoid the loss of lives, damage to property and/or to prevent environmental harm; or
(c) Approved out of standard hours works identified in a CNVMP.

Headland Park Early Works
For the purposes of works and activities permitted by project Approval MP10_0047, work at the premises must be conducted between 7am and 6pm Monday to Friday and between 8am and 3pm Saturdays and at no time on Sundays and public holidays, unless inaudible at any residential premises.

Works outside these hours are not permitted except as explicitly specified below or in other conditions and include:

(a) the delivery of materials which is required outside these hours as requested by Police or other authorities for safety reasons;
(b) emergency work to avoid the loss of lives, damage to property and/or to prevent environmental harm; or
(c) Approved out of standard hours works identified in a CNVMP.

L5 Potentially offensive odour

Note: Section 129 of the Protection of the Environment Operations Act 1997, provides that the licensee must not cause or permit the emission of any offensive odour from the premises but provides a defence if the emission is identified in the relevant environment protection licence as a potentially offensive odour and the odour was emitted in accordance with the conditions of a licence directed at minimising odour.

L5.1 The licensee must not cause or permit the emission of offensive odour beyond the boundary of the premises.

4 Operating Conditions

Environment Protection Licence

Licence - 13336

NSW GOVERNMENT | Office of Environment & Heritage

O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.
This includes:
a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:
a) must be maintained in a proper and efficient condition; and
b) must be operated in a proper and efficient manner.

O3 Dust

O3.1 All activities on the site must be undertaken with the objective of preventing visible emissions of dust beyond the boundary of the premises. Should such visible dust emissions occur at any time, the licensee must identify and implement all practicable dust mitigation measures, including cessation of relevant works, as appropriate, such that emissions of visible dust cease.

O4 Waste management

O4.1 The licensee must not cause, permit or allow any waste generated:
a) Outside the premises to be received at the premises; and
b) On-site to be disposed of outside of the premises except as permitted by c) and d) below.

c) The licensee must assess, classify and manage any waste generated at the premises in accordance with the Waste Classification Guidelines 2009 prior to transporting the waste off site.

d) If waste is transported from the premises, the licensee must ensure that the waste is transported by a waste transporter authorised to transport such waste and is transported to a place that can lawfully accept that waste.

O5 Other operating conditions

O5.1 Sewer Relocation
For the purposes of the sheduled development works described as "Preparation for Sewage Treatment Systems" as authorised in condition A1, the licensee must not undertake any sewer relocation works within the Declared Area being the area defined by Declaration Number 21122 untill written permission from the EPA is sought and granted.

O5.2 SISCO and SEPR Trial
This condition relates to discharge points 14, 15 and 16. The stacks must be installed and maintained at a height of not less than 2 metres above ground level. When operating the

minimum stack discharge velocity must be maintaned at 15m/s.

O5.3 Water Treatment Plant
The discharge point height of stacks at Points 17 and 18 must be maintained at least 2.77 m above ground level.

By 16 December 2011 the licensee must provide a report to the EPA which demonstrates the air impacts under the actual discharge velocities for points 17 & 18 will not result in any exceedence of the EPA's assessment criteria.

5 Monitoring and Recording Conditions

M1 Monitoring records

M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.

M1.2 All records required to be kept by this licence must be:
a) in a legible form, or in a form that can readily be reduced to a legible form;
b) kept for at least 4 years after the monitoring or event to which they relate took place; and
c) produced in a legible form to any authorised officer of the EPA who asks to see them.

M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
a) the date(s) on which the sample was taken;
b) the time(s) at which the sample was collected;
c) the point at which the sample was taken; and
d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

M2.2 Air Monitoring Requirements

POINT 13,8,5

Pollutant	Units of measure	Frequency	Sampling Method
Lead	micrograms per cubic metre	Special Frequency 3	Other Approved Method 1
Metallic Compounds	micrograms per cubic metre	Special Frequency 3	AM-15
PM10	micrograms per cubic metre	Continuous	AM-22

Polycyclic aromatic hydrocarbons	milligrams per cubic metre	Special Frequency 3	AM-15
Total Solid Particles	micrograms per cubic metre	Special Frequency 3	AM-15
Volatile organic compounds	milligrams per cubic metre	Continuous	Special Method 1

POINT 14,15,16

Pollutant	Units of measure	Frequency	Sampling Method
volatile organic compounds as n-propane equivalent	milligrams per cubic metre	Continuous	CEM-9
Volumetric flowrate	normalised cubic metres per second	Continuous during discharge	No method specified

POINT 17,18

Pollutant	Units of measure	Frequency	Sampling Method
Dry gas density	kilograms per cubic metre	Special Frequency 6	TM-23
Oxygen (O2)	percent	Special Frequency 6	TM-25
Temperature	degrees Celsius	Special Frequency 6	TM-2

POINT 17

Pollutant	Units of measure	Frequency	Sampling Method
volatile organic compounds as n-propane equivalent	milligrams per cubic metre	Special Frequency 5	Method approved in writing by the Authority

POINT 17,18

Pollutant	Units of measure	Frequency	Sampling Method
Volumetric flowrate	cubic metres per second	Special Frequency 6	TM-2

POINT 18

Pollutant	Units of measure	Frequency	Sampling Method
volatile organic compounds as n-propane equivalent	milligrams per cubic metre	Special Frequency 6	Method approved in writing by the Authority

M2.3 Water and/ or Land Monitoring Requirements

Environment Protection Licence

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POINT 1

Pollutant	Units of measure	Frequency	Sampling Method
Acenaphthene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Acenaphthylene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Ammonia	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Anthracene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Arsenic	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo(a)anthracene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo(a)pyrene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo(b)fluoranthene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo(k)fluoranthene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo[ghi]perylene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Cadmium	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Chromium (trivalent)	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Chromium (VI) Compounds	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Chrysene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Conductivity	millisiemens per centimetre	Special Frequency 1	Method approved in writing by the Authority
Copper	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Cyanide	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Dibenz[a,h]anthracene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Dissolved Oxygen	milligrams per litre	Special Frequency 1	Method approved in writing by the Authority
Ethyl benzene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Fluoranthene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Fluorene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Indeno(1,2,3-cd)pyrene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Lead	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority

m+p-Xylene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Mercury	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Naphthalene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Nickel	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Oil and Grease	milligrams per litre	Special Frequency 1	Method approved in writing by the Authority
o-Xylene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
PCBs	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
pH	pH	Special Frequency 1	Method approved in writing by the Authority
Phenanthrene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Phenol	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Pyrene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Toluene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total Petroleum Hydrocarbons C10-C14 Fraction	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total Petroleum Hydrocarbons C15-C28 Fraction	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total Petroleum Hydrocarbons C29-C36 Fraction	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total Petroleum Hydrocarbons C6-C9 Fraction	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total suspended solids	milligrams per litre	Special Frequency 1	Method approved in writing by the Authority
Turbidity	nephelometric turbidity units	Special Frequency 1	Method approved in writing by the Authority
Zinc	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority

POINT 2

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	millisiemens per centimetre	Special Frequency 2	Method approved in writing by the Authority
pH	pH	Special Frequency 2	Method approved in writing by the Authority
Temperature	degrees Celsius	Special Frequency 2	Method approved in writing by the Authority
Turbidity	nephelometric turbidity units	Special Frequency 2	Method approved in writing by the Authority

POINT 3

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	millisiemens per centimetre	Special Frequency 2	Method approved in writing by the Authority
pH	pH	Special Frequency 2	Method approved in writing by the Authority
Temperature	degrees Celsius	Special Frequency 2	Method approved in writing by the Authority
Turbidity	nephelometric turbidity units	Special Frequency 2	Method approved in writing by the Authority

POINT 4

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	millisiemens per centimetre	Special Frequency 2	Method approved in writing by the Authority
pH	pH	Special Frequency 2	Method approved in writing by the Authority
Temperature	degrees Celsius	Special Frequency 2	Method approved in writing by the Authority
Turbidity	nephelometric turbidity units	Special Frequency 2	Method approved in writing by the Authority

M3 Testing methods - concentration limits

M3.1 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with:
a) any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or
b) if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or
c) if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place.

M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

Note: The *Protection of the Environment Operations (Clean Air) Regulation 2010* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".

M4 Environmental monitoring

M4.1 All noise and vibration monitoring must be done in accordance with the relevent Construction Noise and Vibration Management Plan unless otherwise required in writing by the EPA.

M5 Recording of pollution complaints

M5.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.

M5.2 The record must include details of the following:
a) the date and time of the complaint;
b) the method by which the complaint was made;
c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
d) the nature of the complaint;
e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
f) if no action was taken by the licensee, the reasons why no action was taken.

M5.3 The record of a complaint must be kept for at least 4 years after the complaint was made.

M5.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M6 Telephone complaints line

M6.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.

M6.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.

M6.3 The preceding two conditions do not apply until 3 months after:
a) the date of the issue of this licence or
b) if this licence is a replacement licence within the meaning of the Protection of the Environment Operations (Savings and Transitional) Regulation 1998, the date on which a copy of the licence was served on the licensee under clause 10 of that regulation.

M7 Requirement to monitor volume or mass

M7.1 For each discharge point or utilisation area specified below, the licensee must monitor:
a) the volume of liquids discharged to water or applied to the area;
b) the mass of solids applied to the area;
c) the mass of pollutants emitted to the air;
at the frequency and using the method and units of measure, specified below.

POINT 1

Frequency	Unit of Measure	Sampling Method
Daily	kilolitres per day	No method specified

M8 Other monitoring and recording conditions

M8.1 For the purposes of the tables above:
Discharges to Waters - Water Quality Monitoring - WTP (point 1)
Special Frequency 1 means: Once daily for the first fourteen days then weekly.

Ambient Water Quality - Water Quality Monitoring - (points 2, 3 and 4)
Special Frequency 2 means: Every 15 Minutes.

Ambient Air Quality - (points 5, 8 and 13)
Special Frequency 3 means: 24 Hours every 6 days;
In relation to VOC monitoring - Special Method 1 means: As per table 5.7 in Licence Variation Application dated 10 Dec 2010; and
In relation to Lead monitoring - Other Approved Method 1 means: Either AM-11 or an alternative method to AM-11 for interim use that has been approved in writing by EPA.

Discharges to Air - WTP air emission monitoring (point 17 - stripper)
Other method approved in writing by the Authority means: Stack Test as interim and then CEMS as described in the document titled "*Air Quality and Odour Management Sub-Plan - Document No: PLAN-EN-04- Revision D*".

Special Frequency 5 means: as agreed to in writing by EPA.

Discharges to Air - WTP air emission monitoring (point 18 - displacement tank)
Other method approved in writing by the Authority means: As described in the document titled "*Air Quality and Odour Management Sub-Plan - Document No: PLAN-EN-04- Revision D*".

Special Frequency 6 means: as agreed to in writing by EPA.

6 Reporting Conditions

R1 Annual return documents

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:
a) a Statement of Compliance; and
b) a Monitoring and Complaints Summary.
At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided

below.

R1.3 Where this licence is transferred from the licensee to a new licensee:
a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.

R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.

R1.5 The Annual Return for the reporting period must be supplied to the EPA by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').

R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.

R1.7 Within the Annual Return, the Statement of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
a) the licence holder; or
b) by a person approved in writing by the EPA to sign on behalf of the licence holder.

R1.8 A person who has been given written approval to certify a certificate of compliance under a licence issued under the Pollution Control Act 1970 is taken to be approved for the purpose of this condition until the date of first review of this licence.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R2 Notification of environmental harm

R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.

R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

Note: The licensee or its employees must notify the EPA of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

R3 Written report

R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
a) where this licence applies to premises, an event has occurred at the premises; or
b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.

R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.

R3.3 The request may require a report which includes any or all of the following information:
a) the cause, time and duration of the event;
b) the type, volume and concentration of every pollutant discharged as a result of the event;
c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
g) any other relevant matters.

R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

7 General Conditions

G1 Copy of licence kept at the premises or plant

G1.1 A copy of this licence must be kept at the premises to which the licence applies.

G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.

G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

G2 Signage

G2.1 Each monitoring and discharge point must be clearly marked by a sign that indicates the EPA point identification number.

8 Special Conditions

E1 Site Wide Air Emissions Reporting

E1.1 30 days after commencement of works and monthly thereafter unless otherwise agreed in writing by the EPA, the licensee must submit to the Manager Sydney Industry, Environment Protection Authority, PO Box 668 Parramatta NSW 2124, a monthly air emissions monitoring report. The report must review all air monitoring data collected in compliance with the conditions of this licence and any Air Quality Management Plan and provide an interpretation of those results and any relevant site management responses.

E2 Barangaroo South Water Treatment Plant

E2.1 WTP Performance Report

Commencing one month from the first day of operations of the WTP and monthly thereafter or unless otherwise agreed in writing by the EPA, the licensee must submit to the Manager Sydney Industry, Environment Protection Authority, PO Box 668 Parramatta NSW 2124, a monthly WTP Performance Report. The report must review and compare the performance of the WTP against the requirements of this EPL, including Discharge Point 1 concentration limits, discharge volumes, recycled water quantities and quality as well as ambient monitoring results. The report must outline the circumstances which will trigger additional monitoring arrangements and include details about incidents and responses. The report must include the results of the visual inspections of water quality controls including silt curtains and any remedial action undertaken to ensure compliance with licence conditions including O1 and O2.

E2.2 WTP Commissioning Report

Within 60 days from the date of commissioning of the Water Treatment Plant (WTP) the licensee must submit to the Manager Sydney Industry, Environment Protection Authority, PO Box 668 Parramatta NSW 2124, a WTP commissioning report ("the report"). The report must include but not be limited to details about plant performance when treating a representative range of influents encountered during the initial stage of the works, namely, establishment works and installation of the perimeter retaining wall. The report must be updated ("the updated report") as works progress and as other influents are encountered at the site and directed to the WTP for treatment (for example contaminated groundwater, clean storm-water/surface water; contaminated storm-water/surface water; stockpile leachate etc). The updated report must be made available to an Authorised EPA officer on request.

E2.3 **Air Quality Management Plan**

The licensee must develop and implement an air quality management plan (AQMP) including an air quality monitoring program and VOC breakthrough action plan that will ensure WTP emissions will be controlled by best practice techniques and not cause any adverse environmental or health impact.

The AQMP must be submitted for OEH's review prior to WTP commissioning.

E2.4 **Air Quality Monitoring Program**

The licensee must develop an Air Quality Monitoring Program which must be submitted for EPA's review and approval prior to WTP commissioning. The monitoring program must include fit for purpose monitoring strategies and methods that will demonstrate air stripper and displacement tank emissions will meet emission limits while the WTP is in operation. The licensee must ensure the air quality monitoring program has commenced when WTP operations begin to demonstrate the effective operation of the WTP emission control system.

E2.5 **VOC Breakthrough Action Plan**

Prior to the commencement of WTP operations, the licensee must submit a VOC breakthrough action plan to EPA for review and comment. As a minimum, the plan must:

1. propose a preferred method to monitor VOC breakthrough in the activated carbon treatment units. The preferred method must have an adequate lower detection limit to achieve meaningful comparison with licensee defined carbon breakthrough trigger(s);
2. nominate a VOC breakthrough trigger(s); and
3. define, in detail, breakthrough actions for implementation upon measurement of a VOC concentration at and above the nominated breakthrough trigger level.

The licensee must ensure the VOC breakthrough action plan has commenced when WTP operations begin.

E3 Headland Park - Early Works

E3.1 Air Quality Management Plan

The licensee must develop and implement an Air Quality Management Plan (AQMP) for the Headland Park Early Works Project. The AQMP must include work and management practices that represent best available technology and best environmental practice for emission control.

E3.2 Ambient Air Monitoring Program and Reactive Management Strategy

The licensee must develop and implement an Abient Air Monitoring Program (AAMP) and a Reactive Management Strategy (RMS) to monitor fugitive emissions from the project and prevent exceedences of air quality criteria.

The AAMP must include each of the following elements:

1. the nomination and establishment of a network of real-time particulate monitoring sites within and/or beyond the project boundary for the purposes of monitoring project emissions using short (maximum 15 minute) averaging periods. These "management" monitoring sites shall be used to inform day to day reactive management measures. The management monitors should be fit for purpose but need not comply with AM 22 of the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales;*
2. the nomination and establishment of a suitable number of ambient PM10 monitoring sites at relevant locations, that are predicted to be the most impacted, for the purpose of determining compliance with OEH 24 hour average concentration criterion of 50 µg/m3. These "compliance" monitoring sites must be maintained so as to be capable of continuously monitoring the parameters specified in the table below;
3. the nomination and establishment of a suitable number of ambient monitoring sites to monitor chemicals known to be present in the contaminated soil to be used on-site as fill, for the purpose of determining compliance with the criteria used in the document *Air Quality and Health Impact*

Assessment Early Works – Headland Park dated September 2011;
4. the establishment of a suitable program to monitor odour at locations on and off site; and
5. the establishment of a real time meteorological monitoring station.

The RMS must include:

1. at least hourly review of real time monitoring data;
2. well defined monitoring trigger levels and appropriate trigger actions to prevent any exceedence of air quality criteria; and
3. regular review of monitoring activities, trigger levels and mitigation actions, that are based on monitoring data and site emission control performance.

Details of the AAMP and RMS including the type, location and frequency of monitoring to be undertaken, trigger levels and trigger level actions, must be submitted to the EPA for comment.

Site operations must not commence until the licensee receives and implements all formal written requests from the EPA on the program and strategy.

The licensee must ensure that the ambient air monitoring program is underway when excavation begins in order to demonstrate the effective operation of the emission controls used for the project.

Any sampling required by the licensee must be analysed by a laboratory accredited by NATA or equivalent, for the relevant sample analysis and matrix.

Parameter	Units of measure	Frequency	Averaging period	sampling method
PM10	ug/m3	Continuous	24-hour	AM-22
Siting				AM-1 and AM-4
Measurement				AM-2 and AM-4

E3.3 Tar hot spot works management

Pre-excavation investigation works must be undertaken to accurately identify the geographic extent and location of the hot spot.

Excavation of the hot spot must only occur:

1. between the hours of 10am and 4pm; and
2. when the wind direction is from the south south west, being between the angles of 190° and 220°.

Tar impacted materials must be immediately removed from the site to an appropriately licensed facility in covered vehicles. However, if immediate removal is not possible due to prevailing circumstances at the site, tar impacted materials must be immediately placed in a sealed container and stored in such a manner that prevents air emissions until the material is removed from the site.

Controls to eliminate odour from the tar hot spot works must include the provision of covers for the excavation, minimisation of exposed surface areas, application of dust suppressants where appropriate and the placement of unaffected material as soon as possible.

In the event the excavation of the tar hotspot cannot occur under the wind direction requirements outlined above and the wind conditions remain unfavourable for an extended period of time, the tar hotspot excavation may be undertaken within a temporary enclosure.

If a temporary enclosure is to be used to cover the tar hot spot excavation site, the licensee must provide the EPA with sufficient information to demonstrate emissions from hot spot excavation works will be captured and treated effectively.

E3.4 On-site meteorological weather station establishment, measurements and actions.

A real time meteorological weather station must be established and maintained on site so as to be capable of continuously monitoring the parameters specified in the table below.

Web based telemetry including the capability of notifying appropriate staff where wind speed trigger levels are reached must be established and implemented using meteorological station data.

A site inspection must be undertaken to review dust control measures:

1. During work hours where wind speed exceeds 8 m/s during work hours; and

2. Outside of work hours where wind speed exceeds 8 m/s averaged over a 1 hour period and is dominated by an easterly direction.

Parameter	Units of measure	Frequency	Averaging period	Sampling method
Rainfall	mm	Continuous	1 hour	AM-4
Wind speed @10 metres	m/s	Continuous	15 minute	AM2 and AM-4
Wind direction @ 10 metres	Degrees	Continuous	15 minute	AM2 and AM-4
Temperature @ 2 metres	Degrees C	Continuous	15 minute	AM-2 & AM-4
Temperature @ 10 metres	Degrees C	Continuous	15 minute	AM-4
Sigma theta @ 10 metres	Degrees	Continuous	15 minute	AM-2 & AM-4
Solar radiation	W/m2	Continuous	15 minute	AM-4
Additional requirements Siting and Measurement				AM-2 & AM-4

E3.5 Fill material pre-classification

Site materials originating from parts of the Barangaroo Site other than the Headland Park Site that

are to be used as fill must comply with the maximum criteria and daily mean criteria listed in the table below.

Prior to the receipt of materials from parts of the Barangaroo site other than the Headland Park site, material testing results for the material to be received must be reviewed and compared with the criteria in accordance with the project Materials Compliance Management System.

Materials originating from parts of the Barangaroo Site other than the Headland Park site must not be received on the Headland Park site until test results have been reviewed and it is confirmed that the material complies with the fill criteria.

Constituent	Maximum Criteria mg/kg	Daily Mean mg/kg
Benzene	5.2	2.8
Ethylbenzene	10	2.8
Toluene	12	3.3
Xylene (total)	43	12
2-methylnaphthalene	200	55
Cyanide	2	0.6
Acenaphthene	19	5.2
Naphthalene	170	160
Phenol	3	0.8
Dibenzofuran	53	15
Trimethylbenzenes	30	8
Styrene	7	2

E3.6 Exception reporting

The licensee must submit to the EPA an exception report within two working days of notification of a result where the project criteria have been exceeded (see note below). The report must include details of the exceedence and outline the circumstances that led to the exceedence and any changes to site management practices to prevent future exceedences.

Note: Exceedences of PM10 criteria must be investigated and actioned, but details may be reported to the EPA monthly in the Air Emission Monitoring Report required by condition E1.1

E3.7 Wet cutting methods must be used for sandstone extraction and block shaping. Water sprays and/or misting facilities must be used to prevent visible dust emissions from sandstone extraction and block shaping where wet cutting is not adequate.

E4 SISCO and SEPR Trial

E4.1 For the purposes of the SISCO and SEPR Pilot Trial ("the trial") authorised by licence condition A1.1 and A1.4 the trial must be conducted in accordance with the document titled "*Revised WORK PLAN and TRIAL MANAGEMENT PLAN Surfactant Enhanced In Situ Chemical Oxidation*

(S-ISCO®) & Surfactant Enhanced Product Recovery (SEPR™) Block 5 and Hickson Road Pilot Trial – September 2011". ("the WP&TMP"). The soil and groundwater, soil vapour sampling and process and performance monitoring results must be carried out as specified in the WP&TMP.
A summary and interpretation of all monitoring activities and sampling results specified in the WP&TMP must be provided to the EPA on a weekly basis. This summary must report against contingency triggers in the WP&TMP. The report must demonstrate that the management controls and procedures are sufficiently and accurately assessing the location of the injection front to determine plume movement and temperature. The report must include also any instances where triggers have been reached and a description of what contingencies were implemented.
As soon as practicable after the completion of the trial and in any case within a maximum of 18 weeks of completion, the licensee must prepare and submit to the EPA a detailed assessment report on the trial. The report must summarise all aspects of the trial including a commentary on the success or otherwise on the stated objectives. The report must be provided to the Manager Sydney Industry, Environment Protection Authority, PO Box 668, Parramatta NSW 2124.
Note: The summary and interpretation of sampling and monitoring results required in paragraph 2. above, may be submitted to the EPA by email.

E4.2 The trial success soil/groundwater criteria as noted in Appendix I of the TMP must be revised. The revised criteria can be either:

(a) The criteria for Area A from the ORWS HHERA; or

(b) OEH will accept a commitment from the applicant to formulate appropriate ecological criteria and present these in the ORWN HHERA.

The vapours from the pressure relief valves on the tanks used for treating water must be vented through the SVE charcoal bed;
Any treated water proposed for re-use or re-injection must meet the concentration limits specified in EPL condition L3 at Point 1; and
With respect to Contingency table (T21) an increased temperature of 15 degrees Celsius must trigger the addition of cold water into the wells.

E4.3 For the purposes of discharge points 14, 15 and 16 - the the breakthrough trigger for contingencies as per the Trial Management Plan is a VOC stack concentration of 10mg/m3 (5.1 ppm).

E5 Ambient Water Quality

E5.1 Ambient Water Quality Monitoring Reporting

Commencing one month from the first day of operations of the ambient water quality monitoring network and monthly thereafter or unless otherwise agreed in writing by the EPA, the licensee must submit to the Manager Sydney Industry, Environment Protection Authority, PO Box 668 Parramatta NSW 2124, a monthly Ambient Water Quality Monitoring Report. The report must include all results for ambient water quality monitoring around the site, an interpretation of those results and any relevant site management responses.

E5.2 Ambient Water Quality Trigger

A management trigger for turbidity at Points 2 and 3 must be established as outlined in Section

3.3.2 of Appendix 4 of the document entitled WATER & STORMWATER MANAGEMENT SUB-PLAN - BARANGAROO STAGE 1 prior to any discharges from the works. If the trigger is exceeded the licensee must implement the actions listed in Section 3.3.6 of Appendix 4 of this document.

E6 Completed PRPs

E6.1

PRP Number	Description	Completed Date
U1	Provide Discharge Dilution Criteria Report and Revised Stormwater and Water Management Plan	June 2011

E7 Special Dictionary

Note: SPECIAL DICTIONARY

For the purposes of the monitoring requirements in condition M2,2 (Points 5, 8 and 13) – under the heading Pollutant the words "metallic compounds" means the heavy metals copper, zinc and mercury (organic and inorganic).

For the purposes of the monitoring requirements in condition M2.2 (Points 1 – 4) under the heading Sampling Method the words "Method approved in writing by the Authority" means the Approved Methods Publication as in the Protection of the Environment Operations (General) Regulation 1998.

For the purposes of condition P1.1 the acronym LVA means Licence Variation Application.
For the purposes of condition O3.1 the acronym CNVMP means construction noise and vibration management plan.

Note: **Clarifying Notes.**

To further clarify the terms of this licence the licensee should note:

The licensee is responsible for compliance with all activities permitted by this licence:

Administrative (A) conditions
All relate to the premises.

Discharge Points (P) conditions
Points 5, 8 and 13 relate to Ambient Air Monitoring Stations;
Points 14, 15 and 16 relate to the SISCO and SEPR Trial;
Points 17 & 18 relate to air discharges from the Water Treatment Plant;
Point 1 relates to water discharges from the Water Treatment Plant; and
Points 2, 3 and 4 relate to Ambient Water Quality Monitoring.

Limit (L) Conditions
L1.1, L2.1, L2.2, and L2.3 relate to the premises;
L2.4 relates to specific Points as noted;
L3.1 relates to specific Points as noted;
L4.1 relates to hours of work at specific locations as permitted by Project Approvals (as noted); and
L5 and L5.1 relates to the premises.

Operating (O) Conditions
O1.1, O2.1, O3.1 O4.1 relate to the premises;
O5.1 relates to the sewer relocation activity;
O5.2 relates to the SISCO and SEPR Trial; and
O5.3 relates to the Water Treatment Plant.

Monitoring (M) Conditions
M1.1, M1.2 and M1.3 relate to the premises;
M2.1 and M2.2 relate to specific Points as noted;
M3.1 and M3.2 relate to the premises;
M4.1 relates to the premises;
M5.1, M5.2, M5.3 and M5.4 relate to the premises;
M6.1, M6.2 and M6.3 relate to the premises;
M7.1 relates to specific Points as noted; and
M8.1 relates to specific Points as noted.

Reporting (R) Conditions
R1.1, R1.2, R1.3, R1.4, R1.5, R1.6, R1.7, R1.8 relate to the premises;
R2.1 and R2.2 relate to the premises; and
R3.1, R3.2, R3.3 and R3.4 relate to the premises.

General (G) Conditions
G1.1, G1.2 and G1.3 relate to the premises; and
G2.1 relates to the premises.

Special (E) Conditions
E1.1 relates to the premises;
E2.1, E2.2, E2.3, E2.4 and E2.5 relate to the Water Treatment Plant;
E3.1, E3.2, E3.3 E3.4, E3.5, E3.6 and E3.7 relates to Headland Park Early Works;
E4.1, E4.2 and E4.3 relate to the SISCO and SEPR Trial;
E5.1 and E5.2 (Ambient Water Quality) relate primarily to works at Barangaroo South; and
E6 relates to the premises as noted.

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Dictionary

General Dictionary

3DGM [in relation to a concentration limit]	Means the three day geometric mean, which is calculated by multiplying the results of the analysis of three samples collected on consecutive days and then taking the cubed root of that amount. Where one or more of the samples is zero or below the detection limit for the analysis, then 1 or the detection limit respectively should be used in place of those samples
Act	Means the Protection of the Environment Operations Act 1997
activity	Means a scheduled or non-scheduled activity within the meaning of the Protection of the Environment Operations Act 1997
actual load	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
AM	Together with a number, means an ambient air monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales.*
AMG	Australian Map Grid
anniversary date	The anniversary date is the anniversary each year of the date of issue of the licence. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
annual return	Is defined in R1.1
Approved Methods Publication	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
assessable pollutants	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
BOD	Means biochemical oxygen demand
CEM	Together with a number, means a continuous emission monitoring method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales.*
COD	Means chemical oxygen demand
composite sample	Unless otherwise specifically approved in writing by the EPA, a sample consisting of 24 individual samples collected at hourly intervals and each having an equivalent volume.
cond.	Means conductivity
environment	Has the same meaning as in the Protection of the Environment Operations Act 1997
environment protection legislation	Has the same meaning as in the Protection of the Environment Administration Act 1991
EPA	Means Environment Protection Authority of New South Wales.
fee-based activity classification	Means the numbered short descriptions in Schedule 1 of the Protection of the Environment Operations (General) Regulation 2009.
general solid waste (non-putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997

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flow weighted composite sample	Means a sample whose composites are sized in proportion to the flow at each composites time of collection.
general solid waste (putrescible)	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environmen t Operations Act 1997
grab sample	Means a single sample taken at a point at a single time
hazardous waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
licensee	Means the licence holder described at the front of this licence
load calculation protocol	Has the same meaning as in the Protection of the Environment Operations (General) Regulation 2009
local authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
material harm	Has the same meaning as in section 147 Protection of the Environment Operations Act 1997
MBAS	Means methylene blue active substances
Minister	Means the Minister administering the Protection of the Environment Operations Act 1997
mobile plant	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
motor vehicle	Has the same meaning as in the Protection of the Environment Operations Act 1997
O&G	Means oil and grease
percentile [in relation to a concentration limit of a sample]	Means that percentage [eg.50%] of the number of samples taken that must meet the concentration limit specified in the licence for that pollutant over a specified period of time. In this licence, the specified period of time is the Reporting Period unless otherwise stated in this licence.
plant	Includes all plant within the meaning of the Protection of the Environment Operations Act 1997 as well as motor vehicles.
pollution of waters [or water pollution]	Has the same meaning as in the Protection of the Environment Operations Act 1997
premises	Means the premises described in condition A2.1
public authority	Has the same meaning as in the Protection of the Environment Operations Act 1997
regional office	Means the relevant EPA office referred to in the Contacting the EPA document accompanying this licence
reporting period	For the purposes of this licence; the reporting period means the period of 12 months after the issue of the licence, and each subsequent period of 12 mo nths. In the case of a licence continued in force by the Protection of the Environment Operations Act 1997, the date of issue of the licence is the first anniversary of the date of issue or last renewal of the licence following the commencement of the Act.
restricted solid waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
scheduled activity	Means an activity listed in Schedule 1 of the Protection of the Environment Operations Act 1997
special waste	Has the same meaning as in Part 3 of Schedule 1 of the Protection of the Environment Operations Act 1997
TM	Together with a number, means a test method of that number prescribed by the *Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales*.

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TSP	Means total suspended particles
TSS	Means total suspended solids
Type 1 substance	Means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements
Type 2 substance	Means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements
utilisation area	Means any area shown as a utilisation area on a map submitted with the application for this licence
waste	Has the same meaning as in the Protection of the Environment Operations Act 1997
waste type	Means liquid, restricted solid waste, general solid waste (putrescible), general solid waste (non-putrescible), special waste or hazardous waste

Mr Stuart Clark

Environment Protection Authority

(By Delegation)

Date of this edition: 25-October-2010

End Notes

1 Licence varied by notice 1123651, issued on 06-Jun-2011, which came into effect on 06-Jun-2011.