Human Health and Ecological Risk Assessment for Proposed Imported Soils

Barangaroo Delivery Authority

Barangaroo Central
Hickson Road, Sydney, NSW

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Table of Contents

List of Abbreviations vii

Definitions ix

Executive Summary x

1 Introduction 1

1.1 Introduction and Background 1

1.2 Objectives 1

1.3 Risk Assessment Process 2

1.4 Consideration of Interaction of Human Health and Ecological Risk Assessments 3

2 Summary Site Condition/Surrounding Environment 4

2.1 Site Identification 4

2.2 Current Site Condition 5

2.3 The Proposed Development / Current Design 5

2.3.1 Barangaroo Central Stage 1 Public Domain 6

2.3.2 Barangaroo Central Residential / Open Space Development 6

2.4 Proposed Site Condition 7

2.5 Surrounding Land use 8

2.6 Topography 8

2.7 Hydrology 8

2.8 Geology 9

2.9 Hydrogeology 9

2.10 Meteorology 10

3 Summary Site History/Previous Assessments 11

3.1 Barangaroo Project Site 11

3.2 Barangaroo Central 11

3.3 Previous Site Assessments 13

3.3.1 Environmental Site Assessment (ERM 2007) 13

3.3.2 Additional Investigation Works (ERM 2008a) 14

3.3.3 Stage 2 Remedial Action Plan (ERM 2008b) 15

3.3.4 AECOM Data Gap Investigation Remediation Works (South) Area (AECOM 2010a) 15

3.3.5 AECOM Data Gap Investigation EPA Declaration Area (AECOM 2010b) 15

3.3.6 AECOM Data Gap Investigation Remediation Works (North) Area (AECOM 2010c) 16

3.3.7 AECOM Additional Analysis 16

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3.3.8 AECOM Intertidal Study (AECOM 2010d) 16
3.3.9 Douglas Partners Sampling and Analysis 16
3.3.10 JBS Data Gap Investigation (JBS 2012) 17
3.3.11 Data Quality 17
4 Conceptual Site Model 18
4.1 Constituents of Potential Concern 18
4.2 Exposure Pathways 18
4.3 Receptors 19
4.4 Existing Environmental Data 19
4.5 Potential Off-Site Sources of COPCs 19
4.6 Preferential Pathways 20
4.7 Potential Leaching of Environmental Impact 20
5 Issue Identification 21
5.1 Issue Identification 21
5.2 Identification of Environmental Hazards 21
5.3 Environmental Sampling and Analysis 22
5.4 Putting Hazards into their Environmental Health Context 22
5.5 Identification of Potential Interactions between Agents 23
5.6 Why is Risk Assessment Needed? 23
5.7 Limitations and Uncertainties 23
6 Selection of Constituents of Potential Concern 25
6.1 Selection of Screening Criteria 25
6.2 Selection of COPCs in Soils 27
7 Toxicological Review 30
7.1 Hazard Identification 30
7.2 Dose-Response Assessment 31
7.3 Threshold Approaches 31
7.4 Non-Threshold Approaches 32
7.5 Sources of Toxicological and Tolerable Intake Data 33
7.6 Review of Published Hazard Data 34
7.6.1 Arsenic 34
7.6.2 Chromium 36
7.6.3 Copper 39
7.6.4 Lead 40
7.6.5 Ammonia (as N) 43

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7.6.6 Cyanide 44
7.6.7 Total Petroleum Hydrocarbons 46
7.6.8 Benzene 47
7.6.9 Toluene 50
7.6.10 Ethylbenzene 53
7.6.11 Xylene 55
7.6.12 Trimethylbenzenes 57
7.6.13 Polycyclic Aromatic Hydrocarbons 58
7.6.14 Phenols 66
7.6.15 Dibenzofuran 69
7.6.16 Asbestos 70
7.7 Summary and Evaluation of Toxicological Data 74
7.8 Odour Thresholds 79
7.9 Background Concentrations 82
8 Human Exposure Assessment 84
8.1 Exposure Scenario(s) Requiring Risk Assessment 84
8.2 Discussion of Exposure Scenarios 84
8.2.1 Open Space / Recreational Areas 84
8.2.2 Surface Car Park 85
8.2.3 Basement Car Park 85
8.2.4 Residential Apartments 86
8.2.5 'Cultural Space' 86
8.3 Exposure Parameters 87
8.4 Estimation of Inhalation Exposure 89
8.5 Estimation of Oral and Dermal Exposure 90
8.6 Estimation of Airborne Concentration 90
8.6.1 Vapour from Soil 90
8.6.2 Particulates 91
8.6.3 Volatilised Constituents from Seepage Water in Basement 91
8.7 Use of RISC Modelling Package 92
8.8 Characterisation of Open Space / Recreational Outdoor Areas 92
8.9 Characterisation of Sub-Surface Maintenance Trench/ Excavation 93
8.10 Characterisation of Indoor Spaces 93
8.10.1 Car Park 93
8.10.2 'Cultural Space' 94

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8.10.3 Residential Building 94
8.10.4 Vapour Flow into Buildings 94
8.10.5 Impacts of Soil Types on Vapour Movement into Buildings 95
8.11 Characterisation of Site Geology 96
8.11.1 Root Zone Soils 96
8.11.2 Fill Materials 96
8.11.3 Summary of Geological Properties 96
8.11.4 Leaching 97
8.12 Assessment of Total Petroleum Hydrocarbons 99
8.13 Characterisation of Physical and Chemical Properties of COPCs 99
8.14 Asbestos Exposure 102
8.14.1 Characterisation of Potential Occurrence of Asbestos 102
8.14.2 Identification of Potential Exposure Pathways 102
8.14.3 Estimation of Exposure Concentration for Pathways 102
8.14.4 Occurrence of Free Asbestos Fibres at Barangaroo 103
8.14.5 Occurrence of ACM at Barangaroo Central 103
8.14.6 Generation of Asbestos Fibres from Asbestos Cement Materials 103
8.14.7 Estimate of Free Asbestos Fibre Generation Rate from ACM 105
8.14.8 Generation of Asbestos Fibres from Asbestos Fibre Contaminated Soils 106
8.14.9 Dispersion of Asbestos Fibres between Soil Surface and Human Exposure 109
8.14.10 Estimation of Contaminant Intakes for Pathways 109
8.14.11 Intake Estimation 109
8.15 Risk Modelling 110
8.16 Models 111
8.17 Adoption of Published Criteria 111
9 Assessment of Human Health Risk 112
9.1 Risk Measurement 112
9.2 Adopted Risk Criteria 113
9.3 Assessment of Background Contributions 113
9.4 Assessment of Mixtures 114
9.5 Estimation of Risk 115
9.6 Assessment of Potential Coal Tar Odours 122
9.7 Asbestos 122
9.8 Preparation of Combined TPH Criteria 124
10 Sensitivity Analysis 125

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10.1 Sampling Programs 125
10.2 Toxicological Parameters 126
10.3 Land-Use 126
10.4 Exposure Parameters 126
10.5 Building Parameters 127
10.6 Modelling Equations 127
10.6.1 Application of Johnson & Ettinger Relationships 128
10.6.2 Biodegradation 128
10.7 Geological Parameters 129
10.8 Potential Synergistic / Additive Effects 130
10.9 Conclusion 130
11 Ecological Risk Assessment 132
12 Application of Risk Based Criteria 135
13 Conclusions and Recommendations 138
14 References 143
15 Limitations 150

Figures

Figure 1 Site Location
Figure 2 Barangaroo Central Site Plan
Figure 3 Barangaroo Central Concept Plan – Barangaroo Central Stage 1 Public Domain
Figure 4 Barangaroo Central Concept Plan – Barangaroo Residential / Open Space Development
Figure 5 Anticipated Application of HHRA Zone Based Criteria – Barangaroo Central Stage 1 Public Domain
Figure 6 Anticipated Application of HHRA Zone Based Criteria – Barangaroo Residential / Open Space Development

Appendices

Appendix A – Historical Soil and Groundwater Results Summary Tables
Appendix B – RISC Modelling Equations
Appendix C – Risk Modelling Spreadsheets and Summary
Appendix D – Ecological Risk Assessment

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List of Abbreviations

A list of the common abbreviations used throughout this report is provided below.

- ACL added contaminant level
- As Arsenic
- Cd Cadmium
- Cr Chromium
- Cu Copper
- BDA Barangaroo Delivery Authority
- BTEX Benzene, Toluene, Ethylbenzene and Xylenes
- B(a)P Benzo (a) pyrene
- COPCs Constituents of Potential Concerns
- DECCW NSW Department of Environment Climate Change and Water
- DQO Data Quality Objectives
- DP Deposited Plan
- EPA NSW Environment Protection Authority
- HHERA Human Health and Ecological Risk Assessment
- Hg Mercury
- HI Hazard Index
- HIL Health Based Investigation Level
- LOR Limit of Reporting
- LTEMP Long Term Environmental Management Plan
- MAH Monocyclic Aromatic Hydrocarbon
- Ni Nickel
- OCP Organochlorine Pesticide
- OEH NSW Office of Environment and Heritage
- OoW NSW Office of Water
- SAR Site Audit Report
- SAS Site Audit Statement
- PAH Polycyclic Aromatic Hydrocarbons
- Pb Lead
- PIL Phytotoxicity Based Investigation Level
- PCB Polychlorinated Biphyenyls
- PQL Practical Quantitation Limit
- PSH Phase Separated Hydrocarbons
- QA/QC Quality Assurance/Quality Control

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- REMP Remediation Environmental Management Plan
- RME Reasonably Maximum Exposed
- ROHSMP Remediation Occupational Health and Safety Management Plan
- RPD Relative Percentage Difference
- SWC Sydney Water Corporation
- TPH Total Petroleum Hydrocarbons (C_6-C_9 and C_{10}-C_{36})
- Zn Zinc

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Definitions

For the purposes of this document, the following definitions apply:

- "Barangaroo Central" – refers to the central portion of the Barangaroo site comprising part Lots 5 and 6 in DP876514. Located adjoining the southern boundary of the Headland Park Site, adjoining the northern boundary of the Stage 1 development and adjoining the northern and part of the western boundary of the Declaration Area.
- "Barangaroo Project Site" – refers to the Barangaroo Site, as defined in this SAQP, and adjoining parts of Sussex Street, Hickson Road and Towns Place.
- "Declaration Area" - refers to the part of the Barangaroo Project Site which is the subject of the declaration of Significantly Contaminated Land by the NSW DECCW under the *Contaminated Land Management Act 1997* (Declaration Number 21122, Area Number 3221, dated 6 May 2009). Inclusive of part Lots 3 and 5 in DP876514.
- "Headland Park Site" – refers to Part Lots 1, 5 & 6 and Lot 4 of DP 876514 located at the northern portion of the Barangaroo Site and includes adjacent parts of Hickson Road and Towns Place.
- "Imported Materials" – refers to fill/soil/rock materials imported onto the Barangaroo Central Site as part of the remediation works, sourced from land other than the Barangaroo Project Site, as defined in this RAP.
- "Overarching RAP" – refers to the Overarching RAP for the whole Barangaroo Project Site, prepared by ERM Australia Pty Ltd.
- "Remediation Consultant" – refers to JBS Environmental Pty Ltd.
- "Risk-based Criteria" – refers to the criteria proposed to be established in the Barangaroo Central HHERA, which will form part of the Site Acceptance Criteria for acceptance of materials to Barangaroo Central.
- "Site Materials" – refers to fill/soil/rock materials sourced from land within the Barangaroo Project Site.
- "Stage 1 Development" – refers to the southern part of the Barangaroo Project Site, which will be developed for commercial/residential/open space uses. This includes Lot 3 and part Lots 5 and 6 in DP876514.

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Executive Summary

JBS Environmental Pty Ltd (JBS) was engaged by the Barangaroo Delivery Authority (BDA) to complete human health and ecological risk assessments (HHERA) for the portion of the Barangaroo Project Site known as the Barangaroo Central Site. The Barangaroo Central Site is proposed to be initially developed as the Barangaroo Stage 1 Public Domain, which consists of a range of open space uses and car parking. In the future, the Barangaroo Central Site will be developed for a mixture of high density residential and open space uses.

A human health risk assessment has been completed for the assessment of imported fill materials to be used with the proposed development of the Barangaroo Central as:

- Barangaroo Central Stage 1 Public Domain; and
- Combined high density residential / recreational development as consistent with the proposed Masterplan for Barangaroo.

The risk assessment has considered a range of human health exposure scenarios for imported fill as used on Barangaroo Central. The key facets of the proposed development that have been considered in the risk assessment include:

- Construction of basement car park with overlying residential building;
- Construction of a 'Cultural Space' building;
- Recreational / open space areas; and
- Sub-surface services / infrastructure over the open space area of Barangaroo Central typically to a maximum depth of 0.5 m.

On the basis of these land-use parameters, the conceptual plans for Barangaroo Central, consideration of human exposure scenarios only, consideration of existing levels of exposure of human receptors to background levels of constituents and the limitations provided in **Section 15**, risk based criteria have been derived for use on the site as summarised in **Table E1**. **Table E1** provides a range of criteria for potential soil zones. Imported fill materials are required to be assessed as per the proposed soil zone where the materials will be placed. These soils zones are required to be interpreted as per the following rules:

- Zone 1 – Soils within 0.5 m of the finished surface of the Park;
- Zone 2 – Soils located below a depth of 0.5m bgs and located more than 30m from basements / Cultural Space;
- Zone 3 – Soils used as fill material within 10m of the basements to the residential buildings;
- Zone 4 – Soils used as fill materials greater than 10m and less than 30m from the basements to the residential buildings;
- Zone 5 – Soils used as fill material within 10m of the Cultural Space Building; and
- Zone 6 – Soils used as fill materials greater than 10m and less than 30m from the Cultural Space Building.

An ecological risk assessment has also been completed for the site. The risk assessment has considered a range of ecological exposure scenarios for the proposed development of

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Barangaroo Central that may be impacted by imported fill materials bought to the site. The key facets of the proposed open space areas of Barangaroo Central that have been considered in the risk assessment include:

- Provision of root zone soils to areas of site plantings designated as lawn areas, areas of shrubs and trees, or large tree plantings;
- Potentially leaching of chemical constituents within imported fill materials and migration to Darling Harbour.

On the basis of these land-use parameters and the conceptual plans for each of the development scenarios for Barangaroo Central and with consideration of the limitations provided in **Section 15**, the following risk based ecological criteria have been derived for use on the site as summarised in **Table E2**. It is intended that each of the criteria are to be applied as follows:

- Ecological Investigation Level (EIL) Protective of Potential Phytotoxicity Effects – to be applied to soils classified as root zone soils;
- EIL Protective of Surface Water – Saturated Zone – to be applied to soils that are proposed to be used as fill materials below the depth of groundwater (assumed to be 1.9 m AHD based on the predicted 2100 high water mark);
- EIL Protective of Surface Water – Unsaturated Zone – to be applied to be used as fill materials that are present above the depth of groundwater (assumed to be 1.9 m AHD based on the potential future high water mark).

Human health and ecological risk based criteria are required to be applied to the site as per the following decision rules:

- Human health based criteria – the 95% $UCL_{average}$ of the relevant constituent within the soil data set within the particular soil zones requires to be below the criteria. Existing soil data for Barangaroo Central soils may be considered with data used to characterise imported fill materials;
- EIL Protective of Potential Phytotoxicity Effects – the maximum concentration of each constituent with the soils used as root zone soils requires to be below the criteria; and
- EILs Protective of Surface Water – the average concentration of each constituent within the unsaturated soils data set, or within the extent of imported fill materials to be used as fill material below the depth of groundwater, is required to be below the criteria. Existing soil data for Barangaroo Central soils as present above the depth of groundwater may be considered with data used to characterise imported fill materials for the assessment to the unsaturated soils criteria.

Surface water discharges from the site are required to meet the protection of surface water criteria in **Table 13.3**.

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Table E1: Summary of Human Health Risk Based Criteria for Imported Fill Materials to be Used at Barangaroo Central

Constituent	Zone 1 Risk Based Criteria (mg/kg)	Zone 2 Risk Based Criteria (mg/kg)	Zone 3 Risk Based Criteria (mg/kg)	Zone 4 Risk Based Criteria (mg/kg)	Zone 5 Risk Based Criteria (mg/kg)	Zone 6 Risk Based Criteria (mg/kg)
Acenaphthene	900	49 000	540	4 000	380	2 800
Acenaphthylene	900	170 000	880	7 100	630	5 000
Ammonia	5 200	16 000	12	1 200	202	860
Anthracene	4500	NC	30 000	280 000	22 000	200 000
Arsenic	190	NC	NC	NC	NC	NC
Benzo(a)pyrene	2.0	NC	62	NC	NC	NC
Benzene	0.9	4.8	0.1	0.1	0.1	0.2
Chromium	630	NC	59 000	NC	NC	NC
Copper	6 400	NC	NC	NC	NC	NC
Cyanide	310	14 000	230	1 200	330	860
Dibenzofuran	4 400	150 000	0.5	5 600	86	4 000
2,4-dimethylphenol	1 800	NC	3 300	NC	NC	NC
Ethylbenzene	130	130	8	44	3	20
Fluoranthene	610	NC	180 000	NC	NC	NC
Fluorene	600	250 000	1200	10 000	900	7 300
Lead	480	NC	NC	NC	NC	NC
2-methylnaphthalene	60	9 600	16	450	45	320
Cresols	4 300	NC	7 200	NC	NC	NC
Naphthalene	33	170	1.2	7.3	0.8	5.1
Phenanthrene	4 500	NC	39 000	420 000	30 000	300 000
Phenol	25 000	25 000	2 800	20 000	850	4 000
Pyrene	460	NC	38 000	540 000	32 000	400 000
Toluene	92	92	7	41	2.8	15
TPH C_6-C_8 (aliphatic)	890	4 400	50	210	35	150
TPH C_{10}-C_{14}	830	4 500	48	210	34	140
TPH $C_{>15}$	5 100	NC	NC	NC	NC	NC
1,2,4-trimethylbenzene	6.3	215	1.9	16	1.8	11
Xylenes	33	33	2.5	15	1.1	5.4

Note: 1. To be assessed as per equivalent toxicity equivalence factor (TEF) to benzo(a)pyrene. Sum of carcinogenic PAHs to be summed, with multiplication of TEF, and assessed to benzo(a)pyrene criteria. As per WHO (2003) 'Polynuclear aromatic hydrocarbons in Drinking-water' relative potencies of Benz(a)anthracene – 0.1; Benzo(a)pyrene – 1.0; Benzo(b)fluoranthene – 0.1; Benzo(g,h,i)perylene – 0.01; Benzo(k)fluoranthene – 0.1; Chrysene – 0.01; Dibenz(a,h)anthracene – 1.0; and Indeno(1,2,3-c,d)pyrene – 0.1.

Zone 1 – 0-0.5m Soil Horizon

Zone 2 – Soils >0.5m below site surface

Zone 3 –Soil Within 10m of Basement Car Park

Zone 4 – Unsaturated Soil Within 30m and Greater than 10m from Basement Car Park

Zone 5 – Unsaturated Soil Within 10m of Cultural Space

Zone 6 – Unsaturated Soil Within 30m and Greater than 10m from Cultural Space

NC – no criteria as no complete exposure pathway identified for constituent and soil zone, or risk based level beyond maximum possible level

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Table 13.2: Summary of Ecological Risk Based Criteria for Imported Fill to be Used at Barangaroo Central

Constituent	Ecological Criteria		
	Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Ecological Investigation Level Protective of Surface Water – Saturated Soils	Ecological Investigation Level Protective of Surface Water – Unsaturated Soils
	mg/kg	mg/kg	mg/kg
Arsenic	20	4.6	18
Cadmium	3	0.1	0.2
Chromium (VI)[1]	-	18	70
Chromium (total)	190	-	-
Cobalt	-	1.7	6.7
Copper	60	6.8	27
Lead	1100	46	190
Mercury	1	0.2	0.9
Nickel	30	210	850
Vanadium	-	300	1200
Zinc	200	20	79
Cyanide (free)	0.9	0.4	1.6
Ammonia	20	<LOR	<LOR
Benzene	0.2	0.1	0.3
Toluene	0.3	<LOR	0.1
Ethylbenzene	0.8	<LOR	0.1
Xylene	-	<LOR	0.1
Styrene	-	<LOR	0.4
Acenaphthene	29 (sum)	0.4	1.5
Acenaphthylene		0.7	2.7
Anthracene		<LOR	<LOR
Fluorene		1.2	4.7
Naphthalene		1.6	6.4
Phenanthrene		0.1	0.5
2-methylnaphthalene	-	<LOR	<LOR
Benz(a)anthracene	18 (sum)	-	-
Benzo(a)pyrene		0.2[2]	0.7[2]
Benzo(b)fluoranthene		-	-
Benzo(g,h,i)perylene		-	-
Benzo(k)fluoranthene		-	-
Chrysene		-	-
Dibenz(a,h)anthracene		-	-
Fluoranthene		1.2	4.7
Indeno(1,2,3-c,d)pyrene		-	-
Pyrene		<LOR	0.1
Dibenzofuran	-	<LOR	<LOR
Phenol	3.8	-	-
Cresols	3.8	<LOR	<LOR
2,4-dimethylphenol	3.8	<LOR	<LOR
TPH C_6-C_9	210	<LOR	<LOR
TPH C_{10}-C_{14}	150	<LOR	<LOR
TPH C_{15}-C_{36}	300	-	-

Note: <LOR – below typical laboratory limit of reading

1. Criteria for chromium (VI)
2. To be assessed as per equivalent toxicity equivalence factor (TEF) to benzo(a)pyrene. Sum of carcinogenic PAHs to be summed, with multiplication of TEF, and assessed to benzo(a)pyrene criteria. As per WHO (2003) 'Polynuclear aromatic hydrocarbons in Drinking-water' relative potencies of Benz(a)anthracene – 0.1; Benzo(a)pyrene – 1.0; Benzo(b)fluoranthene – 0.1; Benzo(g,h,i)perylene – 0.01; Benzo(k)fluoranthene – 0.1; Chrysene – 0.01; Dibenz(a,h)anthracene – 1.0; and Indeno(1,2,3-c,d)pyrene – 0.1.

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Table 13.3: Surface Water Protection Criteria for Discharges from Barangaroo Central (µg/L)

Constituent	Protection of Surface Water Quality Criteria
Arsenic	2.3[2]
Cadmium	0.7[2]
Chromium (III)	27[2]
Chromium (VI)	4.4[2]
Cobalt	1[3]
Copper	1.3[2]
Lead	4.4[2]
Mercury	0.1[2]
Nickel	7[2]
Vanadium	100[3]
Zinc	15[2]
Ammonia	910[3]
Cyanide	4[3]
Benzene	500[2]
Toluene	180[2]
Ethylbenzene	80[2]
m&p-Xylene	75[2]
o-Xylene	350[2]
Styrene	72[3]
Acenaphthene	2[1, 2]
Acenaphthylene	2[1, 2]
Anthracene	2[1, 2]
Benzo(a)pyrene	2[1, 2]
Benzo(a)anthracene	2[1, 2]
Benzo(b)fluoranthene	2[1, 2]
Benzo(k)fluoranthene	2[1, 2]
Benzo(g,h,i)perylene	2[1, 2]
Dibenz(a,h)anthracene	2[1, 2]
Fluoranthene	2[1, 2]
Fluorene	2[1, 2]
Indeno(1,2,3-c,d)pyrene	2[1, 2]
Naphthalene	50[2]
Phenanthrene	2[1, 2]
Pyrene	2[1, 2]
2-methylnaphthalene	0.42[3]
Phenol	400[2]
Cresols	4.29[3]
2,4-dimethylphenol	0.66[3]
Dibenzofuran	0.74[3]
TPH C_6-C_9	20[1, 2]
TPH C_{10}-C_{14}	50[1, 2]
TPH C_{15}-C_{28}	100[1, 2]
TPH C_{29}-C_{36}	50[1, 2]

Note: 1. Based on limit of reporting.
2. As per Licence limits.
3. As per OHE provided protection of marine water quality criteria with mixture modifying factors included where appropriate.

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1 Introduction

1.1 Introduction and Background

JBS Environmental Pty Ltd (JBS) was engaged by the Barangaroo Delivery Authority (BDA) to complete human health and ecological risk assessments (HHERA) for the portion of the Barangaroo Project Site known as the Barangaroo Central Site. The Barangaroo Central Site is proposed to be initially developed as the Barangaroo Stage 1 Public Domain, which consists of a range of open space uses and car parking. In the future, the Barangaroo Central Site will be developed for a mixture of high density residential and open space uses.

It is proposed that imported fill materials, anticipated to include surplus materials from other portions of the Barangaroo Project Site, will be used to form the proposed profile of the Barangaroo Stage 1 Public Domain, and be retained in open space areas of the proposed high density residential / open space development of the site. It is estimated that between 80 000 and 150 000 m^3 of materials will be required to develop the proposed final landform of the open space areas.

Imported fill materials are required to be environmentally suitable for use on the Barangaroo Central Site. The assessment of environmental suitability is required to consider potential human exposure to imported soils, and potential interactions with ecological receptors in proximity of the site and flora proposed to be established on the site. This has been undertaken by a process of human health and ecological risk assessment to derive acceptable limits of a range of environmental constituents in soils.

The human health risk assessment has been undertaken by the methodology outlined in Department of Health and Ageing and enHealth Council (2002) '*Environmental Health Risk Assessment Guidelines for Assessing Human Health Risks from Environmental Hazards*' (enHealth, 2002).

1.2 Objectives

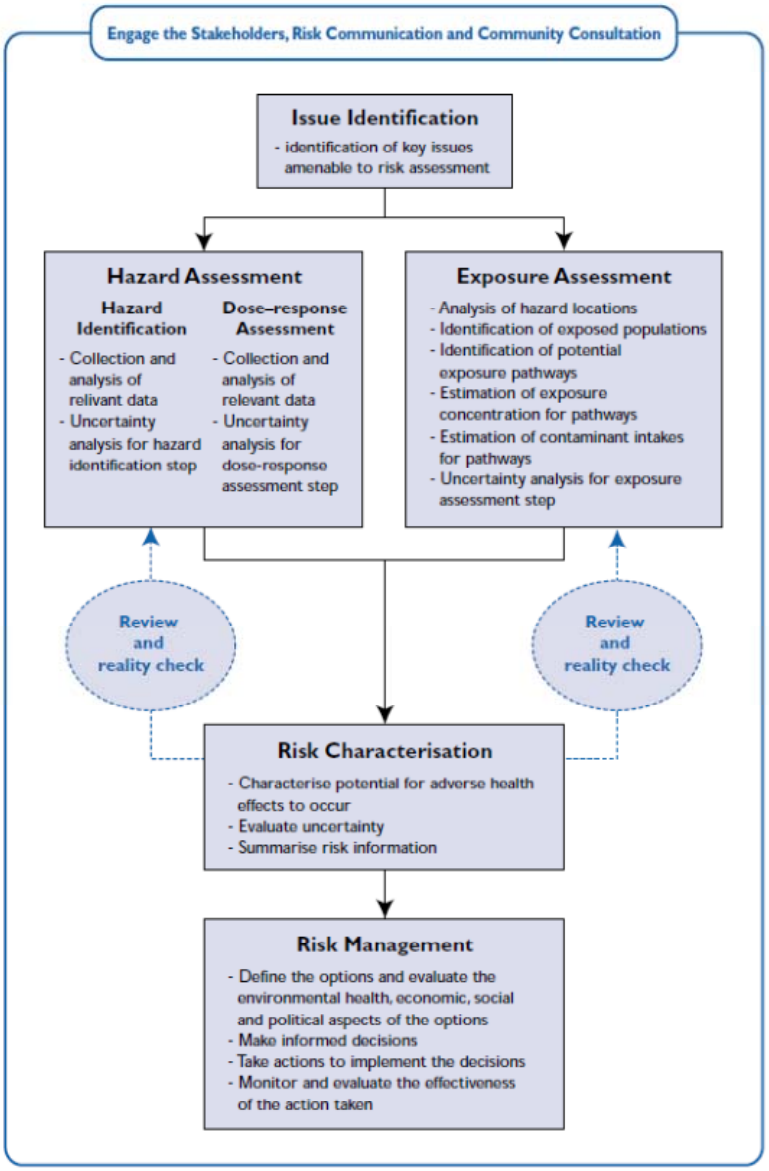
The primary objectives of the HHRA and ERA are to determine suitable levels of a range of environmental constituents identified as being present in soils across the Barangaroo Site, for future use in the development of the Barangaroo Central Site. These are to be provided as a set of quantitative criteria to facilitate the rapid assessment of the suitability of soils proposed to be used as imported fill during the construction works phases.

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1.3 Risk Assessment Process

Risk assessment is the process of estimating the potential impact of a chemical, physical, microbiological or psychosocial hazard on a specified human population or ecological system under a specific set of conditions and for a certain timeframe. A schematic of the risk assessment process is shown the diagram below (source: enHealth 2004).

- Issue Identification identifies issues amenable to risk assessment and assists in establishing a context for the risk assessment by a process of identifying the problems that the risk assessment needs to address. This includes the selection of Constituents of Potential Concern (COPC's) for the site and each identified potential exposure population.



- Hazard Assessment including toxicological assessment and dose-response assessment. Toxicological assessment involves determining what types of (adverse) health effects might be caused by the agent; and how quickly the adverse health effects might be experienced and their duration. Dose-response assessment considers both qualitative and quantitative toxicity information to determine 'the incidence of adverse effects occurring in humans at different exposure levels'.

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- Exposure Assessment involves the determination of the frequency, extent, duration and character of exposures in the past, currently, and in the future. There is also the identification of exposed populations, particularly sensitive sub populations, and potential exposure pathways.
- Risk Characterisation provides a qualitative and / or quantitative estimate, including attendant uncertainties, of the nature, severity and potential incidence of effects in a given population, based on the hazard identification and exposure assessments.

The human health risk assessment has specifically considered a range of potential human receptors that may use the site in the future. The ecological risk assessment has considered a range of potential on-site and off-site ecological receptors, including proposed flora communities on the Barangaroo Central Site and flora and fauna communities within the adjoining Darling Harbour.

1.4 Consideration of Interaction of Human Health and Ecological Risk Assessments

Human health and ecological risk assessments have been prepared for the site, respectively protective of future human and ecological populations. The findings of the ecological risk assessment (ERA) are summarised in **Section 11**. The ERA is provided as **Appendix D**. Criteria as derived by each of the risk assessments are required to be applied together in the future assessment of materials to be used as imported fill. Human health and ecological based criteria must be considered for each part of the risk assessment. To this extent, it is noted that there are several areas of overlap of human health and ecological criteria. The relevant criteria to each area of the site are identified in **Section 12**.

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2 Summary Site Condition/Surrounding Environment

2.1 Site Identification

The Barangaroo Project Site is located at Hickson Road, Millers Point, NSW and is legally referred to as Lots 1, 3, 4, 5 and 6 Deposited Plan (DP) 876514 and includes the adjacent parts of Sussex Street, Hickson Road and Towns Place, as shown in **Figure 1**. The Barangaroo Project Site details are summarised in **Table 2.1** and described in more detail in the following sections.

Table 2.1 Summary Details for the Barangaroo Project Site

Lot/DP	Lots 1, 3, 5 and 6 of Deposited Plan 876514, including adjacent parts of Sussex Street, Hickson Road and Towns Place
Address	Hickson Road Millers Point NSW
Local Government Authority	City of Sydney
Site Zoning	Zone B4 Mixed Use and RE1 Public Recreation
Current Use	Vacant/Roadway
Geographical Co-ordinates, Elevation	Easting – 333643m E, Northing – 6251851m S, 2-3m AHD
Site Area	Approximately 22 ha

The Barangaroo Central Site is located within the central portion of the Barangaroo Project Site. Site details are summarised in **Table 2.2** and described in more detail in the following sections. The extent of the site is shown as **Figure 2**.

Table 2.2 Summary Details for the Barangaroo Central Site

Lot/DP	Part Lots 5 and 6 of Deposited Plan 876514
Address	Hickson Rd Millers Point NSW
Local Government Authority	City of Sydney
Site Zoning	Zone B4 Mixed Use and RE1 Public Recreation
Current Use	Interim Cruise Passenger Terminal and Water Treatment Plant at south-western portion
Geographical Co-ordinates, Elevation	Easting – 333620m E, Northing – 6251850m, 2-3m AHD
Site Area	Approximately 4.3 ha

A formal site survey had not been prepared for the Barangaroo Central Site at the time of preparation of the Imported Soils HHERA. A formal site survey will be prepared prior to the issue of the Data Gap Investigation, being completely separately to the Imported Soils HHERA. The Barangaroo Central Site boundary will be defined as:

- North – The northern boundary of the Barangaroo Central Site is defined by the southern boundary of the Barangaroo Headland Park as defined in Remedial Action Plan Barangaroo Delivery Authority Barangaroo Headland Park revision 3, JBS Environmental, 8 November 2011;
- East – The eastern extent of Lot 5 DP876514, apart from the proximity of the Declaration Area. The Barangaroo Central Site eastern boundary in proximity of the Declaration Area is defined by the northern and western extent of the Significantly Contaminated Land as identified by the former NSW DECCW (now EPA) under the Contaminated Land Management Act 1997 (Declaration Number 21122, Area Number 3221, dated 6 May 2009);
- South – The northern boundary of the 'Stage 1' area as shown by the Stage 1 Site plan in the Part 3A Preliminary Assessment Barangaroo Concept Plan Modification Request for DGRs and PEAR, prepared by JBA Urban Planning Consultants in February 2010 (JBA 2010), apart from the proximity of the Declaration Area. The Barangaroo Central Site southern boundary in proximity of the Declaration Area is defined by the northern and western extent of the Significantly Contaminated Land as identified by the former NSW DECCW (now

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EPA) under the Contaminated Land Management Act 1997 (Declaration Number 21122, Area Number 3221, dated 6 May 2009); and

- West – The western extent of Lot 6 DP876514.

The extent of the Barangaroo Central site boundaries are shown on **Figure 2**.

2.2 Current Site Condition

The Barangaroo Central Site is characterised as being level over the site area and paved. The northern and central portions of the Barangaroo Central Site are currently used as an Interim Cruise Passenger Terminal, as per a lease agreement with Sydney Ports Corporation. A large temporary structure is located over the central west portion of the Barangaroo Central Site, comprising the Interim Terminal. The temporary structure is provided with a false floor within the southern and central portions, for use as Passenger waiting area and Customs. The northern portion of the temporary structure is used for luggage handling and does not have temporary flooring. The area to the east of the Interim Terminal is used for car parking and passenger drop off / pick up as associated with the Cruise Ships.

A Water Treatment Plant is located within the southern portion of the Barangaroo Central Site. This is characterised by a series of large above ground storage tanks, filters and associated smaller tanks and shipping containers. The Water Treatment Plant is understood to be used with the current site development works on the Stage 1 Development.

A small Gate House Structure is located adjoining the eastern boundary of the Barangaroo Central Site. Portions of the Foreshore Walk are also present within the Barangaroo Central Site, with a walkway moving in an east-west direction through the southern portion, and extending in a southerly direction along the eastern boundary. The Foreshore Walk areas are delineated on the Barangaroo Central Site by fencing and signage.

2.3 The Proposed Development / Current Design

The Barangaroo Central Site is proposed to be initially developed as the Barangaroo Stage 1 Public Domain. This development is described in more detail in **Section 2.3.1** and is proposed to be undertaken in the near future. This development is proposed as an interim site use prior to the commencement of the proposed long term development.

The Barangaroo Central Site is proposed to be ultimately developed for combined high density residential and open space purposes. This development is described in more detail in **Section 2.3.2**. This development is anticipated to commence in 2015.

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2.3.1 Barangaroo Central Stage 1 Public Domain

JBS has been advised that the Barangaroo Central Site is to be initially developed as 'Barangaroo Stage 1 Public Domain'. This is to facilitate a recreational use of Barangaroo Central Site prior to anticipated long term development in accordance with the current Barangaroo concept plan. A concept plan of the 'Barangaroo Stage 1 Public Domain' is provided as **Figure 3**. Characteristics of this development and associated land use are anticipated to include:

- Use of Barangaroo Central Site for recreational purposes, similar to the open areas of the Headland Park Site;
- Landscaping with grasses and some large plantings over approximately 70% of the Barangaroo Central Site;
- Retention of existing site paving and use for Car Parking over approximately 30% of the Barangaroo Central Site as present to the south of the central portion; and
- Importation of between 80 000 and 150 000 m3 of fill materials to raise the site level and create a slope towards Darling harbour.

It is understood that these works will be the subject of a Project Application to be prepared in the near future. A range of environmental studies are required to support the Project Application.

The Sampling, Analysis and Quality Plan (SAQP) and associated future data gap investigations / environmental assessments will consider the future use of the Barangaroo Central Site for recreational uses consistent with the 'Barangaroo Stage 1 Public Domain'.

2.3.2 Barangaroo Central Residential / Open Space Development

The Barangaroo Concept Plan identifies that the area of Barangaroo Central will be developed long term as a mixture of high density residential and open space / recreational land uses. The current concept plan for the long term Barangaroo Central site development has been provided as **Figure 4**. From review of **Figure 4**, land-uses can be observed to include:

- Two high density residential developments located in the central and northern portion of the site adjoining the eastern site boundary;
- Part of a basement of an additional high density residential building as located adjoining the eastern part of the southern boundary and the southern part of the eastern boundary. The basement for this building is almost wholly located within the Declaration Area, which has been excluded from the Barangaroo Central Site; and
- Recreational / open space land-uses located within the western portion of the site including areas of large tree and garden plantings, grassed areas to be used for playing fields or other events, an open amphitheatre and pathways along the foreshore and throughout the site.

The lateral dimensions of the proposed basements can be observed from **Figure 4**. The basement areas should be assumed to extend between the building outlines as shown on **Figure 4**. No definitive guidance is available as to the anticipated depth of the basements. However, review of a similar basement proposed for the Barangaroo South Site as reported in JBA Planning (November 2010) 'Bulk Excavation and Basement Car Parking PA1 (MP10_0023) Barangaroo South', indicates similar sized basements on the

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southern portion of the site are proposed to extend to a depth of 22m below ground surface (terminating at approximately -18.5m AHD).

A Cultural Space is also proposed to be constructed with the long term development of the site. Two options are currently proposed for the Cultural Space including:

- Integration of the Cultural Space within the existing Residential Buildings at the eastern portion of the site; or
- Construction of a Cultural Space as a structure with a concrete slab, potentially partially submerged in sections by contouring of soils at the perimeter, in the proximity of the current 'Amphitheatre Building' as shown on **Figure 4** at the north-west of the Barangaroo Central Site.

The risk assessment will consider both options.

2.4 Proposed Site Condition

The Barangaroo Central Site is proposed to be initially developed as 'Barangaroo Stage 1 Public Domain' and later developed for a combined high density residential / recreational land use. Environmental criteria for imported fill materials are required to be protective of both land-uses.

Potential uses / areas that have been identified with these land-uses as per BDA concept plans (provided as **Figures 3** and **4**) include:

- A landscaped area located within the central and northern parts of Barangaroo Central Site with the Barangaroo Stage 1 Public Domain. Landscaped areas confined to the western portion of the site with the subsequent high density residential / recreational development;
- A car parking area located to the south of the central portion of the Barangaroo Central Site and reported to occupy 30% of the Barangaroo Central Site to operate while the site is developed as Barangaroo Stage 1 Public Domain;
- Large basement areas constructed in the eastern portion of the site, associated with the proposed residential building;
- Access corridors throughout the Barangaroo Central Site;
- Pavilions, presumed to be naturally ventilated and marked as being approximately 500 m2 in area, present adjoining the northern and eastern boundaries; and
- A potential Cultural Space to be constructed at the north-west of the Barangaroo Central site, with a concrete slab / potentially partially submerged structure, with concrete walls as appropriate.

The landscaping areas for the Barangaroo Stage 1 Public Domain will be formed by the importation and placement of between 80 000 to 150 000 m^3 of soils over the site, graded gently towards Darling Harbour. Part of this fill material will potentially be retained in the open spaces areas of the proposed high density residential / recreational land use. The area will be landscaped with grassed areas, small and large plantings. It has been reported by BDA that site pavement will be removed from within the proposed landscaped areas.

Site pavement is proposed to be retained on the area of Barangaroo Stage 1 Public Domain where the temporary car parking is proposed. The estimated extent of the proposed future car park is shown on **Figure 3**.

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2.5 Surrounding Land use

The surrounding uses of land adjacent to the Barangaroo Central Site have been previously reported as follows (ERM 2008b[1]):

- North: Immediately to the north is the proposed Northern Cove, to be constructed with the development of the Headland Park Site.
- East: Immediately to the east is Hickson Road. Residential and commercial areas of the northern part of Sydney are located further east.
- South: Immediately to the south is the Barangaroo South Stage 1 Development. This also comprises the Declaration Area.
- West: Immediately to the west is Darling Harbour.

A former gasworks is known to have been in operation until the 1920s over part of the Stage 1 Development, located adjoining the south of the Barangaroo Central Site. The former gasworks location is known to continue to the east beneath Hickson Road, and the contaminated gasworks waste material in this area has been identified to be contaminating soils and groundwater on the south-eastern portion of the Barangaroo Project Site. This part of the Stage 1 Development, referred to as the Declaration Area in this SAQP, has been declared a Remediation Site by the former NSW DECCW, now EPA (Declaration No. 21122, Area No. 3221) under the CLM Act 1997. The Declaration Area forms part of the eastern and southern boundary of the Barangaroo Central Site. It is understood that environmental assessment programs are being undertaken on the Stage 1 Development in preparation for remediation.

2.6 Topography

The Barangaroo Central Site is relatively flat, having been filled for its previous use as a stevedoring facility (ERM 2008b).

The topography is proposed to be modified by the importation of fill material to create a surface graded towards Darling Harbour. It is estimated that 80 000 to 150 000 m^3 of materials will be imported to the Barangaroo Central Site to create the raised site surface for the Barangaroo Stage 1 Public Domain, predominantly over the northern and central portions.

2.7 Hydrology

The closest surface water body to the Barangaroo Central Site is Darling Harbour, located immediately adjacent to the western boundary (ERM 2008b). Surface water from the Barangaroo Central Site is collected via a sub-surface drainage network, which generally flows toward the Harbour.

Hydrology with the proposed development will be potentially modified with the amended topography. However, it is proposed at this stage that any future drainage system provided to the Barangaroo Central Site will also discharge to Darling Harbour.

[1] *Stage 2 Remedial Action Plan for Barangaroo*, Hickson Road, Sydney, ERM, September 2008 (ERM 2008b)

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2.8 Geology

The 1:100 000 Geological Survey of NSW (Sydney) Sheet 9130 (Ed 1) 1983, states that the Barangaroo Central Site is generally underlain by man-made fill that has been placed over marine sands over Hawkesbury Sandstone, which is described as follows (ERM 2008b):

- Man-made fill may consist of "dredged estuarine sand and mud, demolition rubble, industrial and household waste"; and
- Hawkesbury Sandstone is characterised as "medium to coarse-grained quartz sandstone with very minor shale and laminite lenses".

The general geological profile observed at the Barangaroo Central Site, as reported by previous investigations, is summarised in **Table 2.2**.

Table 2.2 Summary of Observed Site Geology

Lithological Unit	Description	Depth (mbgl)
Hardstanding	Asphalt, bitumen or concrete, generally in good condition with no staining.	0 – 0.46
Road base fill	Very dark grey, dry, loose, medium grained sand to fine gravel, poorly sorted, sub angular, no odours or staining noted.	0 – 0.5
Fill	A range of materials have been reported as being present as fill, including silty clay, clayey sand, sand, sandy gravel, sandy gravelly clay, sandy clay and gravelly sand. Sandstone floaters have also been reported as occurring in fill materials. Anthropogenic materials have also been reported in fill material including building rubble, bricks and concrete.	Surface depth to 4 – 18.3
Marine Clay/Sand	Interbedded clayey sand and sandy clay, dark greyish brown, saturated, some shell fragments and organic matter. Sandy clay – soft, high plasticity. Clayey Sandy – loose to dense, fine to coarse sand, low to no plasticity.	Below 4 – 18.4
Bedrock	Weathered sandstone, white, light yellowish brown, olive brown and reddish brown, wet, fine to coarse grained, some fracturing noted.	Below 9.5 - 38

It is estimated that 560 000 m^3 of fill material is present within the Barangaroo Central Site. An additional 80 000 to 150 000 m^3 of fill materials will be placed on the site with the development of Barangaroo Stage 1 Public Domain. Where materials are sourced from the Barangaroo Project Site, soil descriptions would be anticipated to be similar to those described for the Barngaroo Central Site.

2.9 Hydrogeology

As previously reported (ERM 2008b), information obtained from the Department of Natural Resources (DNR) indicated that 33 registered groundwater bores were situated within a 4 kilometre (km) radius of the Barangaroo Central Site. Review of the groundwater bore information indicated that the bores were used for the following purposes: recreation (8), irrigation (3), and monitoring (22). None of the listed bores were reported to be registered for drinking water purposes. No registered groundwater bores have been reported to be present on or adjacent to the Barangaroo Central Site, apart from monitoring bores.

The quality of groundwater on the Barangaroo Central Site has been reported to have been assessed via a network of monitoring wells installed across the Site (ERM 2008b). Hydrological data indicated that groundwater on the Barangaroo Project site was strongly influenced by tidal fluctuations, suggesting a hydraulic connection with the Harbour.

The hydrological data suggest that much of the Barangaroo Central Site is likely to be subject to significant seawater flushing, as consistent with the extent of filling undertaken on the site. Under typical conditions there is reported to be a likely net groundwater flux towards the Harbour, at a velocity of up to 7.6 m/day (ERM 2008b).

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It is not anticipated that the current hydrogeological regime would change substantially with the proposed development. The removal of site pavement from the majority of the Barangaroo Central Site has the potential to cause greater levels of surface infiltration to occur. The installation of deep basements will potentially cause local variations in groundwater flow patterns in close proximity.

2.10 Meteorology

The Sydney area has a humid to temperate climate with a seasonal rainfall maximum during the summer and autumn months. Annual mean rainfall recorded at Sydney (Observatory Hill) is 1212 mm (BOM 2010)[2].

The area has a history of droughts, which are broken by periods of heavy rainfall resulting in significant recharges to groundwater resources. The 1940s and 1980s and the current decade are observed to be dry periods, while the early 1970s and 1990s were wet periods.

Summer winds are predominantly northeasterly with southerly thunderstorms common. Winter winds are predominantly westerly.

[2] http://www.bom.gov.au/climate/averages/tables/cw_066062.shtml visited 7th May 2010 (BOM 2010)

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3 Summary Site History/Previous Assessments

3.1 Barangaroo Project Site

The Barangaroo Project Site was a large precinct occupied by shipping and related merchants over the 1900s. A gasworks operated by The Australian Gas Light Company (AGL) over the period of 1840 to 1925 was located on part of the Barangaroo Project Site, within the Stage 1 Development, and extended across what is now Hickson Road. During the use of the Barangaroo Project Site for these purposes, the original shoreline was altered to enable the construction of a number of finger wharves and associated activities, with these reclaimed over the period spanning the 1950s to 1970s. Over the past 20 years, the Barangaroo Project Site was used principally for stevedoring purposes, until the majority of buildings were demolished and the land prepared for redevelopment in the past 5 years.

3.2 Barangaroo Central

A summary of the Barangaroo Project Site history was provided in a previous report (ERM 2006[3]), and was based on review of historical title deeds, historical aerial photographs, and a previous Contamination Assessment conducted by URS (2001) on the 'Darling Harbour Berths 3 – 8'.

Considerable detail was provided in ERM (2006) relating to the operation of a gasworks on Lot 3 DP 876514, which is currently referred to as the 'Declaration Area' and is located outside the boundaries of the Barangaroo Central Site. With respect to Lot 3, it was reported that the gasworks were operation from 1841 to 1921. Decommissioning was reported to occur between 1922 and 1925, comprising the demolition of gas holders and purifiers and backfilling of holding tanks.

With respect to the Barangaroo Project Site external to Lot 3, ERM (2006) states that "*The exact history of the remainder of the site is unclear. Originally the remainder of the site consisted of finger wharfs. These wharves were changed over time and then removed, and the site was filled in.*" No evidence was provided in ERM 2006 to suggest that the Barangaroo Central Site was used as part of the Lot 3 gasworks operation, or that waste from the operational gasworks, or rubble generated during decommissioning were placed within the boundaries of the Barangaroo Central Site.

A chronological summary of the findings of the ERM (2006) historical review pertinent to activities on the Barangaroo Central Site is provided below:

- 1840 to 1910: The Barangaroo Central Site was owned by merchants, compositors, manufacturers and various shipping companies and was also used for ship berthing and associated activities. Ownership was largely transferred to Sydney Harbour Trust Commissioners (SHTC) circa 1910.
- 1910 to 1936: The majority of the Barangaroo Central Site continued to be owned by the SHTC and was used for ship berthing and associated activities such as workshops and stores.
- 1936 to 1998: Ownership transferred to the Maritime Services Board of NSW and subject to various commercial leases. Part of the Barangaroo Central Site initially consisted of finger wharves, which were removed over time with a significant

[3] *East Darling Harbour Geotechnical and Environmental Investigations: Summary of Findings*, ERM, September 2006 (ERM 2006)

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portion of land reclaimed from the Harbour with unclassified fill between 1951 and 1972. The following was noted on the historical aerial images viewed from this period:

  - 1951 – Barangaroo Central Site Central used as part of a shipping berthing / dock facility with the site area comprising finger wharves and submerged areas; and
  - 1972 – Significant reclamation earthworks occurring on the Barangaroo Central Site;

- 1998: Sydney Ports Corporation was proprietor of Lot 5. Maritime Ministerial Holding Corporation became proprietor of Lot 6;
- 1996-2007: A number of environmental investigations were conducted on the Barangaroo Central Site;
- 2007 - 2008: The Barangaroo Central Site was vacated by Patrick Stevedores Operations. The warehouses were demolished and the land predominantly cleared and leveled in preparation for future redevelopment; and
- 2011: The Interim Cruise Ship Passenger Terminal was established on the Barangaroo Central Site and commenced operations.

In order to verify the ERM (2006) assessment, the 1943 historical aerial image of the Barangaroo Central Site was obtained from the NSW Land and Property Management Authority (LPMA 2012[4]) online database and reviewed. The 1943 image shows the majority of the Barangaroo Central Site to have been inundated. Finger wharves were regularly spaced, extending from the eastern boundary. Shed structures, consistent with the structures on the finger wharves, can also be observed adjoining the eastern boundary, along Hickson Rd.

This is consistent with the historical detail provided in ERM (2006), indicating that between 1936 and 1998 the Barangaroo Central Site was used for various commercial purposes and as finger wharves. Buildings and finger wharves are visible in the Lot 3 area, and no gasworks infrastructure is visible. It is therefore considered unlikely that large volumes of gasworks waste/demolition material, if any, were used as fill material during reclamation works on the Barangaroo Central Site.

[4] http://imagery.maps.nsw.gov.au/ as viewed on 23 January 2012 (LPMA 2012)

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3.3 Previous Site Assessments

A number of previous site investigations have been undertaken to provide environmental data for remediation planning. Environmental assessments that have been made available to JBS include:

- ERM (June 2007) '*Environmental Site Assessment, East Darling Harbour, Sydney, NSW*' (ERM 2007);
- ERM, (July 2008) '*Additional Investigation Works at Barangaroo, Hickson Road, Millers Point, NSW*' (ERM 2008a);
- ERM (September 2008) '*Draft Stage 2 Remedial Action Plan for Barangaroo, Hickson Road, Sydney*' (ERM 2008b);
- Douglas Partners (14 May 2010) '*Barangaroo Draft Factual Environmental Site Investigation Report*' (DP 2010a);
- AECOM Australia (27 May 2010) '*Data Gap Investigation, Other Remediation Works (South) Area Hickson Road, Millers Point NSW*' (AECOM 2010a);
- AECOM (23 September 2010) '*Data Gap Investigation EPA Declaration Area (Parts of Barangaroo Site and Hickson Road), Millers Point, NSW*' (AECOM 2010b); and
- AECOM (20 October 2010) '*Data Gap Investigation Other Remediation Works North, Hickson Road, Millers Point, NSW*' (AECOM 2010c).
- AECOM (3 November 2010) '*Groundwater Discharge Study Stage 1 Barangaroo Development*' (AECOM 2010d);
- Douglas Partners (17 December 2010) '*Factual Report – Pre Early Works Additional Environmental Assessment – Soils Barangaroo Headland Park*' (DP 2010b); and
- JBS Environmental (January 2012) '*Data Gap Investigation and Prevalidation Sampling Report Barangaroo Headland Park and Northern Cove*' (JBS 2012a).

The works and findings of each of these assessments are summarised following.

3.3.1 Environmental Site Assessment (ERM 2007)

This investigation (ERM 2007[5]) comprised a desktop study of existing and previous land uses, the placement of 161 soil sample locations across the site and the assessment of groundwater from 25 groundwater monitoring wells.

The investigations reported encountering a layer of silty / gravelly sand fill in all boreholes, raging in thickness from 0.5 to 21 m. Boreholes drilled in the northern and eastern portion of the Barangaroo Project Site were reported as being generally devoid of a layer of natural sediment, with fill underlain by the sandstone bedrock. In the central portion of the Barangaroo Project Site the fill layer was found to be underlain by natural marine sediments generally comprising silty clays underlain by sandstone. An underground storage tank (UST) was identified at the north-eastern corner of the Barangaroo Project Site.

Soils were reported to be sampled and analysed for a wide range of contaminants commonly associated with former gasworks and industrial sites including heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), cyanides, sulphates, total petroleum hydrocarbons

[5] *Environmental Site Assessment, East Darling Harbour*, Sydney, NSW, ERM, June 2007 (ERM 2007)

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(TPH), monocyclic aromatic hydrocarbons (including benzene, toluene, ethylbenzene and xylene – collectively referred to as BTEX), polycyclic aromatic hydrocarbons (PAHs), phenols, polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs) and organophosphorus pesticides (OPPs).

Two primary areas were identified which had levels of contaminants above the adopted investigation criteria. These areas were described as being located in the proximity of the former gasworks (see **Figure 2**) and in the north-western portion of the site adjacent to Warehouse 3. The primary COPCs were identified as copper, lead, PAHs, TPH, BTEX and sulphates.

Isolated areas of soil impact were also identified including the western portion of Wharf 8, the eastern boundary north of Warehouse 5 and the western edge of Warehouse 4. Impact at these locations was found to consist of PAHs including benzo(a)pyrene and lead. Impact was found to occur within a fill layer present to a maximum reported depth of 3.5 m bgl.

Widespread elevated levels of heavy metals were also reported across the Barangaroo Project Site. The potential for asbestos containing materials (ACM) to be present was also identified across the Barangaroo Project Site. However, the consultant (ERM 2007) noted that the sampling methods employed during the assessment were not appropriate to identify ACM.

Groundwater underlying the Barangaroo Project Site was found to be subject to strong tidal influence. Groundwater impact was identified as consistent with the constituents identified as soil impact. The majority of groundwater impact was identified in the proximity of the former gasworks, with localised impact in other areas of the Barangaroo Project Site, such as in the proximity of the UST. Groundwater constituents identified at elevated levels included PAHs, TPH, BTEX cadmium, copper, lead, zinc and free cyanide.

3.3.2 Additional Investigation Works (ERM 2008a)

This additional investigation (ERM 2008a) consisted of additional soil and groundwater assessment to address perceived data gaps in the initial site assessment (ERM 2007).

A total of 55 soil sample locations were placed across the Barangaroo Project Site, consisting of 34 grid based locations and 21 targeted locations. Sandstone bedrock was additionally cored at 13 locations. A total of 23 existing, and 13 newly installed, wells were assessed across the site.

Soil and groundwater were analysed for the COPCs identified in the initial site assessment (ERM 2007). The following results were reported (ERM 2008a):

- Localised levels of lead, TPH, BTEX, PAHs and sulphate exceeded the adopted assessment criteria. The highest levels were located within the area of the former gasworks;
- The highest levels of groundwater impact, occurring as TPH, BTEX and PAHs were located within the area of the former gasworks. Groundwater impact was identified in this area to occurr in fill materials, natural clayey sands and sandstone;
- Groundwater was found to be substantially influenced by tidal movements with very high hydraulic conductivities recorded for the fill material. It was considered that substantial tidal flushing of the aquifer had occurred which had resulted in a relatively small migration of impact from the area of the former gasworks; and

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- Phase separated hydrocarbon (PSH) impact was identified at monitoring well MW204D in the area of the former gasworks.

This investigation was subject to the same issue regarding the capacity of the sampling method to identify ACM as the ERM 2007 study.

3.3.3 Stage 2 Remedial Action Plan (ERM 2008b)

A remedial strategy for the whole of the Barangaroo Project Site was prepared in ERM (2008b). The preferred remedial approach for the former gasworks portion of the site, currently subject to EPA regulation and proposed for future mixed use, was determined to be source removal via either excavation and off-site treatment and disposal (for the most heavily impacted materials) or excavation and on-site stabilisation / reuse (for less heavily impacted materials). The materials were proposed to be re-used in any appropriate area of the site, including the proposed development of Barangaroo Central.

The remaining areas of the Barangaroo Project Site (including the area of Barangaroo Central) were proposed to be made suitable for the proposed developments by on-site management involving capping of impacted materials and hotspot removal of materials exceeding risk based clean-up levels.

3.3.4 AECOM Data Gap Investigation Remediation Works (South) Area (AECOM 2010a)

Targeted sampling and analysis was completed by AECOM in the area of Blocks 1, 2 and 3 within Stage 1 of the Barangaroo Project Site. The investigations were undertaken to obtain additional contaminant data in these areas. The works comprised the placement of 35 soil sample locations, seven groundwater monitoring wells, four soil vapour wells and additional sampling and analysis of selected existing groundwater monitoring wells.

Hot-spots of environmental impact were recorded throughout the fill materials and in the proximity of the former gasworks on the site. Constituents identified included lead, total petroleum hydrocarbons (TPH), benzene, xylenes, polycyclic aromatic hydrocarbons (PAHs) and sulphate.

Where soils were analysed for the presence of acid sulphate soils, potential acid sulphate soils were generally recorded in the natural soils.

3.3.5 AECOM Data Gap Investigation EPA Declaration Area (AECOM 2010b)

Targeted sampling and analysis was undertaken by AECOM in the area of Blocks 3, 4 and 5 of the Barangaroo Project Site, part of the proposed Southern Cove, and part of Hickson Rd adjacent to the Barangaroo Site. The investigations were undertaken to obtain additional contaminant data in these areas. The works comprised the placement of 25 soil sample locations, nine groundwater monitoring wells, seven soil vapour wells and additional sampling and analysis of selected existing groundwater monitoring wells.

The additional sampling and analysis confirmed the findings of previous assessments that substantial environmental impact is present in the proximity of the former gasworks infrastructure. Soil vapour, principally consisting of naphthalene, was identified in the proximity of the former gasworks.

Of two samples analysed for acid sulphate soils, one sample consisting of clayey sand from a depth of 7.3-7.5 m recorded potential acid sulphate soils. The other sample analysed, consisting of sandy gravelly clay fill, did not identify potential or actual acid sulphate soils.

Samples submitted for 'neutral water leach' (by ASLP leaching) reported potentially leachable levels of lighter PAHs and heavy metals.

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3.3.6 AECOM Data Gap Investigation Remediation Works (North) Area (AECOM 2010c)

Targeted sampling and analysis was undertaken by AECOM in the area of the proposed Blocks 4, 5, Southern Cove and the Public Domain of the Barangaroo Project Site. The investigations were undertaken to obtain additional contaminant data in these areas. The works comprised the placement of 13 soil sample locations, five groundwater monitoring wells, one soil vapour well, and additional sampling and analysis of selected existing groundwater monitoring wells.

Elevated levels of hydrocarbon constituents were identified at some sample locations, including monocyclic aromatic hydrocarbons and polycyclic aromatic hydrocarbons. The highest levels of soil impact were identified in Blocks 4 and 5 in close proximity to the former gasworks. Naphthalene was also identified in soil vapour. Some elevated levels of heavy metals were identified in groundwater, with the highest levels being recorded in wells screened at deeper depths.

Samples submitted for 'neutral water leach' (by ASLP leaching) reported some potentially leachable levels of lighter PAHs and heavy metals.

3.3.7 AECOM Additional Analysis

Limited additional analysis of AECOM samples was undertaken by JBS to assist with the interpretation of the leachability data. Summarised environmental data from these works is provided as **Appendix A**.

3.3.8 AECOM Intertidal Study (AECOM 2010d)

AECOM undertook a study of groundwater discharge from the Barangaroo Central and South Sites. It was found that an attenuation factor of five could be applied to groundwater constituents present in groundwater underlying the site when this groundwater discharged to Darling Harbour. This factor is intended to be applied to predict the dilution of leachate in saturated soil to the receiving environment (i.e., Darling Harbour).

3.3.9 Douglas Partners Sampling and Analysis

Targeted sampling and analysis works were completed by Douglas Partners (DP2010a & 2010b) across the majority of the Barangaroo Project Site in April, May, November, and December 2010. Soil analyses included analysis of total and ASLP leachable concentrations.

A comparison of total and leachable levels of constituents as generated by the completion of the DP (2010a & 2010b) works has been provided in JBS Environmental (10 January 2011) '*Summary of Results of Soil Analysis of Chemical Constituent Leachability Barangaroo*'.

Two additional groundwater monitoring wells were also installed within the Headland Park site during the November and December 2010 works and all monitoring wells (new and existing) within the Headland Park site were sampled and analysed.

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3.3.10 JBS Data Gap Investigation (JBS 2012)

Grid based soil sampling was undertaken across the area of the proposed Headland Park and Northern Cove by JBS (2012). Existing and additional groundwater monitoring were installed and/or sampled at the boundary of the proposed Headland Park. Soil and groundwater samples were analysed for a range of analytes consistent with environmental constituents historically recorded on the Barangaroo Project Site.

A localised tar hot-spot was identified in near surface soils at the southern extent of the proposed Headland Park. No other areas of gross contamination were identified throughout the soils. Areas of localised elevated heavy metal and PAH impacted soils were identified on the site, consistent with the findings of previous investigations of sites in other areas of the site (apart from the Declaration Area). Simultaneous site works undertaken at the Headland Park identified the occurrence of asbestos containing materials (ACM) in fill materials.

Slightly elevated concentrations of copper, lead, and zinc were recorded in groundwater at some monitoring wells. These were found to marginally exceed the adopted water quality criteria, but were consistent with previous monitoring rounds. Ammonia was reported at levels exceeding the groundwater assessment criterion, though no specific source of ammonia was identified during the soil and groundwater investigations. The reported concentrations of the constituents were not considered to pose a risk to the receiving environment.

3.3.11 Data Quality

Each of the respective assessments identified in **Sections 3.3.1** to **3.3.10** have concluded that the data presented are adequately reliable to be used in decision making on the Barangaroo site. JBS has undertaken no further assessment of the data and it is assumed that all data are reliable for use in the HHRA and ERA.

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4 Conceptual Site Model

A conceptual site model (CSM) has been prepared to document the constituents of potential concern (COPCs), sources of COPCs, pathways, and potential receptors on the Barangaroo Central Site. The CSM is considered to be an essential pre-requisite to development of data quality objectives for the additional investigations.

4.1 Constituents of Potential Concern

COPCs identified as adversely impacting soils and/or groundwater within the Barangaroo Project Site, which may potentially be present in surplus soils to be used as imported fill on Barangaroo Central, have been found to include:

- Heavy metals including arsenic, cadmium, copper, lead, nickel and zinc;
- Total petroleum hydrocarbons (TPH);
- Polycyclic aromatic hydrocarbons (PAHs);
- Cyanide;
- Phenols; and
- Asbestos.

4.2 Exposure Pathways

The exposure pathways considered to be potentially complete for the Barangaroo Central Site, considering the interim and long term development scenarios for the site, include:

- Inhalation of COPC vapours migrating upwards from current in-situ impacted soils and/or groundwater; and/or
- Inhalation of COPC vapours migrating upwards and laterally from current in-situ impacted soils and/or groundwater, and accumulating within car parks, overlying residential buildings, and/or Cultural Space Building; and/or
- Dermal and oral contact to impacted soils present at shallow depths and/or accessible by future service excavations with the proposed Park design; and/or
- Oral and dermal contact, and/or inhalation of volatilised constituents, of groundwater which may seep into basements; and/or
- Contaminant uptake by vegetation proposed to be established in the vegetated areas of the Barangaroo Central Site, reported to potentially include large trees.

Oral and dermal contact of regular site users to current in-situ soils on the Barangaroo Central Site is expected to be restricted over the majority of the area due to the retention of pavement for the car park area with the Barangaroo Stage 1 Public Domain, the extent of site basements, pavements surrounding residential buildings, and the placement of imported fill materials over the remainder of the area.

It is not anticipated that any groundwater extraction will occur on the Barangaroo Central Site. Levels of total dissolved solids consistent with marine water cause the groundwater underlying the site to be unsuitable for beneficial use. There is also anticipated to be a supply of grey water harvested from near surface seepage water flows available from the Headland Park site. This has not been considered as a complete exposure pathway for potential surface users as per either of the development scenarios.

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Basements are proposed to be constructed underlying the residential buildings that will extend substantially below the current depth of groundwater. Users of these basements will potentially be exposed to infiltrating seepage water. This seepage water will potentially infiltrate from areas both hydrogeologically up- and down-gradient of the basement, as well as areas hydrogeologically cross-gradient.

There is potential for the basement to cause a localised depression in the water table, drawing in groundwater / seepage water. However, it is not considered that this would be particularly significant. Where the basement design permitted significant quantities of seepage water to discharge into the basement, then the purpose of the basement would be compromised. The basement is proposed to be constructed to a tanked design, effectively excluding seepage water inflow. To remain conservative in ensuing risk calculations undertaken here, it has been assumed that seepage will potentially flow into the basements from soils located within a 10m distance from the basement perimeter.

4.3 Receptors

Potential receptors of COPCs include:

- Future recreational users of the Barangaroo Central Site; and/or
- Future residents of the residential buildings and associated basements (sub-surface car parks); and/or
- Excavation / construction / maintenance workers conducting activities at or in the vicinity of the Barangaroo Central Site, who may potentially be exposed to COPCs through inhalation of vapours or via direct dermal contact with impacted soils present within excavations; and/or
- Flora species to be established on the vegetated areas of the Barangaroo Central Site including potential large tree plantings; and/or
- The marine water ecosystem of Darling Harbour and Port Jackson.

4.4 Existing Environmental Data

Surplus soils to be re-used on the Barangaroo Central Site will be potentially generated from the Barangaroo Central and Stage 1 Development Sites. Environmental data available for the Headland Park and Northern Cove portion of the Barangaroo Project Site have not been considered as a deficit of soils exists in these areas of the site. It is not anticipated that surplus soils from these areas of the Barangaroo Project Site will be used as imported fill on Barangaroo Central.

Soil and groundwater data are available for the Barangaroo Central and Stage 1 Development Sites as previously collected by ERM (2007 and 2008a) and AECOM (2010a, 2010b and 2010c). All environmental data available for soils are summarised in **Appendix A**.

The highest levels of impact, consisting of PAHs, TPH, heavy metals, phenolics and cyanide, have been identified within the Declaration Area. Generally, impact in other areas of the site is restricted to elevated levels of PAHs and some heavy metals, occurring as hot-spots within fill materials.

4.5 Potential Off-Site Sources of COPCs

The most potentially significant off-site source of environmental impact is the Declaration Area present adjoining the south-eastern portion of the Barangaroo Central Site. The

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northern portion of the Declaration Area is found to be hydrogeologically upgradient of the southern portion of the Barangaroo Central Site. However, the majority of the Declaration Area, including the area which contains the former gasworks infrastructure, is hydrogeologically cross-gradient of much of the Barangaroo Central Site.

Several gasworks contaminants are reported to be mobile in the environment and it is considered highly likely that some level of gasworks-based contaminants will have migrated onto the Barangaroo Central Site.

Environmental impact is understood to be present in Hickson Road, associated with the former gasworks and associated Declaration Area. The highest levels of impact are understood to be present to the south and hydrogeologically cross-gradient of the Barangaroo Central Site.

4.6 Preferential Pathways

For the purpose of this assessment, preferential pathways have been identified as natural and/or manmade pathways that result in the preferential migration of COPCs as either liquids or gasses.

Man-made preferential pathways are present throughout the Barangaroo Central Site, generally associated with extensive sand and gravel based fill materials. Based on estimates of hydraulic conductivity and the extent of tidal influence observed in groundwater monitoring wells on the site, these fill materials are found to have a high permeability.

Preferential pathways are also important in the assessment of potential off-site sources of COPCs. Preferential pathways are potentially present in Hickson Rd, associated with service easements, and typically running in a north-south direction along the length of the street. Preferential pathways could cause known environmental impact in Hickson Rd to migrate to the extent of the Barangaroo Central Site.

4.7 Potential Leaching of Environmental Impact

Environmental impact within soils underlying the Barangaroo Central Site may be leachable. Estimates of leachability for similar soils in other areas of the Barangaroo Project Site, as reported in *Human Health and Ecological Risk Assessment Barangaroo Delivery Authority Barangaroo Headland Park Hickson Road, Sydney*, NSW, JBS Environmental, August 2011 (JBS 2011a), found that at least heavy metals and light PAHs are leachable. Similar levels of leachability have been recorded for fill based soils across the Barangaroo Project Site. This enabled an approach in JBS (2011a) of referring to total levels of constituents in fill based soils to characterise the potential leachability of these materials.

Groundwater levels at the Barangaroo Central Site have been found to be related to sea levels in the adjoining Darling Harbour, and therefore that the depth to groundwater can be correlated to tides within Darling Harbour. City of Sydney planning instruments recommend that a 0.9 m rise in sea water level be considered for the next 100 years. This would lead to an increase in the groundwater level, and some currently unsaturated soils within the Barangaroo Central Site becoming saturated.

Currently, imported soils are not anticipated to be placed below the depth of groundwater, and potential leaching of impact would be restricted to surface water percolation throughout the soils.

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5 Issue Identification

Issue identification is the first step of the risk assessment process.

5.1 Issue Identification

Issue identification determines whether risk assessment is useful, and establishes a context for the risk assessment by a process of identifying the concerns the risk assessment needs to address. Issue identification draws on all relevant lines of information.

Issue identification comprises several phases:

1. Identification of environmental health issues (or an individual issue) and determining whether there are hazards amenable to risk assessment. This will involve demarcating 'hazards' from 'issues' and may require environmental sampling;
2. Putting the hazards into their environmental health context (clarification and prioritising of problems and hazards);
3. Identification of potential interactions between agents; and
4. Stating clearly why risk assessment is needed and the scope and objectives of the risk assessment. This will involve identifying problems for which information is, or can be, available to undertake adequate risk assessments and problems which risk assessment cannot assist.

5.2 Identification of Environmental Hazards

Environmental health hazards may be caused by physical, chemical, biological or social factors in the environment. Physical factors include heat, cold, noise, mechanical hazards etc. Chemical factors include synthetic and naturally occurring substances. Biological factors include viruses, prions, bacteria, parasites and vermin.

The proposed development(s) of the Barangaroo Central Site is the subject of this assessment. Environmental impact is currently present in isolated areas of the Barangaroo Project Site.

Surplus materials from the remainder of the Barangaroo Project Site will potentially be used as fill materials in the development of the Barangaroo Central Site. A range of industrial uses and associated filling activities have occurred across the Barangaroo Project Site. Most significantly a former gasworks operated within the southern portion. A range of environmental contaminants have been identified within soil and groundwater in the proximity of the former gasworks including heavy metals, petroleum hydrocarbons, MAHs, PAHs, cyanides and phenols. The highest levels of these constituents have generally been associated with observations of tar within soils and groundwater.

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5.3 Environmental Sampling and Analysis

Environmental sampling and analysis are a key factor in identifying the agents that may be present, their concentrations and distributions. Environmental sampling and analysis of materials are to be used as imported fill is required to be assessed to address the identified potential environmental hazards.

Environmental sampling and analysis has been detailed in previous investigations listed in **Section 3**. Across the area of the Barangaroo Project Site, where surplus soils are anticipated to be used as imported fill materials to create the proposed landform of Barangaroo Central, significantly elevated levels of heavy metals, petroleum hydrocarbons, MAHs, PAHs, cyanides and phenols have been reported in soils and/or groundwater, particularly associated with tar impacted materials identified in the proximity of the former gasworks.

5.4 Putting Hazards into their Environmental Health Context

Putting the hazards into their environmental context entails consideration of:

- Whether the hazard has single or multiple sources;
- Whether the type of environmental impact affects multiple environmental media;
- How stakeholders perceive the problem, including different groups of stakeholders; and
- How the hazards compare to other environmental hazards affecting the community.

The environmental hazards across the Barangaroo Project Site may have multiple sources arising from the former commercial / industrial processes undertaken (including operation of a gasworks) and the anticipated significant generation and potential on-site placement of waste materials / by-products. Human health risks associated with tar-based contaminants include potential dermal and oral contact with tar containing materials, and potential inhalation of volatile constituents of tars (i.e. benzene and naphthalene). These materials may also pose ecological impacts, particularly in locations where leaching of impact may enter waterways, or seep into sub-surface basements or soils used as a growing medium. The risk is greater where more sensitive site uses and longer exposure periods occur.

The risk assessment requires consideration of the redevelopment of Barangaroo Central into the Barangaroo Stage 1 Public Domain, and later development for high density residential and open space uses. The major human stakeholders identified for Barangaroo Central include recreational users of open space facilities and future residents of residential buildings and their basements.

As the environmental hazards present on the Barangaroo Project Site (which will potentially be present in imported soils to be used on Barangaroo Central) are related to commonly occurring commercial / industrial contaminants, including heavy metals, petroleum hydrocarbons, monocyclic and polycyclic hydrocarbons, which have previously been used widely throughout Australia, it can be demonstrated that the environmental hazard is not a unique hazard to the community. However, the presence of these contaminants in uncontrolled locations, potentially accessed by sensitive populations, may increase the exposure of the community and/or the environment to the environmental hazard.

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5.5 Identification of Potential Interactions between Agents

There may be interactions between the physical, chemical, biological and social hazards that require identification and consideration as part of a risk assessment. There are several potential types of interactions between hazardous agents which include: additive effects; synergistic effects; potentiation effects and antagonistic effects.

It is widely acknowledged that activities such as smoking can increase the susceptibility of a person to the potential effects of some carcinogens. To this effect, it is required that conservatively derived data and reasonably maximum exposed receptors are used as the basis for any risk assessment.

5.6 Why is Risk Assessment Needed?

The occurrence of environmental hazards in the sub-surface of a site is unique for every site and location. Further, the particular populations exposed to an environmental hazard will be unique for each occurrence of the environmental hazard. Regulatory authorities within NSW do not provide comprehensive guidance for environmental hazard assessment of the range of contaminants identified within the Barangaroo Project Site, where fill materials for Barangaroo Central may be sourced. The limited guidance available is considered unsuitable to be applied to the proposed Barangaroo Central development without additional justification.

The requirement, and/or the method, of remediation/management for an environmental hazard needs to be determined. The extent and need for this requirement must be determined by assessment of the presence of an environmental hazard; the degree of potential harm posed by the environmental hazard (in an isolated environment); and the likely exposure of the surrounding community and environment to the environmental hazard. Only through assessment of these factors can the true impact of the environmental hazard be determined.

The risk assessment process is designed to include all of these factors to determine a site specific requirement and associated acceptance criteria for a range of environmental constituents, which may be present in soils and/or sediments and/or seepage water and/or groundwater which will occur on the Site.

5.7 Limitations and Uncertainties

Potential limitations and uncertainties that may occur in the risk assessment process include:

- Information gaps, e.g. effects of mixtures, low level and variable exposures over time, relative contribution of 'lifestyle' factors;
- Poor exposure information, e.g. complex mixtures of hazards with complex behaviours in the environment, or limited knowledge about the actual or potential sub-population;
- Limitations of toxicological or epidemiological research, e.g. small populations and limited exposure information, multifactorial causes of many diseases on health impacts, 'background noise' affecting research into common diseases or symptoms, population heterogeneity;
- Complexity, e.g. large numbers of combinations of hazards, exposures and health states;
- Confidentiality of health and commercial information;

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- Charged atmosphere of fear, antagonism and distrust; and
- Value conflicts.

The risk assessment requires a thorough sensitivity analysis subsequent to the provision of the risk outcomes. The sensitivity analysis will be required to take these matters into account, testing the outcome of the risk assessment of reasonable upper and lower bounds of each assumption. Sensitivity analysis of all assumptions has been undertaken throughout the risk assessment. Risk assessment outcomes may be required to be modified where sensitive parameters are observed to have large reasonable potential distributions.

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6 Selection of Constituents of Potential Concern

Extensive soil and groundwater data have been collected from underlying the Barangaroo Project Site. Surplus soils may potentially be received from the Barangaroo Project Site and used in the development of Barangaroo Central. Where possible, existing soils will be retained for use on the site.

Soils received on the site and used to form the open space areas within Barangaroo Central may leach contaminants and impact the underlying groundwater, which is present at relatively shallow depths in the area of Barangaroo Central.

A screening assessment has been conducted to select constituents of potential concern (COPCs) so as to distinguish between chemical constituents that pose little or no risk to human health and those constituents that may pose a risk. The screening assessment has been undertaken by a comparison of measured constituent concentrations to adopted screening criteria. Constituent concentrations across the entirety of the Barangaroo Central and Stage 1 Development Site have been considered. All available soil data is summarised in **Appendix A**.

Where the maximum constituent concentration in soil at the Barangaroo Project Site does not exceed the screening criteria, it will be concluded with a high degree of confidence that those constituents will not pose a significant risk to human health. Constituents exceeding screening criteria are set as COPCs for further risk assessment.

6.1 Selection of Screening Criteria

Assessment criteria for sensitive land-uses are provided by regulatory authorities in Australia and internationally. While these assessment criteria are not strictly applicable to the exposure scenarios and occurrence of site impact within the study area, they can be used to select COPCs for further assessment. The published assessment criteria used include:

- Soil criteria published in NSW DEC (2006) '*Contaminated Sites: Guidelines for the NSW Site Auditor Scheme 2nd Edition*'. 'Standard Residential (NEHF A)' criteria have been used;
- Soil criteria published in NSW EPA (1994) '*Contaminated Sites: Guidelines for Assessing Service Station Sites*';
- US EPA (November 2011) '*Regional Screening Levels*'. Residential soil criteria have been used as these are the most conservative criteria provided in this document;
- The Dutch Intervention Level for soils and groundwater provided to Ministry of Housing, Spatial Planning and the Environment (2000) *'Circular on target and intervention values for soil remediation*'. Though the Netherlands is a signatory to the World Health Organisation, and WHO sources of toxicity data are preferred by enHealth and NEPC (1999), US EPA criteria have been preferred as these are found to be more recent. Dutch criteria have only been used for constituents where no other agency provides definitive guidance.

The criteria selected from the above sources are summarised in **Table 6.1** for each constituent recorded above detection limits in the analytical data sets.

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Table 6.1: Summary of Soil Screening Criteria (mg/kg)

Constituent	Human Health Based Criteria
Heavy metals	
Aluminum	77 000[6]
Arsenic	100[1]
Barium	15 000[6]
Beryllium	20[1]
Cadmium	20[1]
Chromium	100[1,2]
Cobalt	100[1]
Copper	1000[1]
Lead	300[1]
Manganese	1500[1]
Mercury	15[1]
Nickel	600[1]
Tin	47 000[6]
Vanadium	390[6]
Zinc	7 000[1]
Other Inorganics	
Sulphate	NC
Cyanide (total)	250[1, 3]
Total Petroleum Hydrocarbons	
TPH C_6-C_9	65[5]
TPH C_{10}-C_{14}	1000[5]
TPH C_{15}-C_{28}	
TPH C_{29}-C_{36}	
Monocyclic Aromatic Hydrocarbons	
Benzene	1[5]
Toluene	1.4[5]
Ethylbenzene	3.1[5]
Xylene (total)	14[5]
1,2,4-trimethylbenzene	62[6]
1,3,5-trimethylbenzene	780[6]
Styrene	6300[6]
Polycyclic Aromatic Hydrocarbons	
Total PAHs	20[1]
Acenaphthene	3400[6]
Acenaphthylene	3400[6, 9]
Anthracene	17 000[6]
Benz(a)anthracene	0.15[6]
Benzo(a)pyrene	1[1]
Benzo(b)fluoranthene	0.15[6]
Benzo(g,h,i)perylene	1[1, 8]
Benzo(k)fluoranthene	1.5[6]
Chrysene	15[6]
Dibenz(a,h)anthracene	0.015[6]
7,12-dimethylbenz(a)anthracene	0.00043[6]
Fluoranthene	2300[6]
Fluorene	2300[6]
Indeno(1,2,3-c,d)pyrene	0.15[6]
2-methylnaphthalene	310[6]
Naphthalene	3.6[6]
Phenanthrene	17 000[6, 10]
Pyrene	1700[6]
Other SVOCs	
Phenol	8 500[1]
2,4-dimethylphenol	1200[6]
2-methylphenol	5[4, 7]
3- & 4-methylphenol	
4-chloro-3-methylphenol	NC
1-naphthylamine	NC
Dialate	8
2-picoline	NC
3,3-dichlorobenzidine	1.1
4-(dimethylamino) azobenzene	5.1[6]
4-aminophenyl	0.023
Azobenzene	5.1
Carbazole	NC
Dibenzofuran	78[6]
n-propylbenzene	NC

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Constituent	Human Health Based Criteria
Isopropylbenzene	2100[6]
1,4-dichlorobenzene	2.4[6]

Notes: 1. DEC (2006) 'Standard Residential (NEHF A)' criteria
2. Value for Cr(VI)
3. Based on cyanides (free)
4. Netherlands Ministry for Housing, Spatial Planning and the Environment (2000) intervention value
5. NSW EPA (1994)
6. US EPA (November 2011) Residential Soil Screening Level
7. Criteria for sum of cresols
8. Benzo(a)pyrene criteria used as a surrogate
9. Acenaphthene criteria used as a surrogate
10. Anthracene criteria used as a surrogate
NC no criteria

6.2 Selection of COPCs in Soils

Environmental data for the Barangaroo Project Site have been reviewed and the maximum concentration of each constituent determined. All available soil data for Barangaroo Central and Stage 1 Development Sites has been used as the basis for the selection of COPCs. The soil data set is summarised in **Appendix A**.

It is noted that on the basis of the total PAH criteria, as published by Australian jurisdictions, that all PAH constituents are required to be selected as COPCs in soils.

Maximum concentrations have been compared to the screening criteria and selected as a COPC where the screening criteria are exceeded, as summarised in **Table 6.2**, following.

Table 6.2: Summary of Selection of COPCs for Soils

Constituent	Maximum Concentration (mg/kg)	COPC Selection
		Human Health (soils)
Heavy Metals		
Arsenic	450	X
Barium	690	
Beryllium	4	
Cadmium	5	
Chromium	309	X
Cobalt	39	
Copper	1410	X
Lead	12 100	X
Manganese	864	
Mercury	16	
Nickel	164	
Tin	12	
Vanadium	248	
Zinc	4770	
Other Inorganics		
Sulphate	31 500	
Cyanide (total)	575	X
Total Petroleum Hydrocarbons		
TPH C_6-C_9	2 640	X
TPH C_{10}-C_{14}	54 200	X
TPH C_{15}-C_{28}	72 400	X
TPH C_{29}-C_{36}	20 600	X
Monocyclic Aromatic Hydrocarbons		
Benzene	300	X
Toluene	346	X
Ethylbenzene	88.3	X
Xylene (total)	660	X
1,2,4-trimethylbenzene	92.9	X
1,3,5-trimethylbenzene	31.2	X
Styrene	21.4	
Polycyclic Aromatic Hydrocarbons		
Acenaphthene	273	X[1]
Acenaphthylene	1000	X[1]
Anthracene	1200	X[1]
Benz(a)anthracene	912	X
Benzo(a)pyrene	652	X

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Constituent	Maximum Concentration (mg/kg)	COPC Selection
		Human Health (soils)
Benzo(b)fluoranthene	824	X
Benzo(g,h,i)perylene	305	X[1]
Benzo(k)fluoranthene	324	X
Chrysene	631	X
Dibenz(a,h)anthracene	72.5	X
7,12-dimethylbenz(a)anthracene	98.4	
Fluoranthene	2 130	X[1]
Fluorene	1 290	X[1]
Indeno(1,2,3-c,d)pyrene	247	X
2-methylnaphthalene	967	X
Naphthalene	8 410	X
Phenanthrene	3 130	X[1]
Pyrene	1 670	X[1]
Other SVOCs		
Phenol	1720	
2,4-dimethylphenol	754	
2-methylphenol	1160	X
3- & 4-methylphenol	2290	X
4-chloro-3-methylphenol	1.3	
1-naphthylamine	1.4	
Dialate	1.6	
2-picoline	0.9	
3,3-dichlorobenzidine	1.6	
4-(dimethylamino) azobenzene	1.3	
4-aminobiphenyl	1.2	
Azobenzene	1	
Carbazole	186	
Dibenzofuran	327	X
n-propylbenzene	4.9	
Isopropylbenzene	7.3	
1,4-dichlorobenzene	0.7	

Note: 1. Selected on the basis of Total PAHs exceeding the screening criteria

Mercury has not been selected as a COPC as only one sample recorded a concentration which marginally exceeding the adopted human health based screening criteria. The elevated level of impact occurred with elevated levels of other PAH and heavy metal constituents, and assessment of these constituents is therefore considered to be protective of potential human health impact of coincident slightly elevated levels of mercury.

1,2,4 and 1,3,5 trimethylbenzene have been assessed as total trimethylbenzene, even though only 1,2,4 trimethylbenzene has exceeded the screening criteria. This is protective of potentially malodorous impacts of low levels of trimethylbenzenes.

US EPA priority PAHs, and 2-methylnaphthalene, have been selected for the assessment of PAHs. 7,12-dimethylbenzanthracene has not been selected as a COPC as very limited information is available for this constituent. On the basis of the available data, this constituent occurs concurrently with other PAHs. As criteria for the priority PAHs and 2-methylnaphthalene have been derived, the potential effects of other PAHs will be addressed.

It is noted that no screening criteria were available for carbazole, 4-chloro-3-methylphenol, 1-naphthylamine, 2-picoline and n-propylbenzene. 3,3-dichlorobenzidine and 4-aminobiphenyl have been found to slightly exceed the adopted screening criteria based on limited data sets. These constituents have not been selected as COPCs, and are considered to be adequately addressed by the criteria derived for other contaminants. It is noted that all priority PAH constituents have been selected for further risk assessment.

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Each of the constituents has been found to be relatively non volatile, and therefore are not anticipated to pose a significant inhalation risk. Very conservative criteria will be derived for a range of constituents for accessible soils.

Each of the constituents is further found to be a relatively heavy compound and not readily leachable. Assessment of potential leachability impacts of other constituents are anticipated to be protective of the potential seepage water impacts of these constituents to basement occupants.

Asbestos has been additionally selected as a COPC for soils based on DEC (2006) guidance instructing that asbestos requires specific risk assessment on a site by site basis; and detections of asbestos containing materials on-site in previous investigations. Ammonia (as N) has also been selected as a COPC in soils, because despite there being no health based soil criteria, ammonia presents a potential aesthetic risk and will need to be assessed for potential odours.

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7 Toxicological Review

There are two elements to the toxicological review for the human health risk assessment: hazard identification (using toxicological studies); and dose-response assessment. The Australian approach to each is discussed in detail following.

7.1 Hazard Identification

Hazard identification examines the capacity of an agent to cause adverse health effects in humans and other animals.

Hazard identification uses:

- Animal data. These are usually assessed by toxicological methods;
- Human data. These are usually assessed by epidemiological methods when groups of people are involved, or by toxicological methods when using case studies and acute chamber studies; and
- Other data. These include structure data such as structure activity data or in vitro data assessed by toxicologists.

Hazard identification mostly relies on the results of in vitro toxicity studies conducted according to standard protocols (e.g. OECD Test Guidelines). The following types of studies are defined:

- Acute toxicity studies are studies which investigate the effects of single doses of a substance. The standard acute toxicity studies include tests for: acute, oral, dermal and inhalational toxicity; eye irritation; skin irritation; and skin sensitisation;
- Sub-chronic toxicity studies are short term repeat-dose studies. The main purpose of sub-chronic testing is to identify any target organs and to establish dose levels for chronic exposure studies;
- Chronic toxicity studies, or long-term studies, are defined as studies lasting for the greater part of the lifespan of the test animals. The protocol for these studies may cover the investigation of chronic toxicity or carcinogenicity, or both;
- Reproductive toxicity studies are studies designed to provide general information about the effects of a test substance on reproductive performance in both male and female animals;
- Developmental toxicity studies are studies which examine the spectrum of possible in-utero outcomes for the conceptus, including death, malformations, functional deficits and developmental delays; and
- Genotoxicity studies are designed to determine whether test chemicals can perturb genetic material to cause gene or chromosomal mutations.

The essential purpose of toxicity studies is the detection of valid biological evidence of the hazard potential of the substance being investigated. The evaluation of the weight of evidence from toxicity studies is by a process which considers the cumulative data pertinent to arriving at a level of concern about the potential adverse effects of a substance. In assessing toxicological studies and hazard analysis, judgement and supporting rationale are provided for:

- The acceptability of the study and its database;

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- The existence of biologically important adverse effects;
- The relevance of any factors noted during the evaluation which might have had some bearing on the outcomes of the study and modified the findings in some way; and
- The likelihood that any of the observed effects were induced by the administered substance.

Toxicology assessments are often complemented with epidemiological studies in hazard assessment. Epidemiology is the direct human evidence component of the assessment. Epidemiological studies are used to investigate the cause of adverse health effects; the natural history of health conditions; the description of the health status of populations; to evaluate the health status of populations; and to evaluate health related interventions.

7.2 Dose-Response Assessment

The dose-response assessment examines the quantitative relationships between exposure and the effects of concern. There are different ways of characterising dose-response relationships including:

- Effect levels (e.g. LD_{50}, LC_{50}, ED_{10}) and no observed adverse effect levels (NOAELs);
- Margins of safety;
- Therapeutic indices; and
- Models to interpolate high dose experimental data to the low doses likely to be experienced in the environment.

There are often limited human exposure data, and animal bio-assay data are most often used for dose-response assessment. The use of these data requires extrapolations from animals to humans and interpolations from high doses to low doses.

Dose-response assessments and calculations are generally undertaken by either of a threshold approach or a non-threshold approach. Each is described in further detail following.

7.3 Threshold Approaches

A threshold is considered to occur because of biological mechanisms such as the ability to metabolise or excrete a toxin to repair damage up to a certain dose.

The approach with these models is to derive exposure limits such as an allowable daily intake (ADI), Tolerable Daily Intake (TDI) or reference dose (R*f*D). This approach makes no attempt to calculate a level of risk at low exposures. Rather, it derives a dose which is apparently without effect in a human or suitable animal model population, and then applies a factor to derive an exposure which has a high likelihood that no effect will occur in the general human population.

These exposure limits are derived by first determining the No Observed Adverse Effect Level (NOAEL) or, if the NOAEL cannot be determined, the Lowest Observed Adverse Effect Level (LOAEL) and dividing the value by factors to account for:

- Interspecies differences (extrapolating from animals to humans);
- Intraspecies differences (differing sensitivities between individuals);
- The severity of the adverse effect; and

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- The quantity and quality of the scientific data.

Traditionally, safety factors for intraspecies and interspecies differences have each been assigned values of ten, and the other two have been assigned values between one and ten. An additional factor of ten is sometimes used if the NOAEL was not established in the study. The individual factors are then multiplied to determine an overall safety factor by which the NOAEL is divided to give the ADI, TDI or R*f*D.

Historically, the most common overall factor used by a number of regulatory bodies is 100, if a large toxicological database has been assessed, although the overall factor can range from 10 to 10,000. From the data available on humans and experimental animals, it appears that interspecies and intraspecies differences are in general less than 10; hence the often used safety factor of 100 for these two factors is highly conservative and adequately protective of public health.

7.4 Non-Threshold Approaches

These approaches do not recognise the possibility of a threshold effect and are appropriate for radiation and some genotoxic carcinogens. As a science policy decision, a threshold approach is applied to all carcinogens by the US EPA.

Non-threshold models assume linearity between the lowest experimentally derived dose and the zero dose (the origin). This implies that there is a calculable probability of an adverse effect (risk) no matter how small the dose. This does not mean that there is no dose that could be considered safe unless safety must be equated with zero risk.

Numerical estimates of risk probabilities are generated by fitting one or more mathematical models to the data in the experimental dose range and extrapolating to the low environmental exposure doses. For example, low-dose extrapolation using a linear model is a default approach for cancer risk assessment in the USA and has been used by the WHO for genotoxic carcinogens in deriving water quality guidelines.

The outcomes are estimates of either:

- The dose at a predetermined acceptable risk level (note that this requires some judgement on what constitutes an acceptable level of risk); or
- The estimated risk level at any particular dose.

It has been recognised by IARC and other European based agencies that not all carcinogens have genotoxicity as their prime mode of action. The dose-response curve is assumed to be non-threshold for genotoxic carcinogens and threshold for non-genotoxic carcinogens. Accordingly, the Australian approach is to apply non-threshold and threshold models to genotoxic and non-genotoxic carcinogens.

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7.5 Sources of Toxicological and Tolerable Intake Data

Enhealth (2002) provides advice as to the quality of toxicological data that is available to be used in risk assessments. Data is categorised as Level 1, 2 or 3 data. Level 1 sources are recommended as the preferred sources of chemical data. Level 1 sources, in the order of preference for which they are recommended to be used, include:

1. National Health and Medical Research Council documents and documents from other joint Commonwealth, State and Territory Health organisations. These may be a source of Australian guidance values. Publications prepared by the former Australian and New Zealand Environmental and Conservation Council are considered a suitable Commonwealth source to be included here;
2. ADI list from the Therapeutic Goods Administration;
3. World Health Organisation (WHO) documents. Australia is a party to the WHO process and has incorporated their material in a variety of environmental health criteria. A range of documents include those from the WHO/ILO/UNEP International Programme on Chemical Safety (IPCS) which produces Environmental Health Criteria monographs and Concise International Chemical Assessment documents (CICADs). Documents detailing international Acceptable Daily Intakes (ADI's), Tolerable Daily Intakes (TDI) or Tolerable Weekly Intakes (TWI) may be found in evaluations by the WHO/FAO Joint Meeting on Pesticide Residues (JMPR) and by the Joint FAO/WHO Expert Committee on Food Additives (JECFA);
4. enHealth Council documents;
5. National Environmental Health Forum documents distributed by the Commonwealth Department of Health and Ageing;
6. International Agency for Research on Cancer (IARC) Monographs;
7. WHO/FAO Joint Meeting on Pesticide Residues (JMPR) Monographs;
8. NICNAS Priority Existing Chemical (PEC) reports;
9. US Agency for Toxic Substances and Disease Registry (ATSDR) documents for general toxicological reviews and Reference Doses;
10. National Toxicology Program (NTP) carcinogenicity appraisals which report in detail the results of carcinogenicity tests on a wide range of chemicals;
11. OECD Standard Information Data Sets (SIDS) and SIDS Initial Assessment Reports (SIAR); and
12. US EPA Reference Doses.

Where a rare substance is being assessed, or insufficient data are available within Level 1 sources, then Level 2 sources may require research. Level 2 sources include:

1. European Centre of Ecotoxicology and Toxicology of Chemicals (ECETOC): Monographs, JACC reports and Technical Reports;
2. Chemical Institute of Toxicology (CIIT) reports; and
3. Unpublished industry reports submitted for regulatory purposes. These may have restricted availability but information may be available in evaluation reports from regulatory agencies that have reviewed individual reports.

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Level 2 sources may also include peer-reviewed journals.

7.6 Review of Published Hazard Data

Available toxicological, epidemiological studies and dose-response studies have been reviewed for each of the COPC's (identified in **Section 6**) by the protocols established in **Section 7.5**. Consequently, citing the authority of the Level 1 agencies, there has been no requirement in this risk assessment to further review and comment upon the hazard studies reviewed by each organisation, or those that may be available elsewhere that are not endorsed by these organisations.

Instead, the pertinent toxicological effects identified for each of the COPC's by the Level 1 agencies has been reviewed and summarised for each identified COPC. Risk / hazard factors and guideline values have also been identified from these sources. The most current guidance only has been referenced for each of the sources. It is noted that some agencies have removed historical assessments of some chemicals in most recent guidance.

A brief summary of the toxicological endpoints of each of the identified COPCs is provided in the following sections. The summaries have been generated by a review of the available data held by the Level 1 agencies. Level 2 sources have been reviewed in some cases where no Level 1 data are available, or where recommended in the case of the assessment of PAHs by DECCW officers.

7.6.1 Arsenic

Arsenic has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for arsenic has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.1**.

Table 7.1: Summary of Published Level 1 Hazard Data for Arsenic

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Arsenic in Drinking Water' WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 6.1)
enHealth	YES	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	No	enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	YES	IARC Monographs (1987)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (August 2007) 'Toxicological Profile for Arsenic'
NTP	YES	US Department of Health and Human Services (2009) '11th Report on Carcinogens'
OECD SIDS SIAR	No	
EPA	YES	IRIS database (1998)

NHMRC

NHMRC/NRMMC (2011) recommends the use of a maximum tolerable daily intake (TDI) for arsenic of 0.002mg/kg body weight per day as based on the WHO (1998) guideline value. It is reported that the WHO data were based on the estimated additional lifetime risk of six skin cancers per 10 000 people.

It is estimated in NHMRC/NRMMC (2011) that the average Australia adult dietary intake of arsenic is approximately 0.04mg/day.

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WHO

Arsenic in drinking water is noted to be classified by IARC as a carcinogen. The guideline value by WHO (2003), of 10µg/l is reported to be based on the maximum likelihood estimates, using linear extrapolation, for bladder and lung cancer for US populations exposed to 10µg of arsenic per litre in drinking water of 12 and 18 per 10 000 population for females and 23 and 14 per 10 000 population for males. It is also reported to be based on the practical quantification limit for arsenic and extent to which arsenic can be removed from drinking water.

Arsenic is classified as a human carcinogen in WHO (2000). Risk estimates have been derived from studies in exposed human populations in the United States and Sweden. At an air concentration of 1µg/m^3 an estimate of lifetime risk of $1.5*10^{-3}$ is reported.

enHealth

enHealth (2001) reports a WHO provisional tolerable weekly intake (PTWI) of 0.015mg/kg/week for arsenic. It is reported that there is a narrow margin between the WHO PTWI and intakes reported to have toxic effects in other studies. It is reported that dietary exposure of children could account for 50% of the PWTI.

IARC

Arsenic and arsenic compounds are classified by the IARC as a Group 1 carcinogen.

ATSDR

ATSDR reports that no minimal risk level (MRL) has been derived for exposure to inorganic arsenic by inhalation.

An oral MRL of 0.005 mg As/kg/day has been derived for acute-duration (14 days or less) oral exposure to inorganic arsenic. This is based on an assessment of poisoning cases associated with an episode of arsenic contamination of soy sauce in Japan. The MRL is reported to have been derived on the basis of an LOAEL of 0.05 mg As/kg/day with an uncertainty factor of 10.

An MRL of 0.0003 mg As/kg/day has been derived for chronic-duration (365 days or more) oral exposure to inorganic arsenic. This is reported to have been on the incidence of Blackfoot Disease and dermal lesions (hyperkeratosis and hyperpigmentation) in a large number of poor farmers (both male and female) exposed to high levels of arsenic in well water in Taiwan. The MRL is derived by applying an uncertainty factor of 3 (for human variability) to the NOAEL of 0.0008 mg/kg/day.

NTP

NTP reports that inorganic arsenic compounds are known to be human carcinogens based on sufficient evidence of carcinogenicity in humans. Epidemiological studies and case reports of humans exposed to arsenic compounds for medical treatment, in drinking water, or occupationally have demonstrated that exposure to inorganic arsenic compounds increases the risk of cancer. Cancer tissue sites include the skin, lung, digestive tract, liver, bladder, kidney, and lymphatic and hematopoietic systems (organs and tissues involved in production of blood).

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US EPA

Arsenic is classified as a human carcinogen (Classification A) by the US EPA based on increased lung cancer mortality observed in multiple human populations exposed primarily through inhalation. Increased mortality from multiple internal organ cancers (liver, kidney, lung, and bladder) and an increased incidence of skin cancer were observed in populations consuming drinking water high in inorganic arsenic.

An oral slope factor of 1.5 per (mg/kg)/day is provided by the US EPA on the basis of studies of persons exposed to arsenic in drinking water.

An oral RfD of $3*10^{-4}$ mg/kg/day is provided for arsenic on the basis of studies of effects and dose-response relationships of skin cancer and blackfoot disease with arsenic and the prevalence of skin cancer in an endemic area of chronic arsenicism in Taiwan. The RfD has been based on the lowest of the report NOAELs with an uncertainty factor of 3 to account for lack of data to preclude reproductive toxicity and sensitive individuals.

An inhalation unit risk of $4.3*10^{-3}$ $(\mu g/m^3)^{-1}$ is provided by US EPA on the basis of studies of lung cancers in male humans occupationally exposed by inhalation. The unit risk is the geometric mean of the unit risk derived in several studies.

Level 2 Sources

It is noted that the US EPA (November 2010) 'Regional Screening Levels' adopt a Californian EPA health based RfC of $1.5*10^{-5}mg/m^3$ for assessment of inhalation exposure to arsenic.

7.6.2 Chromium

Chromium has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for chromium has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.2**.

Table 7.2: Summary of Published Level 1 Hazard Data for Chromium

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Chromium in Drinking Water' WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 6.4)
enHealth	YES	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	No	enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	YES	IARC Monographs (1990)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (February 2009) 'Draft Toxicological Profile for Chromium'
NTP	YES	US Department of Health and Human Services (2009) '11th Report on Carcinogens'
OECD SIDS SIAR	No	
EPA	YES	Iris Database (1998)

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NHRMC

NHMRC/NRMMC (2011) reports that the chromium drinking water guideline has been adopted from the WHO guideline.

NHMRC/NRMMC (2011) reports that total concentrations of chromium in Australian drinking water are usually less than 0.005mg/l.

WHO

WHO (2003) reports that IARC has classified Cr(VI) in Group 1 (carcinogenic to humans) and metallic chromium and Cr(III) in Group 3 (not classifiable as to their carcinogenicity to humans). A guideline value has been derived for total chromium. It is reported that the criteria for chromium has been set at 0.05mg/l as a practical measure. This is considered to be unlikely to give rise to significant risks to health.

WHO (2000) reports that only hexavalent chromium is carcinogenic in humans by inhalation. An air concentration of Cr(VI) of 1µg/m^3 is reported to cause a lifetime risk of $4*10^{-2}$. This is based on studies of lung cancer occurrence in occupationally exposed workers.

enHealth

enHealth (2001) reports the US EPA chronic RfD for Cr(III) as being 1mg/kg/day as based on a NOAEL of 1.46mg/kg/day from a chronic feeding study in rats.

It is reported that Cr(VI) assessment has been undertaken on the basis of a skin sensitivity study. It is further reported that the inhalation exposure route to chromium is relatively unimportant in comparison to the oral and dermal pathways.

IARC

Cr(VI) is classified by the IARC as a Group 1 carcinogen. Cr(III) is classified as a Group 3 chemical, not classifiable as to its carcinogenicity to humans.

ATSDR

An intermediate duration inhalation exposure MRL of $5*10^{-6}$ mg Cr(VI)/m^3 is derived for exposure to dissolved hexavalent chromium aerosols and mists. The primary respiratory effects of inhaled chromic acid mists are observed in the nose, while the effects of inhaled particulate Cr(VI) compounds occur throughout the respiratory tract. Upper respiratory effects include nasal irritation, ulceration, and mucosal atrophy and rhinorrhea. The MRL was derived from a benchmark concentration estimated for alterations in lactate dehydrogenase levels in BAL fluid with division by an uncertainty factor of 30 to account for extrapolation from humans to animals and human variability.

An intermediate duration inhalation exposure MRL of 0.005mg Cr(III)/m^3 was derived for exposure to insoluble trivalent chromium particulate compounds. This was based on septal cell hyperplasia and chronic interstitial inflammation of the lung in male rats. A human equivalent LOAEL derived from this study was divided by an uncertainty factor of 90 to account for use of a minimal LOAEL, extrapolation from animals to humans and human variability.

An intermediate duration inhalation exposure MRL of 0.0003mg Cr(VI)/m^3 was derived for exposure to hexavalent chromium particulate compounds. This is based on an LOAEL of rats which showed adverse respiratory effects including obstructive respiratory dyspnea, increased lung weights, hyperplasia of the lung, focal inflammation of the upper airway, and alterations to BAL fluid concentrations of lactate dehydrogenase, protein, and

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albumin. A benchmark dose has been derived from the LOAEL and divided by a factor of 30 to account for extrapolation from humans to animals and human variability.

A chronic duration inhalation exposure MRL of $5*10^{-6}$ mg Cr(VI)/m^3 is derived for exposure to dissolved hexavalent chromium aerosols and mists. This is based on an LOAEL value derived for respiratory, renal and gastrointestinal effects in workers divided by an uncertainty factor of 100 to account for human variability and extrapolation from a LOAEL. It is reported that no chronic inhalation MRL is available for chromium particulates.

An intermediate duration oral exposure MRL of 0.005mg Cr(VI)/kg/day has been reported by ATSDR. This was derived on the basis of hematological effects (microcytic, hypochromic anemia) in male rats observed after exposure for 22 days. A benchmark dose was derived from this study and divided by an uncertainty factor of 100 to account for extrapolation from animals to humans and human variability.

A chronic duration oral MRL of 0.001mg Cr(VI)/kg/day has been reported by ASTDR. This was based on the occurrence of nonneoplastic lesions of the duodenum observed in mice in a chronic drinking water. A benchmark dose was derived from this study and divided by an uncertainty factor of 100 to account for extrapolation from humans to animals and human variability.

No acute, intermediate, or chronic duration oral MRLs were derived by ATSDR for Cr(III) because studies evaluating the effects of Cr(III) in humans and animals following acute, intermediate, and chronic oral exposure were considered to be inadequate for establishing the exposure concentrations associated with adverse health effects.

NTP

NTP reports that chromium hexavalent Cr(VI) compounds are known to be human carcinogens based on sufficient evidence of carcinogenicity in humans. Epidemiological studies in various geographical locations have consistently reported increased risks of lung cancer among workers engaged in chromate production, chromate pigment production, and chromium plating.

US EPA

The US EPA classifies Cr(VI) as a known human carcinogen by the inhalation route of exposure. It is reported that carcinogenicity by the oral route of exposure cannot be determined.

An inhalation unit risk of $1.2*10^{-2}$ $(\mu g/m^3)^{-1}$ is provided by US EPA on the basis of the occupational studies of the occurrence of lung cancers in humans exposed by inhalation.

An Oral RfD of $3*10^{-3}$ mg/kg-day is provided for Cr(VI) on the basis of a NOAEL derived by a study of rats exposed to chromium through drinking water. Levels of chromium in tissues were found to increase with increasing exposure to chromium. The oral RfD was derived by applying an uncertainty factor of 300 to the NOAEL to account for interspecies, intraspecies variability and less than lifetime exposure duration of the supporting study.

An inhalation RfC of $8*10^{-6}$ mg/m^3 for exposure to chromic acid mists and dissolved aerosols and an inhalation RfC of $1*10^{-4}$ mg/m^3 for exposure to particulates have been reported by the US EPA. These RfC's are based on studies reporting nasal mucosal irritation, atrophy, and perforation following occupational exposures to chromic acid mists and dissolved hexavalent chromium aerosols. The particulates RfC has also considered lower respiratory effects following inhalation of Cr(VI) particulates in rats including obstructive respiratory dyspnea and reduced body weight.

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The mist and aerosols RfC has been based on a LOAEL with an uncertainty factor of 90. The particulates RfC is based on a benchmark dose with an uncertainty factor of 300.

7.6.3 Copper

Copper has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for copper has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.3**.

Table 7.3: Summary of Published Level 1 Hazard Data for Copper

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2004) 'Copper in Drinking Water'
enHealth	YES	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	No	enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	YES	IARC Monographs (2002)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (September 2004) 'Toxicological Profile for Copper'
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	IRIS data base (1991)

NHMRC

NHMRC/NRMMC (2011) has recommended a daily intake of 0.5mg/kg body weight per day of copper as based on a maximum tolerable daily intake for humans.

NHMRC/NRMMC (2011) reports that absorption of copper by the gastrointestinal tract is in the range of 25–60%, depending on a number of factors, including copper speciation and copper dietary status. Many cases of copper poisoning have been reported, including cases involving the poisoning of children who had their food prepared in copper or brass pots. Copper poisoning has resulted in cirrhosis of the liver and, in extreme cases, death. Other less severe symptoms associated with the consumption of water containing 3-5 mg/L copper (but not 1 mg/L) are gastrointestinal symptoms such as nausea, abdominal pain and vomiting. Infants are thought to be most susceptible, though in one study of 3-month-old infants given water containing 2 mg/L copper over 9 months there were no acute or chronic adverse consequences. In the genetic disorders Wilson's disease and idiopathic copper toxicosis, sufferers are particularly susceptible to copper.

Apart from humans, sheep have been reported to be the most susceptible animals to the toxic effects of copper, with a daily intake of 1-2 mg/kg body weight resulting in serious illness and death.

Copper is not reported to be carcinogenic.

WHO

WHO (2004) reports that that the upper limit of the acceptable range of oral intake in adults is uncertain but is most likely in the range of several (more than 2 or 3) but not many milligrams per day in adults. This evaluation was based solely on studies of gastrointestinal effects of copper-contaminated drinking-water.

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enHealth

enHealth (2001) reports that young children especially those younger than one year, are the most sensitive groups to copper toxicity. It is reported that a NOAEL is not available for copper. It is recommended that a long-term intake of 0.17 mg/kg bw/day of copper is considered as a safe level.

IARC

IARC has not classified copper as a carcinogen (Group 3).

ATSDR

ATSDR has derived acute and intermediate-duration oral MRLs for copper. The acute duration oral MRL of 0.01 mg copper/kg/day is reported to be based on the occurrence of gastrointestinal disturbances in women ingesting 0.0731 mg Cu/kg/day in drinking water for 2 weeks; no adverse effects were observed at a drinking water dose of 0.0272 mg Cu/kg/day. To calculate an MRL, the NOAEL of 0.0272 mg Cu/kg/day was divided by an uncertainty factor of 3 to account for human variability.

An intermediate-duration oral MRL of 0.01 mg copper/kg/day was derived for copper based on the occurrence of gastrointestinal disturbances in men and women ingesting 0.091 mg Cu/kg/day in drinking water for 2 months; no adverse effects were observed at a drinking water dose of 0.042 mg Cu/kg/day. To calculate an MRL, the NOAEL of 0.042 mg Cu/kg/day was divided by an uncertainty factor of 3 to account for human variability.

US EPA

The US EPA has classified copper as not classifiable as to human carcinogenicity. No data is provided on toxicological values to be used for inhalation or oral exposure to copper.

7.6.4 Lead

Lead has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for lead has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.4**.

Table 7.4: Summary of Published Level 1 Hazard Data for Lead

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Lead in Drinking Water' WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 6.7)
enHealth	YES	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	No	enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	YES	IARC Monographs (1987 and 2006)
WHO/FAO JMPR	No	
NICNAS PEC	YES	NICNAS (September 2007) 'Lead Compounds in Industrial Surface Coatings & Inks'
ATSDR	YES	ATSDR (August 2007) 'Toxicological Profile for Lead'
NTP	YES	US Department of Health and Human Services (2009) '11th Report on Carcinogens'
OECD SIDS SIAR	No	
EPA	YES	IRIS data base (2004)

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NHMRC

NHMRC/NRMMC (2011) has recommended a daily intake of 0.0035mg/kg body weight per day of lead as based on a level which has been demonstrated to not result in an increase in lead retention in metabolic studies with infants. The recommended daily intake is reported to have been based on a WHO value.

NHMRC/NRMMC (2011) estimates that average Australian adult dietary intake of lead to be approximately 0.1mg/day. It is estimated that approximately 80% of the daily intake of lead is from the ingestion of food, dirt and dust.

WHO

It is reported in WHO (2003) that the evidence for the carcinogenicity of lead in humans is inconclusive because of the limited number of studies, the small cohort sizes, and the failure to take adequate account of potential confounding variables. However, an association has been demonstrated experimentally between the ingestion of lead salts and renal tumours. However as there is evidence from human studies that adverse effects other than cancer may occur at very low lead levels, the WHO drinking water guideline has been derived using the TDI approach.

The WHO (2003) drinking water guideline is based on a provisional tolerable weekly intake (PTWI) of 25 µg of lead per kg of body weight (equivalent to 3.5 µg/kg of body weight per day) for infants and children which took account of the fact that lead is a cumulative poison so that any increase in the body burden of lead should be avoided.

WHO (2000) reports that the guideline for lead in air has been based on the concentration of lead in blood. Critical effects in adults include elevation of free erythrocyte protoporphyrin. For children, cognitive deficit, hearing impairment and disturbed vitamin D metabolism are taken as the decisive effects. The guideline is based on a critical level in blood of 100µg/l, based on a child exposure. It is recommended that an annual average lead level in air should not exceed 0.5µg/m^3.

enHealth

enHealth (2001) describes the adopted approaches for assessing lead being the assessment for potential impacts to children by the use of a WHO PTWI of 25µg/kg/week. It was also noted that background exposures may contribute approximately 50% of the PWTI.

IARC

IARC classifies lead compounds as Group 2A chemicals, probably carcinogenic to humans. IARC classified lead as a Group 2B chemical, possibly carcinogenic to humans.

IARC (2006) notes that lead potentially has reduced bioavailability subsequent to exposure. A range of bioavailabilities are presented based on the chemical form of lead (i.e. lead sulphide, lead oxide, lead acetate etc) and the exposure pathway. Based on the range of bioavailabilities presented, it is considered that a bioavailability of 50% (from soil, dust, food and water) is most likely suitably conservative.

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NICNAS

Lead and inorganic lead compounds are reported to have diverse effects on multiple body systems including neurological, gastrointestinal, reproductive and cardiovascular systems.

Few data were reported to be available from acute exposure in humans to lead. Most data was derived from cases of accidental or intentional ingestion of dirt containing lead or lead-based paint. High acute exposure had resulted in encephalopathy, gasterointestinal and renal effects.

It was reported that lead had been shown in animals to produce a variety of cardiovascular effects. The endpoint of greatest concern to humans was possible changes in blood pressure. Although there have been numerous epidemiological studies examining the effect of low concentrations of lead on blood pressure (amongst other endpoints) no causal relationship is reported to have been demonstrated between blood pressure and low blood lead concentration in humans.

The most important confirmed effects of long term exposure to lead were reported to be neurological, including encephalopathy and neurobehavioural changes. Neurological effects were reported to be particularly important in the foetus and in children. Lead was reported to be a known developmental toxicant in humans. Blood lead levels greater than 10 µg/dL can result in a decline in IQ and neurobehavioural deficits. Peripheral neuropathy has been observed in children at blood levels between 60 and 130µg/dL

The report recommended that lead not be used in industrial coatings.

ATSDR

ATSDR reports that MRLs were not derived for lead because a clear threshold for some of the more sensitive effects in humans has not been identified and data suggest that certain subtle neurobehavioral effects in children may occur at very low lead blood levels.

It is reported that blood levels as low as <10µg/dL can cause depressed aminolevulinic acid dehydratase (i.e. anemia). A range of other effects are reported at higher concentrations.

NTP

NTP reports that lead and lead compounds are reasonably anticipated to be human carcinogens based on limited evidence from studies in humans and sufficient evidence from studies in experimental animals. Lead exposure has been associated with increased risk of lung, stomach, and bladder cancer in diverse human populations. The strongest epidemiological evidence is reported to be for lung and stomach cancer, which are consistently but weakly associated with occupations and industries entailing lead exposure and with indices of individual lead exposure, including job history and biological monitoring of occupationally exposed and general populations.

US EPA

The US EPA has classified lead as a probable human carcinogen (Class B2) on the basis of ten rat bioassays and one mouse assay that have shown statistically significant increases in renal tumors with dietary and subcutaneous exposure to several soluble lead salts. Short term studies are also reported to show that lead affects gene expression. Human evidence is described as being inadequate.

US EPA further reports that health effects associated with exposure to inorganic lead and compounds include, but are not limited to, neurotoxicity, developmental delays, hypertension, impaired hearing acuity, impaired hemoglobin synthesis, and male

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reproductive impairment. Lead is reported to have particularly significant effects in children, well before the usual term of chronic exposure can take place.

US EPA does not provide an oral RfD for lead on the basis that some of the effects of lead exposure, particularly changes in the levels of certain blood enzymes and in aspects of children's neurobehavioral development, may occur at blood lead levels so low as to be essentially without a threshold.

An RfC is not provided for lead for the same reason.

7.6.5 Ammonia (as N)

Ammonia (as N) has been selected as a COPC for the assessment of potential aesthetic and human health impacts. A brief summary of the toxicological data available for ammonia has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.5**.

Table 7.5: Summary of Published Level 1 Hazard Data for Ammonia

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Ammonia in Drinking Water'
enHealth	No	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	No	enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	No	
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (September 2004) 'Toxicological Profile for Ammonia'
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	IRIS database (1991)

NHMRC

NHMRC / NRMMC (2004) provide a guideline value for ammonia based on aesthetic considerations only. The aesthetic guideline of 0.5mg/l is based on likelihood of corrosion to copper pipes and fittings. No health based guideline is provided as it is concluded that ammonia is unlikely to occur in drinking water supplies at levels that may cause health effects.

Ammonia is reported to have a toxic effect where the detoxification capacity of the body is exceeded. This is reported to occur at a dose above 32mg ammonium per kg body weight.

WHO

WHO (2003) states that ammonia is not of direct importance for health in the concentrations expected in drinking water. It is reported that the ammonium can have a toxic effect where the intake becomes higher than the capacity to detoxify, which is reported to occur at a dose above 33.7mg ammonium per kg body weight.

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ATSDR

ATSDR provides an MRL of 1.7ppm for the acute duration inhalation exposure to ammonia. The MRL is reported to be based on the LOAEL of 50ppm base don mild irritation in exposed humans.

An MRL of 0.1ppm is provided for chronic duration inhalation exposure to ammonia. The MRL is reported to be based on an a NOAEL of 9.2ppm for the sense of smell and prevalence of respiratory symptoms in occupationally exposed humans. The NOAEL is reported to have been calculated by adjusting the mean TWA (time weighted average) exposure, dividing by an uncertainty factor of 10 and a modifying factor of 3.

No oral MRLs are provided for ammonia by ATSDR based on the lack of suitable toxicological studies and the high doses of ammonium that are anticipated to be required in drinking water / food to allow acceptable levels to be exceeded. It was further noted that oral exposure to ammonia generally consists of ammonium chloride. The anion chloride is reported to assist in the metabolism of the co-occurring ammonium.

US EPA

The US EPA provides a reference concentration (RfC) for ammonia of 0.1mg/m^3. The RfC is reported to be based on studies of occupationally exposed workers and a study of rats which identified significantly increased severity of rhinitis, otitis media, tracheitis and pneumonia, a significant concentration response between observed respiratory lesions and increasing environmental ammonia concentration, gross bronchiectasis and/or pulmonary abscesses and the extent of gross atelectasis. The RfC has been principally derived from a NOAEL derived from the occupational study.

No data was available on the potential toxicity of ammonia by oral exposure or potential carcinogenicity.

7.6.6 Cyanide

Cyanide has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for cyanide has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.6**.

Table 7.6: Summary of Published Level 1 Hazard Data for Cyanide

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2009) 'Cyanide in Drinking Water'
enHealth	YES	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	No	enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	No	
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (July 2006) 'Toxicological Profile for Cyanide'
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	IRIS database (1993)

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NHMRC

NHMRC/NRMMC (2011) has recommended a daily intake of 1.2mg/kg body weight per day based on the no effect level from 6 month feeding studies using pigs. Exposure to cyanide was reported to increase ambivalence and result in slower response times to stimuli of the pigs. It is also recommended that a 100 safety factor be used the recommended daily intake based on interspecies and intraspecies variations.

A background exposure to cyanide was not reported in NHMRC/NRMMC (2011), however it was noted that typical concentrations of cyanides in drinking water are less than 0.02mg/l.

WHO

WHO (2009) reports a cyanide dose of 12.5 mg/kg body weight per day as the LOAEL, based on all the effects on reproductive organs observed in the male rats, and a cyanide dose of 4.5 mg/kg body weight per day as the NOAEL, on the basis of a 13-week study in which rats and mice were administered sodium cyanide in drinking-water.

An uncertainty factor of 100 (based on inter and intraspecies variations) has been applied to the LOAEL to derive a TDI of 12µg/kg of body weight.

enHealth

enHealth reports that the toxicity of complexed cyanides is generally dependent on the release of free cyanides occurring. A WHO (1993) TDI of 0.012mg/kg/day is reported for free cyanide. It is noted that analytical methods for the assessments of free cyanides should include thiocyanates.

The enHealth (2001) soil guideline for complexed cyanides is reported to have been derived on the basis of a subchronic study deriving a NOAEL for complexed cyanides of 25,g/kg/day and a applying a safety factor of 1 000 to derive a TDI of 0.025mg/kg/day.

It is recommended that assessment of cyanides as free or complexed cyanides should be on the basis of the state in which cyanides occur on a site. Criteria presented by enHealth for complexed cyanides are 5 times higher than those for free cyanides.

ATSDR

No inhalation exposure MRLs have been derived by ASTDR.

An intermediate duration oral exposure MRL of 0.05mg CN^-/kg/day is derived by ASTDR. This is reported to be based on studies of animals exposed to sodium or potassium cyanide. The MRL is reported to have been derived from a LOAEL and a NOAEL, as based on the reduced weights of male reproductive system of rats. The NOAEL has been divided by an uncertainty factor of 100 to account for extrapolation from humans to animals and human variability.

A chronic duration oral MRL has not been derived consequent of a lack of appropriate data.

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US EPA

The US EPA has not classified free cyanide as a carcinogen (classification D). Feeding studies have showed decreased weight gain and thyroxin levels and myelin degeneration in rats. An oral RfD of $2*10^{-2}$ mg/kg/day is provided by the US EPA. This is based on the NOAEL of a rat chronic oral study, adjusted by an uncertainty factor of 100 and a modifying factor of 5.

7.6.7 Total Petroleum Hydrocarbons

Total petroleum hydrocarbons (TPH) have been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for TPH has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.7**.

Table 7.7: Summary of Published Level 1 Hazard Data for Total Petroleum Hydrocarbons

Organisation	Availability	Reference
NHMRC	No	
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2005) 'Petroleum Products in Drinking Water'
enHealth	YES	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	No	enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	YES	IARC Monographs (1987 and 1989)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	No	Profiles on commercial petroleum products considered inappropriate for TPH principally consequent of coal tar. ATSDR (September 1999) 'Toxicological Profile for Total Petroleum Hydrocarbons' is substantially based on speciated constituents of TPH.
NTP	No	
OECD SIDS SIAR	No	
EPA	No	

WHO

WHO (2005) derives drinking water criteria for a range of TPH fractions on the basis of Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) toxicity criteria for aliphatic and aromatic fractions.

enHealth

enHealth (2001) references the TPHCWG (1997) approach to assessing hydrocarbons. Specific mention is made of the TPHCWG (1997) proposing two approaches to the assessment of petroleum hydrocarbons to be used in a hybrid framework:

- The first approach examines the presence of indicator chemicals which are carcinogenic substances. This generally includes substances such as benzene and polycyclic aromatic hydrocarbons such as benzo(a)pyrene which, if detected, require an appraisal; or
- If indicator chemicals are not present then the second stage is used. The second stage is the TPH fraction stage which assigns toxicity criteria to well defined fractions based on the available toxicity data for constituents, mixtures, solvent streams and whole product

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IARC

IARC classifies mineral oils as a mixture containing Group 1 carcinogens. IARC classifies fuel oil, gasoline and diesel fuel as Group 2B mixtures, containing chemicals that are possibly carcinogenic to humans. IARC classifies coal tars as mixtures containing Group 1 carcinogens.

Level 2 Sources

On the basis of TPHCWG (1997) being identified in the WHO and enHealth documents, a further review has been undertaken of TPHCWG. TPH fractions described in TPHCWG are classified as aromatic and aliphatic fractions. Toxicity data are provided for fractions of TPH as based on indicator chemicals that occur within that fraction. This is summarised in **Table 7.8** following.

Table 7.8: Summary of Fraction Specific TPH Toxicity Values (mg/kg/day)

TPH Range	Oral RfD (mg/kg/day)	Inhalation RfC (mg/m^3)	Comments / Source
Aliphatic			
$C_{>6}$-C_8	5.0	18..4	RfD and RfC based on consideration of relative levels of hexane and heptane in petroleum products.
$C_{>8}$-C_{10}	0.1	1.0	RfD based on oral gavage studies using dearomatised aromatics (C_9-C_{12}) and dearomatised aliphatics (C_{10}-C_{13}) RfC based on inhalation studies for various petroleum streams and JP-8 (jet fuel).
$C_{>10}$-C_{12}	0.1	1.0	
$C_{>12}$-C_{16}	0.1	1.0	
$C_{>16}$-C_{21}	2.0	N/A	RfD based on low molecular weight mineral oils and high molecular weight mineral oils.
$C_{>21}$-C_{35}	2.0	N/A	
Aromatic			
$C_{>7}$-C_8	0.2	0.4	RfD based on toluene. RfC based on toluene
$C_{>8}$-C_{10}	0.04	0.2	RfD based on naphthalene RfC based on inhalation studies using TPH C_9 mixture. Value less conservative than published values for naphthalene and isopropylbenzene.
$C_{>10}$-C_{12}	0.04	0.2	
$C_{>12}$-C_{16}	0.04	0.2	
$C_{>16}$-C_{21}	0.03	N/A	RfD based on pyrene.
$C_{>21}$-C_{35}	0.03	N/A	

7.6.8 Benzene

Benzene has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for benzene has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.9**.

Table 7.9: Summary of Published Level 1 Hazard Data for Benzene

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Benzene in Drinking Water' WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 5.2)
enHealth	No	
NEHF	YES	NEHF (1997) 'Benzene National Environmental Health Monographs' NEHF (May 2003) 'Benzene Health Review' NEHF (2004) 'National Environment Protection (Air Toxics) Measure'
IARC	YES	IARC Monographs (1987)
WHO/FAO JMPR	No	
NICNAS PEC	YES	NICNAS (September 2001) 'Benzene Priority Existing Chemical Assessment Report No. 21'
ATSDR	YES	ATSDR (August 2007) 'Toxicological Profile for Benzene'
NTP	YES	US Department of Health and Human Services (2009) '11th Report on Carcinogens'
OECD SIDS SIAR	No	
EPA	YES	IRIS Database (2003)

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NHMRC

NHMRC/NRMMC (2011) reports that the IARC has concluded that benzene is carcinogenic to humans. The guideline value presented is reported to have been based on a WHO extrapolation model as based on the incidence of leukaemia in humans. The NHMRC/NRMMC (2011) guideline value is further noted to be based on an incremental risk of cancer of 1 in 100 000.

A background exposure to benzene was not reported in NHMRC/NRMMC (2011). It was reported that benzene has not been found in Australian drinking waters.

WHO

WHO (2003) reports that benzene is carcinogenic in mice and rats after both inhalation and oral exposure, producing malignant tumours at many sites. It is considered to be a human carcinogen and is classified by IARC in Group 1. The drinking water guideline has been derived based on a risk estimate using data on leukaemia from epidemiological studies involving inhalation exposure. The epidemiological data was reported to be supported by leukaemia and lymphomas in female mice and oral cavity squamous cell carcinomas in male rats. A slope factor for oral exposure of 0.035 $(mg/kg/day)^{-1}$ is reported to have been used.

WHO (2000) reports that benzene is carcinogenic to humans. The geometric mean of the range of estimates of the excess lifetime risk of leukaemia at an air concentration of $1\mu g/m^3$ is reported to be $6*10^{-6}$.

NEHF

NEHF (1997) reports a number of effects of benzene exposure including narcotic or anaesthetic effects, deaths of workers, development of severe and sometimes fatal damage to the blood-forming elements of the bone marrow preventing the manufacture of essential blood cells, central nervous system depression, cardiac arrhythmia, respiratory failure, headaches, lassitude and general weakness, increases in the number of chromosomal aberrations, increasing susceptibility to allergens, increased incidence of leukemias (especially non-lymphocytic leukemia) and some evidence of decreased immune function. NEHF (1997) reports that the most commonly found associations have been with increases in non-lymphocytic leukemia.

NEHF (1997) reports that WHO concluded that a time-weighted average of 1 ppm or less over a 40-year working life is not statistically associated with any increase in deaths from leukemia. It is further reported that in the United Kingdom, the Expert Panel on Air Quality Standards determined that a level of 0.5 ppm over a working lifetime would not produce any detectable adverse health effect.

NEHF (2003) contains a review of international sources of benzene toxicological data. This is undertaken to premise the benzene criteria as provided to the NEHF (2004) 'National Environment Protection (Air Toxics) Measure' (Air Toxics NEPM). An annual average of 0.003ppm as an eight year goal is recommended for benzene.

IARC

IARC classifies benzene as a Group 1 carcinogen.

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NICNAS

NICNAS reports anecdotal evidence of acute exposure to benzene vapours causes dizziness and other CNS effects at concentrations above 25 ppm and eye, mucous membrane and skin irritation at levels above 30-60 ppm. Aspiration of liquid benzene is reported to have been observed to cause lung oedema and bleeding. Deaths from cardio-respiratory arrest are reported to have occurred following short-term inhalation of 20 000 ppm benzene, or from ingestion of a single dose of 125 mg benzene per kg.

Several studies are reported to demonstrate that repeated exposure to benzene may induce bone marrow depression, cause damage to genetic material and induce leukaemia. Some studies also reported to point to an association between benzene exposure and the risk for lymphoma. For bone marrow depression, the best estimate for a LOAEL is reported to be 7.6 ppm (TWA). An appropriate NOAEL is reported to have not been determined, although studies with various limitations indicate that would be likely to be >0.5 ppm (TWA).

The risk of developing leukaemia is reported to increase with exposure and has been shown to be significantly elevated above, but not below, a cumulative exposure of 50 ppm-years, corresponding to an average occupational exposure of 1.25 ppm (TWA) over 40 years. A potential lack of conservatism is noted in this study.

A national occupational exposure standard of 0.5ppm (TWA) was recommended in the study.

ATSDR

ATSDR provides an acute duration inhalation exposure MRL of 0.009ppm. The MRL is reported to have been derived from a LOAEL value of 10.2 ppm for reduced lymphocyte proliferation following mitogen stimulation in mice.

An intermediate duration inhalation exposure MRL of 0.006ppm has been reported. This is reported to have been derived from a LOAEL of 10ppm for significantly delayed splenic lymphocyte reaction to foreign antigens evaluated in *in vitro* mixed lymphocyte reaction following the exposure of male mice to benzene vapours.

A chronic duration inhalation exposure MRL of 0.003ppm has been reported by ATSDR. The MRL is reported to be based on statistically significantly decreased counts of B-lymphocytes in workers of shoe manufacturing industries in Tianjin, China. A benchmark dose was derived from this study and adjusted by an uncertainty factor of 10 to account for human variability.

No acute or intermediate duration MRLs have been derived for benzene based on insufficient studies being available.

A chronic duration oral exposure MRL of 0.0005 mg/kg/day has been reported by ATSDR. This is reported to have been based on inhalation studies in workers, as described for the inhalation MRL. A benchmark dose has been derived from this study and adjusted for an oral route of exposure. A further uncertainty factor of 30 has been incorporated to account for human variability and uncertainty in route to route extrapolation.

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NTP

Benzene is reported to be a human carcinogen based on sufficient evidence in humans. Case reports and case series have reported leukemia (mostly acute myelogenous leukemia, also known as acute myeloid or myelocytic leukemia) in individuals exposed to benzene. It was also reported that occupational exposure to benzene increased the risk of mortality from leukemia (mainly acute myelogenous leukemia).

US EPA

The US EPA classifies benzene as a known human carcinogen (classification A) for all routes of exposure. Epidemiologic studies and case studies are reported to provide clear evidence of a causal association between exposure to benzene and acute nonlymphocytic leukemia and also suggest evidence for chronic nonlymphocytic leukemia and chronic lymphocytic leukemia. Other neoplastic conditions that are associated with an increased risk in humans are hematologic neoplasms, blood disorders such as preleukemia and aplastic anemia, Hodgkin's lymphoma, and myelodysplastic syndrome. These human data are reported to be supported by animal studies.

US EPA provides an oral slope factor of $1.5*10^{-2}$ to $5.5*10^{-2}$ per (mg/kg)/day based on occurrences of leukaemia in occupational workers exposed by inhalation. An air unit risk of $2.2*10^{-6}$ to $7.8*10^{-6}$ is provided for benzene on the basis of the occurrence of leukaemia in humans.

An oral RfD of $4.0*10^{-3}$ mg/kg/day is also provided by the US EPA. This is reported to have been derived based on a benchmark dose calculated by the modelling of the absolute lymphocyte count (ALC) data from an occupational epidemiologic study in which workers were exposed to benzene by inhalation. Absolute lymphocyte count, white blood cell count, red blood cell count, hematocrit, and platelets were all significantly decreased, and mean corpuscular volume was significantly increased in the exposed workers. The benchmark dose was adjusted by an uncertainty factor of 300.

The same study has been used by the US EPA to derive an inhalation RfC of $3*10^{-2}$ mg/m^3. The benchmark concentration has been likewise adjusted by an uncertainty factor of 300.

7.6.9 Toluene

Toluene has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for toluene has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.10**.

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Table 7.10: Summary of Published Level 1 Hazard Data for Toluene

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2004) 'Toluene in Drinking Water' WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 5.14)
enHealth	No	
NEHF	YES	NEHF (May 2003) 'Toluene Health Review' NEPC (2004) 'National Environment Protection (Air Toxics) Measure'
IARC	YES	IARC Monographs (1999)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (2000) 'Toxicological Profile for Toluene'
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	IRIS database (2005)

NHMRC

NHMRC/NRMMC (2011) has recommended a daily intake of 312mg/kg body weight per day as based on a no effect levels derived from a 13 week oral study using rats. Rats and mice exposed via a 13 year gavage study reported increased liver weights at doses from 625 mg/kg body weight per day.

It was also recommended that a safety factor of 1 000 is used with the recommended tolerable daily intake based on interspecies variations, intraspecies variations and to account for the use of a less than lifetime study. A correction factor of 5/7 is also recommended to convert a 5 day per week gavage study to a 7 day week equivalent (TDI of 0.223 mg/kg body weight per day).

A background exposure to toluene was not reported in NHMRC/NRMMC (2011). It was reported that toluene has not been found in Australian drinking waters.

WHO

WHO (2004) reports that the guideline value for toluene has been derived by a TDI approach. A TDI of 223 µg/kg of body weight is reported to have been derived using the LOAEL for marginal hepatotoxicity in mice of 312mg/kg of body weight per day (equivalent to 223 mg/kg of body weight per day for 7 days per week dosing) and applying an uncertainty factor of 1000 (100 for inter- and intraspecies variation and 10 for the short duration of the study and use of a LOAEL instead of a NOAEL).

WHO (2000) reports that the LOAEL for effects on the CNS from occupational studies, is approximately 332mg/m^3. A guideline value of 0.26mg/m^3 is reported to be established from these data adjusting for continuous exposure (dividing by a factor of 4.2) and dividing by an uncertainty factor of 300 (10 for interindividual variation, 10 for use of a lowest-observed-adverse-effect level rather than a no-observed-adverse-effect level, and an additional factor of 3, given the potential effects on the developing CNS). It is recommended that this guideline value be applied as a weekly average.

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NEHF

NEHF (2003) contains a review of international sources of toluene toxicological data. This is undertaken to premise the toluene criteria as provided to the Air Toxics NEPM. An annual average of 0.1ppm as an eight year goal is recommended for toluene. A 24 hour average of 1ppm is also recommended for toluene as an eight year goal.

IARC

IARC classifies toluene as a Group 3 chemical, not classifiable as to its carcinogenicity to humans.

ATSDR

ATSDR provide an acute duration inhalation exposure MRL of 1mg/kg/day. This is reported to be based on changes in neurological effects of human subjects to short terms exposures. A NOAEL was derived from this study and adjusted for an uncertainty factor of 10 to account for human variability.

A chronic duration inhalation exposure MRL of 0.08mg/kg/day is reported. This is based on studies of Canadian workers occupationally exposed to toluene. A LOAEL was derived from this study on the basis of colour vision impairment. The LOAEL was adjusted to account for affects of age and alcohol exposure. An uncertainty factor of 100 was also used to account for use of an LOAEL and human variability.

An acute duration oral exposure MRL of 0.8mg/kg/day is reported. This is based on the observation of neurological effects in rats. The LOAEL derived from the study was divided by an uncertainty factor of 300 to account for use of an LOAEL, extrapolation from humans to animals and human variability.

An intermediate duration oral exposure MRL of 0.02mg/kg.day has been reported by ATSDR. This is based on significant increases in norepinephrin present in the hypothalamus and in the midbrain in dosed mice. A LOAEL was derived from this study and divided by an uncertainty factor of 300 to account for used of an LOAEL, extrapolation from humans to animals and human variability.

A chronic duration oral MRL is not available.

US EPA

US EPA reports that there is inadequate information to assess the carcinogenic potential of toluene because studies of humans chronically exposed to toluene are inconclusive. Toluene is reported to have not been found to be carcinogenic in adequate inhalation cancer bioassays of rats and mice exposed for life.

An oral RfD of 0.08mg/kg-day is reported by the US EPA as based on a benchmark dose derived from a subchronic study that examined oral exposure to toluene in rodents (rats and mice). The rodents developed increased kidney and liver weights. Histopathologic lesions in the liver consisted of hepatocellular hypertrophy. Nephrosis was observed in rats that died, and damage to the tubular epithelia of the kidney occurred in terminally sacrificed rats. The benchmark dose was derived on the basis of increased kidney weights. This is reported by US EPA to have been supported by several acute oral and inhalation human toxicity studies. The RfD incorporated an uncertainty factor of 3 000 to account for extrapolation for interspecies differences, consideration of intraspecies variation, use of a subchronic study to estimate chronic effects and database insufficiencies and contradictions in the immunotoxicity data.

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An inhalation RfC of 5mg/m^3 is reported by US EPA as based on an average NOAEL as derived from studies of neurological effects of occupational workers exposed by inhalation. Neurological effects are reported to include impaired colour vision, impaired hearing, decreased performance in neurobehavioral analysis, changes in motor and sensory nerve conduction velocity, headache and dizziness. The RfC incorporated an uncertainty factor of 10 for intraspecies differences.

7.6.10 Ethylbenzene

Ethylbenzene has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for ethylbenzene has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.11**.

Table 7.11: Summary of Published Level 1 Hazard Data for Ethylbenzene

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Ethylbenzene in Drinking Water'
enHealth	No	
NEHF	No	
IARC	YES	IARC Monographs (2000)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (November 2010) 'Toxicological Profile for Ethylbenzene'
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	IRIS Database (1991)

NHMRC

NHMRC/NRMMC (2011) has recommended a daily intake of 136 mg/kg body weight per day as based on a no effect level from a 6 month gavage study using rats. The gavage study found that rats reported enlargement of the liver and kidney at high doses (400 mg/kg body weight per day).

It was also recommended that a safety factor of 1 000 is used with the recommended tolerable daily intake based on interspecies variations, intraspecies variations and to account for the use of a less than lifetime study. A correction factor of 5/7 is also recommended to convert a 5 day per week gavage study to a 7 day week equivalent (TDI of 0.097 mg/kg body weight per day).

A background exposure to ethylbenzene was not reported in NHMRC/NRMMC (2011). It was reported that ethylbenzene has not been found in Australian drinking waters.

WHO

WHO (2003) reports that the guideline value for ethylbenzene has been derived by a TDI approach. The TDI is reported to have been derived using a NOAEL of 136 mg/kg of body weight per day based on hepatotoxicity and nephrotoxicity observed in a limited 6-month study in rats (administration 5 days per week). After application of an uncertainty factor of 1 000 (100 for intra- and interspecies variation and 10 for the limited database and short duration of the study), a TDI of 97.1 µg/kg of body weight is reported to have been used.

Most recent editions of WHO air quality guidelines do not include an assessment of ethylbenzene in air.

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IARC

IARC classified ethylbenzene as a Group 2B chemical, possibly carcinogenic to humans.

ATSDR

ATSDR provide an acute duration inhalation exposure MRL of 5ppm. This is reported to be based on auditory losses of rats. Increased kidney and liver weights have also been reported in exposed rats.

An intermediate duration inhalation exposure MRL of 2ppm. This is reported to be based on a loss of cochlear outer hair cells in exposed rats. Human equivalent concentrations were calculated from the data and divided by an uncertainty factor of 30 to account for extrapolation from animals to humans and human variability.

A chronic duration inhalation exposure MRL of 0.06ppm was reported as based on the human equivalent concentrations of observed nephropathy in rats. The MRL has incorporated an uncertainty factor of 300 to account for use of an LOAEL, extrapolation from animals to humans and human variability.

An intermediate duration oral exposure MRL of 0.4 mg/kg/day has been reported by ASTDR as based on a human equivalent toxicity dose derived for liver effects in exposed male rats. The human equivalent toxicity was divided by an uncertainty factor of 30 to account for extrapolation from animals to humans and human variability to derive the MRL.

No acute or chronic duration oral exposure MDLs were provided by ASTDR.

US EPA

US EPA reports that ethylbenzene is not classifiable as to human carcinogenicity due to a lack of animal bioassays and human studies.

An oral RfD of 0.1mg/kg/day is reported by US EPA based on a NOAEL derived for a oral bioassay study of rats given ethylbenzene doses in olive oil gavage. Toxic effects on the animals included growth, mortality, appearance and behaviour, hematologic findings, terminal concentration of urea nitrogen in the blood, final average organ and body weights, histopathologic findings and bone marrow counts. The RfD incorporated an uncertainty factor of 1 000 for intraspecies and interspecies variability and extrapolation of a subchronic effect level to its chronic equivalent.

An inhalation RfC of 1mg/m^3 is reported based on a NOAEL as derived from inhalation experiments conducted with Wistar rats and New Zealand white rabbits. The principal observation of the exposed animals was a reduced number of live rabbit kittens per litter, an increased incidence of supernumerary and rudimentary ribs and extra ribs in exposed rats and increased liver, kidney, and spleen weights in pregnant rats. The RfC incorporated an uncertainty factor of 300 for unusually sensitive individuals, interspecies conversion and to adjust for the absence of multigenerational reproductive and chronic studies.

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7.6.11 Xylene

Xylene has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for xylene has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.12**.

Table 7.12: Summary of Published Level 1 Hazard Data for Xylene

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Xylenes in Drinking Water'
enHealth	No	
NEHF	YES	NEHF (May 2003) 'Xylenes Health Review' NEPC (2004) 'National Environment Protection (Air Toxics) Measure'
IARC	YES	IARC Monographs (1999)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (August 2007) 'Toxicological Profile for Xylene'
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	IRIS Database (2003)

NHMRC

NHMRC/NRMMC (2011) has recommended a daily intake of 250 mg/kg body weight per day as based on a no effect level from a 2 year gavage study using rats and mice. The gavage study found that rats and mice reported decreased growth at high doses (500 mg/kg body weight per day).

It was also recommended that a safety factor of 1 000 is used with the recommended tolerable daily intake based on interspecies variations, intraspecies variations and to account for the use of a less than lifetime study. A correction factor of 5/7 is also recommended to convert a 5 day per week gavage study to a 7 day week equivalent (TDI of 0.179 mg/kg body weight per day).

Background exposure to xylenes was not reported in NHMRC/NRMMC (2011). It was reported that xylenes have not been found in Australian drinking waters.

WHO

WHO (2003) reports that the guideline value for xylene has been derived by a TDI approach. A TDI of 179 µg/kg of body weight is reported to have been derived using a NOAEL of 250 mg/kg of body weight per day based on decreased body weight in a 103-week gavage study in rats with administration 5 days per week (equivalent to 179 mg/kg of body weight per day 7 days per week) and an uncertainty factor of 1000 (100 for intra- and interspecies variation and 10 for the limited toxicological endpoint).

Most recent editions of WHO air quality guidelines do not include an assessment of xylenes in air.

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NEHF

NEHF (2003) contains a review of international sources of xylene toxicological data. This is undertaken to premise the xylene criteria as provided to the Air Toxics NEPM. An annual average of 0.2ppm as an eight year goal is recommended for xylene. A 24 hour average of 0.25ppm is also recommended for toluene as an eight year goal.

IARC

IARC classify xylenes as a Group 3 chemical, not classifiable as to its carcinogenicity to humans.

ATSDR

ATSDR report an acute duration inhalation exposure MRL of 2ppm for mixed xylenes. This is based on neurological and respiratory effects of humans. A LOAEL was derived from the study and divided by an uncertainty factor of 30 to account for use of an LOAEL and human variability to derive the MRL.

An intermediate duration inhalation exposure MRL of 0.6ppm is reported for mixed xylenes. This was based on neurotoxicity effects in rats. A human equivalent LOAEL was derived from the study and divided by an uncertainty factor of 90 to account for use of a LOAEL, extrapolation from humans to animals and human variability.

A chronic duration inhalation exposure MRL of 0.5ppm has been reported for mixed xylenes. The MRL was based on the observation of respiratory and neurological effects in exposed workers. The study derived an LOAEL as the geometric mean of the critical neurological and respiratory effects. The LOAEL was divided by an uncertainty factor of 100 to account for use of an LOAEL and human variability and a modifying factor of three to account for lack of supporting studies evaluating the chronic neurotoxicity of xylene.

An acute duration oral exposure MRL of 1mg/kg/day was reported for mixed xylenes. This was derived from neurotoxicity effects observed in exposed rats. An NOAEL was derived from this study. The NOAEL was divided by an uncertainty factor of 100 to account for extrapolation from animals to humans and human variability to derive the MRL.

An intermediate duration oral exposure MRL of 0.4mg/kg/day was reported for mixed xylenes. This was based on an NOAEL derived from observations of hyperactivity in exposed mice. An uncertainty factor of 100 to account for extrapolation from animals to humans and human variability and a modifying factor of 10 to account for the lack of testing for sensitive neurological end points and lack of developmental and multigenerational data were applied to a duration adjusted NOAEL to derive the MRL.

A chronic duration oral exposure MRL of 0.2 mg/kg/day has been reported for mixed xylenes. This was based on an NOAEL derived from observations of hyperactivity in exposed mice. An uncertainty factor of 100 to account for extrapolation from animals to humans and human variability and a modifying factor of 10 to account for the lack of testing for sensitive neurological end points and lack of developmental and multigenerational data were applied to a duration adjusted NOAEL to derive the MRL.

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US EPA

It is reported that data are inadequate for an assessment of the carcinogenic potential of xylenes. Available animal data are reported to be inconclusive.

An oral RfD of 0.2mg/kg/day is reported for xylene on the basis of a NOAEL as based on increased mortality and decreased body weight of rats. It is reported that a study of rats administered mixed xylenes by gavage identified effects of exposure including decreased body weight and decreased survival. Studies of mice have also reported hyperactivity. The RfD incorporated an uncertainty factor of 1 000 for interspecies and intraspecies differences and database uncertainty.

An inhalation RfC of 0.1mg/m^3 is reported for xylenes based on a NOAEL derived from a study of rats exposed to toluene and xylene via inhalation. Exposed rats exhibited statistically significantly decreased rotarod performance and decreased spontaneous activity. Another study of rats reported statistically significant decreases in erythrocyte number and decreased levels of hemoglobin. Rats also reported increased sensitivity to pain. The RfC incorporated an uncertainty factor of 300 for laboratory animal-to-human interspecies differences, intraspecies uncertainty, extrapolation from subchronic to chronic duration and uncertainties in the database.

7.6.12 Trimethylbenzenes

1,2,4- and 1,3,5-trimethylbenzene have been selected as a COPC for the assessment of potential human health impacts. 1,2,4-trimethylbenzene is reported to be the more toxic of the trimethylbenzene isomers, and the assessment of trimethylbenzene has been based A brief summary of the toxicological data available for 1,2,4-trimethylbenzene has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.13**.

Table 7.13: Summary of Published Level 1 Hazard Data for 1,2,4-trimethylbenzene

Organisation	Availability	Reference
NHMRC	No	
Therapeutic Goods Administration	No	
WHO	No	
enHealth	No	
NEHF	No	
IARC	No	
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	No	
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	US EPA (August 1994) 'Chemical Summary for 1,2,4-trimethylbenzene

Significant information on the toxicity of 1,2,4-trimethylbenzene has only been identified with the US EPA preparation of a chemical summary of 1,2,4-trimethylbenzene of the Level 1 sources. It is reported that direct contact with liquid 1,2,4-trimethylbenzene is irritating to the skin. Inhalation of vapour has been found to cause chemical pneumonitis, headache, fatigue and drowsiness. Long term exposure of humans to trimethylbenzenes has been found to cause nervousness, tension and anxiety, asthmatic bronchitis, anemia, and alterations in blood clotting, based on a study of painters exposed to a solvent containing 50% 1,2,4-trimethylbenzene.

A review of Level 2 sources has been additionally undertaken. The US EPA (November 2010) regional screening level table cites a provisional peer reviewed toxicity value as an RfC equal to $7*10^{-3}$mg/m^3. Background studies on the derivation of PPRTV's are not available.

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Level 2 Sources

Air quality standards for trimethylbenzenes have been provided to Ontario Ministry of the Environment (June 2007) 'Ontario Air Standards for Trimethylbenzenes: 1,2,3-Trimethylbenzene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene'. A 24 hour average Ambient Air Quality Criterion of 220µg/m^3 has been provided for any isomer of 1,2,3-trimtehylbenzene or 1,2,4-trimethylbenzene or any mixture of those isomers based on the central nervous system effects of those compounds. This guideline has been based on a NOAEL of 123mg/m^3 of trimethylbenzenes as adjusted for time and uncertainty factors.

7.6.13 Polycyclic Aromatic Hydrocarbons

A range of polycyclic aromatic hydrocarbons (PAHs) have been selected as COPCs for the assessment of potential human health impacts. A brief summary of the toxicological data available for PAHs has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.14**.

Table 7.14: Summary of Published Level 1 Hazard Data for Polycyclic Aromatic Hydrocarbons

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Polynuclear aromatic hydrocarbons in Drinking-water' WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 5.9)
enHealth	YES	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	YES	NEHF (May 2003) 'Polycyclic Aromatic Hydrocarbons (PAHs) Health Review' NEHF (2004) 'National Environment Protection (Air Toxics) Measure' enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	YES	Anthracene, IARC Monograph in preparation (2010) Benz(a)anthracene, IARC Monograph in preparation (2010) Benzo(a)pyrene, IARC Monograph in preparation (2010) Benzo(b)fluoranthene, IARC Monograph in preparation (2010) Benzo(k)fluoranthene, IARC Monograph in preparation (2010) Chrysene, IARC Monograph in preparation (2010) Dibenz(a,h)anthracene, IARC Monograph in preparation (2010) Fluorene, IARC Monograph in preparation (2010) Indeno(1,2,3-c,d)pyrene, IARC Monograph in preparation (2010) Naphthalene, IARC Monographs (2002) Phenanthrene, IARC Monograph in preparation (2010) Pyrene, IARC Monograph in preparation (2010)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (August 1995) 'Toxicological Profile for Polycyclic Aromatic Hydrocarbons' ATSDR (August 2005) 'Toxicological Profile for Naphthalene, 1-Methylnaphthalene and 2-Methylnaphthalene'
NTP	YES	US Department of Health and Human Services (2009) '11th Report on Carcinogens'
EPA	YES	IRIS Database (1991), acenaphthylene IRIS Database (1994), benz(a)anthracene IRIS Database (1994), benzo(a)pyrene IRIS Database (1994), benzo(b)fluoranthene IRIS Database (1990), benzo(g,h,i)perylene IRIS Database (1994), benzo(k)fluoranthene IRIS Database (1994), chrysene IRIS Database (1994), dibenz(a,h)anthracene IRIS Database (1990), fluorene IRIS Database (1994) ,indeno(1,2,3-c,d)pyrene IRIS Database (1998), naphthalene IRIS Database (1994), phenanthrene IRIS Database (1994), pyrene

NHMRC

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It is reported in NHMRC (2011) that most of the toxicological literature is specific to benzo(a)pyrene with few studies available for other PAHs. It is reported that the IARC defines benzo(a)pyrene as probably carcinogenic to humans (though recently updated to a confirmed carcinogen as discussed in IARC review).

A guideline value has been presented for benzo(a)pyrene. This is reported to have been based on a WHO linear multistage model as based on the incidence of leukaemia in humans. The NHMRC/NRMMC (2004) guideline value is further noted to be based on an incremental risk of cancer of 1 in 1 000 000.

Background exposure to PAHs were not reported in NHMRC/NRMMC (2011) for Australia. It was reported that benzo(a)pyrene occurs in US drinking waters at a typical concentration of 55ng/l. The intake of PAHs from foods was reported as being at least an order of magnitude higher than from drinking water.

WHO

WHO (2003) reports that benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, Dibenzo(a,h)anthracene, fluoranthene and indeno(1,2,3-c,d)pyrene are classifiable as carcinogens. Relative potencies of PAHs are summarised following:

- Benz(a)anthracene – 0.1;
- Benzo(a)pyrene – 1.0
- Benzo(b)fluoranthene – 0.1;
- Benzo(k)fluoranthene – 0.1;
- Dibenz(a,h)anthracene – 1.0; and
- Indeno(1,2,3-c,d)pyrene – 0.1.

An earlier WHO publication, WHO / IPCS (1998) 'Environmental Health Criteria Selected Non-Hetrocyclic Polycyclic Aromatic Hydrocarbons' also provides potency factors for an increased list of PAHs that includes chrysene. These are reproduced following.

- Benzo(a)pyrene – 1.0
- Benzo(a)anthracene – 0.1-0.145;
- Benzo(b)fluoranthene – 0.1-0.167;
- Benzo(k)fluoranthene – 0.01-0.02;
- Chrysene – 0.001-0.004;
- Diebnz(a,h)anthracene – 1-1.11; and
- Indeno(1,2,3-c,d)pyrene – 0.055-0.1.

It is noted that a range of potential toxicity equivalences are also provided for benzo(g,h,i)perylene of 0.01-0.022, fluoranthene of 0.001-0.1 and pyrene of 0.001-0.81. No final relative potency is recommended for these constituents as there is considered to be insufficient evidence of carcinogenicity.

It is reported that evidence that mixtures of PAHs are carcinogenic in humans comes primarily from occupational studies of workers. Cancer associated with exposure to PAH-containing mixtures in humans occurs predominantly in the lung and skin following inhalation and dermal exposure, respectively.

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A guideline value has been derived by WHO (2003) for benzo(a)pyrene, described as the most carcinogenic of PAHs. It is reported that an excess lifetime cancer risk of $1*10^{-5}$ was estimated for 0.7µg/l, based on an oral carcinogenicity study and a two-stage birth–death mutation model, which incorporated variable dosing patterns and time of sacrifice. It is further reported that a study on forestomach tumour incidence in mice gave nearly identical results.

A guideline value has also been derived for fluoranthene. This is reported to have been estimated from a 13-week oral gavage study in mice with a NOAEL of 125 mg/kg of body weight per day, based on increased serum glutamate-pyruvate transaminase levels, kidney and liver pathology, and clinical and haematological changes. An uncertainty factor of 10 000 (100 for inter- and intraspecies variation, 10 for the use of a subchronic study and inadequate database, and 10 because of clear evidence of co-carcinogenicity with BaP in mouse skin painting studies) is reported to result in a TDI of 0.0125 mg/kg of body weight per day.

WHO (2000) nominated benzo(a)pyrene as an indicator chemical to represent the carcinogenic potential of PAHs in air. It is noted that that evaluation of benzo(a)pyrene solely probably underestimates the carcinogenic potential of airborne PAH mixtures. Based upon epidemiological data from studies in coke-oven workers, a unit risk for benzo(a)pyrene as an indicator in air of PAH constituents, is estimated to be $8.7*10^{-5}$ $(ng/m^3)^{-1}$. This was reported to be supported by animal data.

enHealth

enHealth (2001) reports that some PAHs are classified as IARC Group 2A and 2B carcinogens and the procedure for these compounds, in the absence of an ADI/PTWI, was to establish their carcinogenic potency, and then estimate a dose associated with a particular increased lifetime cancer risk.

A guideline value based on an exposure to benzo(a)pyrene of 0.8ng/kg/day was reported to have been used to derive soils criteria.

NEHF

NEHF (2003) contains a review of international sources of PAHs toxicological data. Most of the available toxicological data is found in this document to be available for benzo(a)pyrene. This review has been undertaken to premise the PAHs criteria as provided to the Air Toxics NEPM. An annual average of $0.3ng/m^3$ as an eight year goal is recommended for benzo(a)pyrene as a marker for PAHs.

IARC

IARC classifies anthracene as a Group 3 chemical, not classifiable as to its human carcinogenicity.

IARC classifies benz(a)anthracene as a Group 2B chemical, possibly carcinogenic to humans.

IARC classifies benzo(a)pyrene as a Group 1 carcinogen.

IARC classifies benzo(b)fluoranthene and benzo(k)fluoranthene as Group 2B chemicals, possibly carcinogenic to humans.

IARC classifies chrysene as a Group 2B chemical, possibly carcinogenic to humans.

IARC classifies dibenz(a,h)anthracene as a Group 2A chemical, possibly carcinogenic to humans.

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IARC classifies fluorene as a Group 3 chemical, not classifiable as to its human carcinogenicity.

IARC classifies indeno(1,2,3-c,d)pyrene as a Group 2B chemical, possibly carcinogenic to humans.

IARC classifies naphthalene as a Group 2B chemical, possibly carcinogenic to humans.

IARC classifies phenanthrene as a Group 3 chemical, not classifiable as to its human carcinogenicity.

IARC classifies pyrene as a Group 3 chemical, not classifiable as to its human carcinogenicity.

ATSDR

ATSDR report that no inhalation exposure MRLs have been derived for PAHs (apart from naphthalene and isomers) consequent of lack of dose-response data that identify noncancer health effects for humans or animals.

No acute or chronic duration oral exposure MRLs are reported to be provided for PAHS, also consequent of a lack of data.

A chronic duration inhalation exposure MRL of 0.0007ppm has been reported for naphthalene. The MRL has been based on an LOAEL derived for nonneoplastic lesions in nasal olfactory epithelium (metaplasia in mice, and hyperplasia, atrophy, and chronic inflammation in rats) and respiratory epithelium (hyperplasia in mice, and hyperplasia, metaplasia, hyaline degeneration, or gland hyperplasia in rats). Exposed rats were also reported to show increased incidences of nasal tumours. A human equivalent LOAEL was derived and divided by an uncertainty factor of 300 to account for use of an LOAEL, extrapolation from animals to humans and human variability.

An intermediate duration oral exposure MRL of 0.6mg/kg.day has been reported for acenaphthene. This is reported to be based on an LOAEL for liver weight changes in exposed mice. The MRL has been obtained by dividing the LOAEL by an uncertainty factor of 300 to account for use of an LOAEL, extrapolation of animals to humans and human variability.

An intermediate duration oral exposure MRL of 0.4mg/kg/day has been reported for fluoranthene. This is reported to be based on an LOAEL for liver weight changes in exposed mice. The MRL has been obtained by dividing the LOAEL by an uncertainty factor of 300 to account for use of an LOAEL, extrapolation of animals to humans and human variability.

An intermediate duration oral exposure MRL of 0.4mg/kg/day has been reported for fluorene. This is reported to be based on an LOAEL for liver weight changes in exposed mice. The MRL has been obtained by dividing the LOAEL by an uncertainty factor of 300 to account for use of an LOAEL, extrapolation of animals to humans and human variability.

An intermediate duration oral exposure MRL of 10mg/kg/day has been reported for anthracene. This is reported to be based on an NOAEL for potential liver effects in exposed mice. The MRL has been obtained by dividing the LOAEL by an uncertainty factor of 100 to account for extrapolation of animals to humans and human variability.

An acute and intermediate duration oral exposure MRL of 0.6mg/kg/day was reported for naphthalene. This is reported to be based on decreased body weights in exposed rats, to

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derive an NOAEL. The NOAEL has been divided by an uncertainty factor of 100 to account for extrapolation from animals to humans and human variability to derive the MRL.

A chronic duration oral exposure MRL of 0.6mg/kg/day has been reported for naphthalene. This was based on a rat developmental study. Effects observed included slow respiration, lethargy, or prone body posture in most rats following dose administration on the first and second day of dosing. The MRL was calculated from the LOAEL derived for these effects and an uncertainty factor of 90 to account for use of an LOAEL, extrapolation from animals to humans and human variability.

NTP

NTP reported polycyclic aromatic hydrocarbons including benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene and indeno(1,2,3-c,d)pyrene to be reasonably anticipated to be human carcinogens based on sufficient evidence of carcinogenicity in experimental animals.

Benz(a)anthracene is reported to have induced papillomas of the forestomach in mice, lung adenomas and hepatomas in mice, skin papillomas in mice sarcomas in adult mice and pulmonary adenomas and adenocarcinomas in newborn mice and local carcinomas in mice (by bladder implantation).

Benzo(a)pyrene is reported to induce malignant and benign forestomach tumors in mice and hamsters, and mammary tumors in female rats, increase the incidence of forestomach tumors and induced lung adenomas in mice, induced skin carcinomas and papillomas in mice, rats, guinea pigs, and rabbits, tracheal papillomas and carcinomas in hamsters and squamous cell carcinomas of the lung in rats, lung tumors in rats, tracheobronchial tumors in hamsters, and squamous carcinomas of the lung in two of six subhuman primates, local sarcomas in rats, hamsters, guinea pigs, newts, subhuman primates, and adult mice, abdominal fibrosarcomas in mice of both sexes, and mammary and uterine carcinomas in rats, mammary carcinomas in female rats, local tumors in rats, increased incidence of lung adenomas and initiated skin carcinogenesis in the offspring.

Benzo(b)fluoranthene is reported to have induced skin tumours in mice and local sarcomas in mice.

Dibenz(a,h)anthracene is reported to have induced local sarcomas in mice, squamous cell carcinomas and papillomas of the forestomach in mice, alveologenic carcinomas of the lung and hemangioendotheliomas in mice of both sexes and mammary carcinomas in female mice, lung squamous cell carcinomas in rats, local sarcomas in rats, guinea pigs, pigeons, fowl, adult mice, and newborn mice, lung adenomas and renal adenocarcinomas

NTP reports that that exposure to coke oven emissions, which contain a variety of PAHs, has been demonstrated to cause increased incidences of lung and genitourinary cancer mortality in coke oven workers. Workers exposed to creosote containing numerous PAHs developed skin tumors. Exposures to other chemical mixtures that contain PAHs, such as cigarette smoke, coal tar, coal tar pitch, and bitumens, have been associated with increased incidences of lung cancer in humans. Dermal exposure to coal tar and shale oils containing PAHs have been associated with increased incidences of skin tumors in humans.

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US EPA

Acenaphthene

US EPA describes acenapthene as a white crystal-like solid most commonly produced from extraction, transport, and refining of petroleum products and combustion products resulting from their use.

US EPA reports an oral RfD of $6x10^{-2}$ mg/kg-day based on a NOAEL of 175 mg/kg-day from a hepatoxicity study in mice. This includes an uncertainty factor of 3000, from 10 each for intra- and inter-species variability, 10 for the use of a subchronic study for chonic RfD derivation, and 3 for the lack of data in a second species and reproductive / development data. Low confidence is reported in this RfD.

No data is available for inhalation RfC calculation or carcinogenicity assessment.

Acenaphthylene

Acenaphthylene has been reported as being non classifiable as to human carcinogenicity, based on no human data and inadequate data from animal bioassays.

Anthracene

US EPA describes anthracene as varying in appearance from a colorless to pale yellow crystal-like solid most commonly produced from extraction, transport, and refining of petroleum products and combustion products resulting from their use.

US EPA reports an oral RfD of $3x10^{-1}$ mg/kg-day based on a NOEL of 1000 mg/kg-day from a subchronic toxicity study in mice. This includes an uncertainty factor of 3000, with 10 to account for interspecies extrapolation, 10 for intraspecies variability, and 30 for the use of a subchronic study for chronic RfD derivation, and the lack of data in a second species and reproductive / development data. Low confidence is reported in this RfD.

An inhalation RfC calculation is not provided.

Anthracene is considered to be non-classifiable as to its human carcinogenicity.

Benz(a)anthracene

Benz(a)anthracene has been reported by US EPA to be a probable human carcinogen (classification B2) based on data from animal bioasays. Benz[a]anthracene administration has been reported to cause an increase in the incidence of tumors in animals by gavage, dermal application and both subcutaneous injection and intraperitoneal injection.

Benzo(a)pyrene

Benz(a)anthracene has been reported by US EPA to be a probable human carcinogen (classification B2) based on human data from multiple animal studies in many species demonstrating benzo(a)pyrene to be carcinogenic following administration by numerous routes. Benzo(a)pyrene is also reported to have produced positive results in numerous genotoxicity assays.

Benzo(a)pyrene administered in the diet or by gavage to mice, rats and hamsters has produced increased incidences of stomach tumours. Intratracheal instillation and inhalation studies in guinea pigs, hamsters and rats have resulted in elevated incidences of respiratory tract and upper digestive tract tumours. Intraperitoneal BAP injections have caused increases in the number of injection site tumours in mice and rats.

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US EPA provides an oral slope factor for benzo(a)pyrene of 7.3 per (mg/kg)/day. This data has been derived on the extrapolation of animal studies that resulted in forestomach, larynx and esophagus, papillomas and carcinoma type tumours. The slope factor has been set by the calculation of a geometric mean of a range of slope factors.

Benzo(b)fluoranthene

Benzo(b)fluoranthene has been reported by US EPA to be a probable human carcinogen (classification B2) based on data from animal bioasays. Benzo[b]fluoranthene is reported to have produced tumors in mice after lung implantation, intraperitoneal or subcutaneous injection, and skin painting.

Benzo(g,h,i)perylene

Benzo(g,h,i)perylene has been reported as being non classifiable as to human carcinogenicity, based on no human data and inadequate data from animal bioassays.

Benzo(k)fluoranthene

Benzo(k)fluoranthene has been reported by US EPA to be a probable human carcinogen (classification B2) based on data from animal bioasays. Benzo(k)fluoranthene is reported to have produced tumours after lung implantation in mice and when administered with a promoting agent in skin-painting studies. Equivocal results have reported to have been found in a lung adenoma assay in mice. Benzo[k]fluoranthene is also reported to have been shown to be mutagenic in bacteria.

Chrysene

Chrysene has been reported by US EPA to be a probable human carcinogen (classification B2) based on data from animal bioasays. Chrysene is reported to have produced carcinomas and malignant lymphoma in mice after intraperitoneal injection and skin carcinomas in mice following dermal exposure. Chrysene is reported to have produced chromosomal abnormalities in hamsters and mouse germ cells after gavage exposure, positive responses in bacterial gene mutation assays and transformed mammalian cells exposed in culture.

Dibenz(a,h)anthracene

Dibenz(a,h)anthracene has been reported by the US EPA to be a probable human carcinogen (classification B2) based on data from animal bioassays.
Dibenz(a,h)anthracene is reported to have produced carcinomas in mice following oral or dermal exposure and injection site tumors in several species following subcutaneous or intramuscular administration and induced DNA damage and gene mutations in bacteria as well as gene mutations and transformation in several types of mammalian cell cultures.

Fluorene

Fluorene has been reported as being non classifiable as to human carcinogenicity, based on no human data and inadequate data from animal bioassays.

An oral RfD of $4*10^{-2}$mf/kg/day is reported by the US EPA on the basis of a NOAEL and LOAEL from a gavage study of mice. A significant decrease in red blood cell count and packed cell volume were observed in the mice. Decreases in erythrocyte count, packed cell volume, and haemoglobin concentration were all observed in the mice. A significant decreasing trend in blood urea nitrogen and a significant increasing trend in total serum bilirubin were observed in both high-dose subjects. Dose-related increases in liver, spleen and kidney weights were also observed. The LOAEL and NOAEL were derived on the basis of the observed haematological effects.

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The RfD has also incorporated an uncertainty factor of 3,000 to account for intra- and interspecies variability, the use of a subchronic study for chronic RfD derivation and to account for the lack of adequate toxicity data in a second species and reproductive / developmental data.

Indeno(1,2,3-c,d)pyrene

Indeno(1,2,3-c,d)pyrene has been reported by US EPA to be a probable human carcinogen (classification B2) based on data from animal bioassays. Indeno(1,2,3-c,d)pyrene is reported to produce tumours in mice following lung implants, subcutaneous injection and dermal exposure. Indeno(1,2,3-c,d)pyrene is reported to have tested positive in bacterial gene mutation assays.

Naphthalene

Naphthalene is classified by the US EPA as a possible human carcinogen (classification C). This is based on limited evidence of carcinogenicity in animals via the inhalation route. Mice exposed to naphthalene vapours were found to have increased rates of mortality. Increases in incidences of nonneoplastic lesions were found in the lung and nose and alveolar/bronchiolar adenomas were also observed.

An oral RfD of $2*10^{-2}$mg/kg/day is reported to have been derived on the basis of the NOAEL as derived from a gavage study of rats. Rats of both sexes were reported to have displayed diarrhoea, lethargy, hunched posture, and rough coats at intermittent intervals throughout the study. Decreases in mean body weight and depression were also reported. A LOAEL and NOAEL were derived on the basis of the decrease in body weight.

The oral RfD has incorporated an uncertainty factor of 3 000 to account for extrapolation from rats to humans, sensitive humans, extrapolation from subchronic to chronic exposure and the lack of chronic oral exposure studies and 2-generation reproductive toxicity studies.

An inhalation RfC of $3*10^{-3}$mg/m^3 is reported to have been derived on the basis of LOAEL human equivalent concentration as derived from an inhalation study of mice. Inflammation, metaplasia of the olfactory epithelium, and hyperplasia of the respiratory epithelium were reported to have occurred in the noses of virtually all exposed mice. The LOAEL was derived on the basis of naphthalene-related effects on the nasal epithelium.

The inhalation RfC has incorporated an uncertainty factor of 3 000 to account for extrapolation from mice to humans, sensitive humans, extrapolation from a LOAEL to a NOAEL and database deficiencies including the lack of a 2-generation reproductive toxicity study and chronic inhalation data for other animal species.

Phenanthrene

Phenanthrene has been reported as being non classifiable as to human carcinogenicity, based on no human data and inadequate data from animal bioassays.

Pyrene

Pyrene has been reported as being non classifiable as to human carcinogenicity, based on no human data and inadequate data from animal bioassays. An oral RfD of $3*10^{-2}$ mg/kg/day is provided for pyrene on the basis of the average of the NOAEL and the LOAEL as determined by a gavage study of mice. Nephropathy, characterised by the presence of multiple foci of renal tubular regeneration, often accompanied by interstitial lymphocytic infiltrates and/or foci of interstitial fibrosis, was reported to be present in the mice. Kidney lesions were also reported. An NOAEL and LOAEL were derived from the

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study on the basis of nephropathy and decreased kidney weights. The RfD has also incorporated an uncertainty factor of 3 000 to account for intra- and interspecies variability, the use of a subchronic study for chronic RfD derivation and to account for the lack of both toxicity studies in a second species and developmental / reproductive studies.

Order of Potency of PAHs

US EPA (1993) 'U.S. Environmental Protection Agency. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons' provides an order of potency for PAHs on the basis of equivalent toxicity to benzo(a)pyrene. This is summarised following:

- Benzo(a)pyrene – 1.0
- Benzo(a)anthracene – 0.1
- Benzo(b)fluoranthene – 0.1
- Benzo(k)fluoranthene – 0.01;
- Chrysene – 0.001;
- Dibenz(a,h)anthracene – 1.0; and
- Indeno(1,2,3-c,d)pyrene – 0.1.

Level 2 Sources

Knafla A, Phillipps KA, Brecher RW, Petrovic S and Richardson M (2006) 'Development of a dermal cancer slope factor for benzo(a)pyrene' in Regulatory Toxicological and Pharmacology recommend that a dermal slope factor of 25 $(mg/kg/day)^{-1}$ be adopted for human health risk assessment of benzo(a)pyrene.

7.6.14 Phenols

Phenol, methyl-phenols (cresols) and 2,4-dimethylphenol have been selected as COPCs for the assessment of potential human health impacts. A brief summary of the toxicological data available for each of the phenols has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.15**.

Table 7.15: Summary of Published Level 1 Hazard Data for Phenols

Organisation	Availability	Reference
NHMRC	No	
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	No	
enHealth	YES	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	No	enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	YES	IARC Monographs (1999)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATDSR (September 2008) 'Toxicological Profile for Phenol' ATDSR (September 2008) 'Toxicological Profile for Cresols'
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	IRIS Database (2002), phenol IRIS Database (1992), 2-methylphenol IRIS Database (1992), 3-methylphenol IRIS Database (1993), 4-methylphenol IRIS Database (1990), 2,4-dimethylphenol

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enHealth

enHealth (2001) reports a US EPA oral RfD for phenol of 0.6mg/kg/day. Potentially significant differences in toxicities between substituted phenolic compounds are identified in the discussion of phenol toxicity.

IARC

IARC classifies phenol as a Group 3 chemical, not classifiable as to its human carcinogenicity.

ATSDR

Inhalation exposure MRLs are reported to not be available for phenols or cresols (methylphenols) due to a lack of data. No intermediate or chronic duration MRLs are available for oral exposure to phenol.

An acute duration oral exposure MRL of 1mg/kg/day is provided for phenol. This is reported to be based on decreased maternal and foetal body weights as observed in a rat development study. A NOAEL derived from this study was used to derive the MRL by dividing by an uncertainty factor of 100 to account for animal to human extrapolation and human variability.

An intermediate duration oral exposure MRL of 0.1mg/kg/day has been reported for cresols. The MRL has been based on the occurrence of nasal respiratory epithelium in rats and mice dosed with p-cresol or a mixture of m- and p-cresol. A benchmark dose was derived and divided by an uncertainty factor of 100 to account for extrapolation for animals to humans and human variability to derive the MRL.

A chronic duration oral exposure MRL of 0.1 mg/kg/day has been reported for cresols. As with the shorter term MRL, the chronic MRL has been derived based on the occurrence of nasal respiratory epithelium in rats and mice dosed with p-cresol, or a mixture of m- and p-cresol. An LOAEL has been derived from the study, which has been divided by an uncertainty factor of 1000 to account for use of an LOAEL, extrapolation for animals to humans and human variability to derive the MRL.

US EPA

Phenol

Phenol is not classified as to its carcinogenicity (classification D) on the basis of inadequate human and animal data.

An oral RfD of 0.3mg/kg-day is provided for phenol on the basis of a benchmark dose derived from a developmental study of rats. Statistically significant decreases in body weight gain and decreases in food consumption were also observed during the dosing period. Lower foetal body weights were also reported. The benchmark dose was derived on the basis of decreases in maternal body weight gain, decreased foetal body weight and delayed ossification.

The oral RfD has incorporated an uncertainty factor of 10 to account for sensitive human subpopulations, extrapolate from animals to humans and uncertainties regarding the immunological and haematological effects in mice.

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2-methylphenol

2-methylphenol is classified by the US EPA as a possible human carcinogen (classification C) based on three cresol isomers producing positive results in genetic toxicity studies both alone and in combination. This was reported as an increased incidence of skin papillomas in mice in an initiation-promotion study.

An oral RfD of $5*10^{-2}$ mg/kg/day has been provided for 2-methylphenol on the basis of a NOAEL of a gavage study of rats. Rats dosed with 2-methyphenol were reported to have increased mortality, reduced body weight and reduced food consumption. Tremors were also reported.

A separate neurotoxicity study produced significant neurological events, such as increased salivation, urination, tremors, lacrimation, palpebral closure, and rapid respiration. High dosed animals were further reported to show abnormal patterns in the neurobehavioral tests.

The oral RFD has incorporated an uncertainty factor of 1 000 to account for interspecies and intraspecies variability and uncertainty in extrapolation of subchronic data to levels of chronic effects.

3-methylphenol

3-methylphenol is classified by the US EPA as a possible human carcinogen (classification C) based on three cresol isomers producing positive results in genetic toxicity studies both alone and in combination. This was reported as an increased incidence of skin papillomas in mice in an initiation-promotion study.

An oral RfD of $5*10^{-2}$ mg/kg/day has been provided for 3-methylphenol on the basis of a NOAEL of a gavage study of rats. Rats dosed with 3-methyphenol were reported to have increased mortality, reduced body weight and reduced food consumption. Tremors were also reported.

A separate neurotoxicity study produced significant neurological events, such as increased salivation, urination, tremors, lacrimation, palpebral closure, and rapid respiration. High dosed animals were further reported to show abnormal patterns in the neurobehavioral tests.

The oral RFD has incorporated an uncertainty factor of 1 000 to account for interspecies and intraspecies variability and uncertainty in extrapolation of subchronic data to levels of chronic effects.

4-methylphenol

4-methylphenol is classified by the US EPA as a possible human carcinogen (classification C) based on three cresol isomers producing positive results in genetic toxicity studies both alone and in combination. This was reported as an increased incidence of skin papillomas in mice in an initiation-promotion study.

2,4-dimethylphenol

An oral RfD of $2*10^{-2}$mg/kg/day is provided for 2,4-dimethylphenol on the basis of a NOAEL as derived from a gavage study of rats. Toxicologically relevant clinical signs observed during the study included squinting, lethargy, prostration, and ataxia, with onset shortly after dosing. Statistically significant haematological changes included lower mean corpuscular volume and mean corpuscular haemoglobin concentration in females. The NOAEL was derived on the basis of the clinical signs and haematological changes.

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The RfD has incorporated an uncertainty factor of 3 000 based on inter- and intraspecies variability and lack of chronic toxicity data, data in a second species and reproductive/developmental studies.

Level 2 Sources

In assessing phenol, US EPA (November 2010) is observed to adopt a Californian EPA RfC of 0.2mg/m^3 for the assessment of inhalation effects of phenol.

7.6.15 Dibenzofuran

Dibenzofuran has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for dibenzofuran has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.16**.

Table 7.16: Summary of Published Level 1 Hazard Data for Dibenzofuran

Organisation	Availability	Reference
NHMRC	No	
Therapeutic Goods Administration	No	
WHO	No	
enHealth	No	
NEHF	No	
IARC	No	
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	No	
NTP	YES	Summary of Data for Chemical Selection: Dibenzofuran (2000)
OECD SIDS SIAR	No	
EPA	YES	IRIS Database (2010) Dibenzofuran

NTP

Dibenzofuran has been nominated as a high priority chemical for action by the NTP. This is based on widespread human exposure and the potential for carcinogenicity via epigenetic mechanisms unrelated to TCDD (dioxin) toxicity. Studies for carcinogenicity and short term chromosomal aberrations have been requested.

US EPA

The US EPA classifies dibenzofuran as class D, not classifiable as to its carcinogenicity to humans. No other data is available as to the toxicity of dibenzofuran.

Level 2 Sources

A PPRTV is provided to the US EPA (November 2010) Regional Screening Level tables as an RfD of $1*10^{-3}$mg/kg-day.

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7.6.16 Asbestos

Asbestos has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for asbestos has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.17**.

Table 7.17: Summary of Published Level 1 Hazard Data for Asbestos

Organisation	Availability	Reference
NHMRC	YES	'Lung Cancer', Section 1, Epidemiology. http://www.nhmrc.gov.au/publications/synopses/_files/cp97_1.pdf 'Asbestos Related Diseases' http://www.nhmrc.gov.au/your_health/issues/asbestos.htm
ANZECC	NO	
Therapeutic Goods Administration	NO	
WHO	YES	'Elimination of Asbestos Related Diseases' http://whqlibdoc.who.int/hq/2006/WHO_SDE_OEH_06.03_eng.pdf 'Asbestos in Drinking Water' http://www.who.int/water_sanitation_health/dwq/asbestos.pdf Air Quality Guidelines, 2nd Edition, Section 6.2, 'Asbestos'. http://www.euro.who.int/document/aiq/6_2_asbestos.pdf 'Environmental exposure to asbestos and the exposure–response relationship with mesothelioma' http://www.emro.who.int/publications/emhj/1501/PDF/03.pdf
enHealth	YES	'Management of Asbestos in the Non-Occupational Environment' http://www.nphp.gov.au/enhealth/council/pubs/pdf/asbestos.pdf
NEHF	NO	
IARC	NO	
WHO/FAO JMPR	NO	
NICNAS PEC	YES	'Chrysotile Asbestos Priority Existing Chemical No. 9' http://www.nicnas.gov.au/publications/CAR/PEC/PEC9/PEC_9_Full_Report_PDF.pdf
ATSDR	YES	'ToxFAQs™ for Asbestos' http://www.atsdr.cdc.gov/tfacts61.html 'Regulations and Advisories' http://www.atsdr.cdc.gov/toxprofiles/tp61-c8.pdf
NTP	YES	Lifetime Carcinogenesis Studies of Amosite Asbestos in Syrian Golden Hamsters http://ntp.niehs.nih.gov/ntp/htdocs/LT_rpts/tr249.pdf Toxicology and Carcinogenesis Studies of Crocidolite Asbestos in F344/N Rats http://ntp.niehs.nih.gov/ntp/htdocs/LT_rpts/tr280.pdf Toxicology and Carcinogenesis Studies of Chrysotile Asbestos in F344/N Rats http://ntp.niehs.nih.gov/ntp/htdocs/LT_rpts/tr295.pdf
OECD SIDS SIAR	NO	
EPA	YES	'Asbestos (CASRN 1332-21-4)' http://www.epa.gov/NCEA/iris/subst/0371.htm

NHMRC

NHMRC define asbestos as a carcinogen with no clearly delineated limiting threshold, and support a cumulative exposure model for risk as defined by exposure. Asbestos has been found to cause pleural disease, asbestosis, lung cancer and mesothelioma.

WHO

WHO classify asbestos (actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite) as carcinogenic, based on a statement by the IARC. Exposure to amosite, anthophyllite, chrysotile or crocidolite results in the increased risk of lung cancer, while occupational exposure to crocidolite, amosite, tremolite and chrysotile has resulted in mesotheliomas. The risk of bronchial cancer also increases, as may that of cancers of the larynx and gastrointestinal tract.

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WHO finds that the occurrence of asbestos-related diseases is related to fibre type, size and dose, and to the industrial procession of that asbestos, while cigarette smoking increases the associated risk. Fibres with a diameter greater than 3 µm are not respirable; fibres shorter than 5 µm and thicker than 2 µm elicit little response, while those longer than 10 µm and thinner than 0.5 µm yield the highest response.

Asbestosis has only been found related to occupational asbestos exposure, while non-occupational asbestos exposure does not appear sufficient. The incidence of mesothelioma has been shown to increase with increased exposure.

WHO studies have not found asbestos to be teratogenic or mutagenic in mice, while there is no conclusive evidence that ingested asbestos is carcinogenic. Drinking water containing high levels of asbestos has not been shown to be carcinogenic.

WHO (2000) provides estimates of mesothelioma risk resulting from lifetime inhalation exposure to asbestos with a best estimate of a risk of $2 * 10^{-5}$ for a lifetime exposure to 100 f/m^3 ($1 * 10^{-4}$ f/ml). WHO (2000) further provides an estimate of $2.2 * 10^{-5}$ risk of lung cancer for a non-smoker exposed to a fibre concentration of 100 f/m^3. These values are each equivalent to an approximate unit risk of 0.2 (f/ml)$^{-1}$. The unit risk is a measure of the incremental lifetime risk of cancer associated with lifetime exposure to a unit concentration (1 f/ml)$^{-1}$ of asbestos in air.

enHealth

enHealth defines asbestos as a carcinogen, with amphibole fibres (crocidolite, tremolite and amosite) considered more dangerous and the primary agents in the increased incidence of mesothelioma. enHealth quotes studies suggesting there is a direct correlation between exposure and risk, with chronic exposure the largest contributor to asbestos related health risks, with significantly increased mortality rates reported in exposed workers with cumulative exposure estimates greater than 25-100 f/mL-years. A further study estimated a 1 per cent increase in the standardised mortality ratio for lung cancer per year of exposure to 1 f/mL

The shape and length of asbestos fibres are also found to alter health risks, with fibres >20 µm <100 µm consider to be most carcinogenic, while in terms of shape, those with fibres >8 µm long and <0.25 µm diameter, with an aspect ratio (length/width) ≥10 appear to be most dangerous.

For non-occupational risk, studies of a crocidolite mining town showed a mesothelioma rate of 260 per 100 million person-years, while the mesothelioma rate for residents living near an asbestos cement factory was 73 (female) and 114 (male) per million person-years, as compared to a background incidence rate of one per million person-years. enHealth quotes guidelines for asbestos exposure as 0.1 f/mL for occupational exposure in Australia, and para-occupational sampling if using a limit of detection of 0.01 f/mL, while there is a proposed standard of 0.033f/mL for ambient air in Tasmania. Further, Australia has set a cut-off of 0.1 per cent by weight asbestos in products for the purpose of carcinogenic classification of the products.

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NICNAS

NICNAS has declared chrysotile a Priority Existing Chemical as it is prevalent and a known human carcinogen, causing asbestosis, mesothelioma, and lung cancer. No estimate is given as to a limiting threshold, but lung cancer occurrence estimates for the Australian friction material manufacturing industry are given as 1 to 2 cases from exposure to 1 f/mL, 1 case at 0.5 f/mL and 0.2 case at 0.1 f/mL, per 1000 workers. The PEC also cites the 1999 national exposure standard (TWA) for chrysotile as 1 f/mL, but suggests that monitoring methods do not distinguish between types of asbestos and a limit of 0.1 f/mL would protect against other forms of asbestos.

ATSDR

ATSDR recognizes asbestos as a carcinogen responsible for mesothelioma and lung cancer. They quote the EPA as proposing a concentration limit of 7 million fibres per litre of drinking water for long fibres (lengths greater than or equal to 5 µm), while the Occupational Safety and Health Administration has set a limit of 100,000 f/m^3 with lengths greater than or equal to 5 µm for workplace air for 8-hour shifts and 40-hour work weeks. A number of sources are quoted as given US standards for limits, typically 0.1 – 1.0 f/mL.

NTP

NTP studies on hamsters and rats show that asbestos is not carcinogenic from ingestion.

US EPA

The EPA established asbestos as a human carcinogen based on consistently higher mortality rates and cancers among occupationally exposed workers. Inhalation was identified as the primary cause, while evidence for carcinogenicity from ingestion remains inconclusive, as studies on white rats resulted in the development of benign polyps. A synergistic interaction between asbestos exposure and cigarette smoking, contributing to the development of lung cancer but not mesothelioma, was identified.

The EPA identifies the Inhalation Unit Risk as 0.23 $(f/mL)^{-1}$. The unit risk is a measure of the incremental lifetime risk of cancer associated with lifetime exposure to a unit concentration (1 $f/ml)^{-1}$ of asbestos in air. Unit risk factors are derived from the cancer slope factor for the inhalation of carcinogenic chemicals. The US EPA unit risk factor is very similar to the unit risk as derived from WHO reports.

Air Concentrations at Specified Risk Levels as provided by the US EPA are summarised following:

Risk Level	Concentration
E-4 (1 in 10,000)	$4*10^{-4}$ f/mL
E-5 (1 in 100,000)	$4*10^{-5}$ f/mL
E-6 (1 in 1,000,000)	$4*10^{-6}$ f/mL

Different types and fibre sizes of asbestos appear to have different health impacts, with fibre size and processing method appearing to impact relative risk as much as the specific type of asbestos. Evidence remains inconclusive as to the exact nature of these differences.

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Level 2 Sources

A range of peer reviewed journals are available describing the potential toxicological effects of asbestos. Noting the extensive data provided with the Level 1 sources for asbestos, these have not been reviewed here. Limited guidance is provided from other regulators as to appropriate levels of asbestos in soils, as discussed in the following section.

Soil Assessment Criteria

Limited soil assessment criteria are available in other jurisdictions globally. As noted in enHealth (2005) 'Management of asbestos in the non-occupational environment' there is currently no reliable method to determine the relationship between soil levels and air levels for asbestos-contaminated soil. As inhalation is the exposure route of concern, this makes exposure assessment from soil concentrations extremely difficult.

EnHealth (2005) notes the work of Addison, J., Davies, L.S.T., Robertson, A., and Willey, R.J. (1988) 'The Release of Dispersed Asbestos Fibres from Soils Technical Memoranda', TM/88/14, Institute of Occupational Medicine: 50, Edinburgh, UK (Addison et al. 1988) in setting an appropriate level of asbestos in soils. Addison et al (1988) have a recommended a level of 0.001% of asbestos in soil as being appropriately protective of construction workers.

EnHealth (2005) also notes the work of Imray and Neville (1993) which suggested a level of <0.001 f/ml in air and <0.001% in soil would be sufficient to classify a site as uncontaminated, as also based on the work by Addison et al (1988). The amount of allowable asbestos fibres nominated by Addison et al (1988) to premise the setting of soil criteria would not be protective of human receptors where more recent WHO or US EPA toxicological data are used.

The Netherlands have provided an interim standard of 100mg of asbestos per kilogram of soil, for the sum of the concentration of chrysotile asbestos and ten times the concentration of amphibole asbestos. The criterion is based on the derivation of a relationship between levels of asbestos in soil and in airborne concentrations as reported in Swartjes F.A, Tromp P.C, Wezenbeek J.M (2003) 'Assessment of the Risks of Soil Contamination with Asbestos' National Health and Environmental Institute, Netherlands, RIVM Report 711701034/2003 and Swartjes, F.A., Tromp, P.C. (2008) 'A Tiered Approach for the Assessment of Human Health Risks of Asbestos in Soils' Soil and Sediment Contamination, Volume 14, Issue 4, pp. 137 – 149. This has then been compared to the concentration of asbestos in soil as required to generate a level of airborne asbestos that would pose a negligible risk.

Western Australian Department of Health (2009) 'Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia' (WA DoH, 2009) provide assessment levels for asbestos cement products and free asbestos fibres in soils. The assessment criteria are based on the work of Swartjes et al (2003) and Swartjes & Tromp (2008), WHO risk figures for mesothelioma and division by a factor of ten, to account for greater dryness and dust generating potential of WA soils and treating all forms of asbestos as being of equivalent toxicity. The soil investigation criteria as provided by WA DoH (2009) are listed following:

- 0.001% asbestos for all site uses, based on free asbestos and asbestos fibres;
- 0.01% asbestos for residential use, based on ACM;
- 0.04% asbestos for residential use with minimal soil access, based on ACM;

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- 0.02% asbestos for parks, public open spaces, playing fields, based on ACM; and
- 0.05% asbestos for commercial / industrial based on ACM.

EnHealth (2005) also provides a summary of other soil asbestos criteria as used globally including:

- Unofficial soil levels of 0.001% have been proposed in the United Kingdom, below which no further action is required;
- Clean up levels between 0.25% and 1% are used by various regions of the United States Environmental Protection Authority; and
- In Manukau City Council, New Zealand, where extensive remediation of asbestos cement fragments has occurred, a semi-quantitative estimate of 0.001% asbestos content has been accepted as a guideline, based on the mass of fibres in handpicked samples and the mass of soil examined.

7.7 Summary and Evaluation of Toxicological Data

The toxicological sources have been reviewed to determine the most appropriate toxicological values to characterise each of the potential exposure pathways for the COPCs. This has been generally undertaken by adopting the order of preference of toxicological data instructed by NEPC (1999) and enHealth (2002). It is also noted that assessment of PAHs has considered constituents in addition to benzo(a)pyrene (in contrast to the enHealth / NEPC approach). This is consequent of WHO (2000) reporting that assessment of benzo(a)pyrene solely probably underestimates the carcinogenic potential of PAHs.

US EPA (1989) reports that where dermal toxicity reference values are being derived from oral values it is necessary to adjust the oral toxicity value from an administered to an absorbed dose. Where the oral toxicity is expressed as an absorbed dose, it is not necessary to adjust the toxicity value. Further detail is provided in US EPA (2004) which provides conditions when an adjustment is required for the oral toxicity factor (to account for 'absorbed dose' in the dermal exposure pathway). These include:

- The toxicity value derived from the critical study is based on an administered dose (e.g. delivery in diet or by gavage) in its study design; and
- A scientifically defensible database demonstrates that the gastrointestinal absorption of the chemical in question, from a medium (e.g. water, feed) similar to the one employed in the critical study, is significantly less than 100%.

Where these conditions are not met, a default of complete oral absorption may be assumed. A review of gastrointestinal tract absorption values (ABS_{GI}), as provided in US EPA (2004), has been undertaken with the finalisation of toxicity values. Dermal toxicity values have been adjusted using an ABS_{GI} as recommended by US EPA (2004), where required.

Toxicological data for non-threshold effects are summarised in **Table 7.18** and threshold effects in **Table 7.19**.

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Table 7.18: Toxicity Criteria for Carcinogenic / Non-Threshold Endpoints

Constituent	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	Oral Slope Factor $(mg/kg/day)^{-1}$	Dermal Slope Factor $(mg/kg/day)^{-1}$	Discussion / Comments
Benzene	$6.0*10^{-6}$	$3.5*10^{-2}$	$3.5*10^{-2}$	Inhalation slope factor based on WHO unit risk of $6.0*10^{-6}$ $(\mu g/m^3)^{-1}$. Oral slope factor based on NHRMC and WHO. No adjustment for dermal slope factor. Benzene reported to be rapidly and efficiently absorbed.
Benzo(a)pyrene	$8.7*10^{-2}$	0.5	25 (soil)	Inhalation slope factor based on WHO unit risk of $8.7*10^{-2}$ $(\mu g/m^3)^{-1}$. Oral slope factor based on WHO, as adopted in NHRMC/NRMMC (2004). No adjustment for dermal slope factor. PAHs reported to be rapidly and efficiently absorbed. Dermal slope factor for exposure to water borne PAHs based on oral slope factor. Dermal slope factor for exposure to benzo(a)pyrene based on Knafla et al (2006). Adopted for dermal exposure to soil containing benzo(a)pyrene. WHO oral slope factor adopted for dermal exposure to water borne benzo(a)pyrene. Other potentially carcinogenic PAH constituents assessed as benzo(a)pyrene toxicity equivalence factors (TEF) as per the following factors: benz(a)anthracene – 0.1; benzo(b)fluoranthene – 0.1; benzo(g,h,i)perylene – 0.01; benzo(k)fluoranthene – 0.1; dibenz(a,h)anthracene – 1.0; chrysene – 0.01; and indeno(1,2,3-c,d)pyrene – 0.1.
Asbestos	Unit Risk – 0.2 $(f/ml)^{-1}$	-	-	Based on WHO increased incidence of mesothelioma and/or lung cancer, which is very similar to US EPA unit risk

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Table 7.19: Toxicity Criteria for Threshold Endpoints

Constituent	Inhalation RfC[1], mg/m^3	Oral RfD, mg/kg/day	Dermal RfD, mg/kg/day	Discussion / Comments
Ammonia	$7.0*10^{-2}$	-	-	Assessment based on ATSDR chronic MRL of 0.1ppm. No toxicity values adopted for oral and dermal exposure pathways based on guidance in all Level 1 sources of non likelihood of toxicity.
Arsenic	$1.5 * 10^{-5}$	$2 * 10^{-3}$	$2 * 10^{-3}$	Inhalation ADI based on Californian EPA values. Alternate non-threshold guidelines for arsenic available typically based on industrial; exposure scenarios. Not considered appropriate for recreational / parkland setting Barangaroo and allows consistent assessment of arsenic by threshold approach. Oral RfD based on NHMRC TDI approach. Very similar to level used by enHealth. No adjustment for dermal RfD as US EPA (2004) reports high levels of absorption.
Chromium	$5.0*10^{-3}$	1.5	$3.75*10^{-2}$	Inhalation ADI based on ATSDR guideline for chronic exposure to Cr(III) particulates. An intermediate duration MRL of $5*10^{-3}$ mg/m^3 is provided. No chronic value available for Cr(VI) particulates. Majority of chromium occurring with particulates would be reasonably considered to consist of the oxidised form of Cr. The use of an intermediate duration based value is not considered non-conservative as inhalation exposure to chromium is restricted to sub-surface maintenance workers and periodic excavation activities of occupational staff on the site. Oral RfD based on US EPA value for Cr(III). Alternate value noted to have been provided by enHeath Cr(III). However by review this is based on an outdated US EPA value. Majority of chromium occurring in soil horizons where available by oral and dermal pathways is considered to more than likely be oxidised to Cr(III) form. Adjustment for dermal RfD required as oral TDI is based on rat dosing study with water. Low rates of absorption nominated in WHO (2004). US EPA (2004) recommends adjustment by 0.025.
Copper	1.75	0.5	0.5	Oral RfD based on NHMRC. No adjustment required for dermal as copper reported to be relatively well absorbed. Inhalation RfC as based on oral RfD.
Lead	$5.0*10^{-4}$	$3.5*10^{-3}$	$3.5*10^{-3}$	Inhalation ADI based on WHO. Oral RfD based on NHMRC. No correction for dermal factor for lead. Toxicity data based on lead exposure to children. Lead absorption in children reported in WHO (2004) to be as high as 50%. Toxicity values and lead exposure assessment are also required to consider bioavailability of lead, conservatively estimated as 50% based on IARC (2006).
Cyanide (free)	$4.2*10^{-2}$	$1.2*10^{-2}$	$1.2*10^{-2}$	Inhalation ADI set equal to Oral RfD in lieu of available data. Oral RfD based on NHRMC TDI with advised correction factor of 100. Same value as recommended by WHO. More conservative than US EPA value. No adjustment for dermal factor. US EPA (1994) reports free cyanide as having high rates of absorption.
TPH $C_{>6}$-C_8 (aliphatic)	18.4	5	5	TPHCWG (1997). No adjustment for dermal RfD. Typically high levels of absorption of organic compounds reported by US EPA (2004).
TPH $C_{>8}$-C_{16} (aliphatic)	1.0	0.1	0.1	TPHCWG (1997). RfC equal to 1.0mg/m^3. No adjustment for dermal RfD. Typically high levels of absorption of organic compounds reported by US EPA (2004).
TPH $C_{>16}$-C_{35} (aliphatic)	1.0	2	2	TPHCWG (1997). Inhalation ADI set equal to $C_{>8}$-C_{16} fraction to allow assessment of inhalation via dust. No adjustment for dermal RfD. Typically high levels of absorption of organic compounds reported by US EPA (2004).
TPH $C_{>7}$-C_8 (aromatic)	0.4	0.2	0.2	TPHCWG (1997). RfC equal to 0.4mg/m^3. No adjustment for dermal RfD. Typically high levels of absorption of organic compounds reported by US EPA (2004).

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Constituent	Inhalation RfC[1], mg/m^3	Oral RfD, mg/kg/day	Dermal RfD, mg/kg/day	Discussion / Comments
TPH $C_{>8}$-C_{16} (aromatic)	0.2	$4.0*10^{-2}$	$4.0*10^{-2}$	TPHCWG (1997). RfC equal to 0.2mg/m^3. No adjustment for dermal RfD. Typically high levels of absorption of organic compounds reported by US EPA (2004).
TPH $C_{>16}$-C_{35} (aromatic)	0.2	$3*10^{-2}$	$3*10^{-2}$	TPHCWG (1997). Inhalation ADI set equal to $C_{>8}$-C_{16} fraction to allow assessment of inhalation via dust. No adjustment for dermal RfD. Typically high levels of absorption of organic compounds reported by US EPA (2004).
Benzene	$1.0*10^{-2}$	$5*10^{-4}$	$5*10^{-4}$	Inhalation ADI based on ATSDR chronic duration inhalation exposure MRL of 10µg/m^3. More conservative than US EPA value. Oral RfD based n ATSDR chronic duration oral exposure MRL. More conservative than US EPA value. No adjustment for dermal RfD. Benzene reported by WHO (2004) to be rapidly and efficiently absorbed.
Toluene	5.0	0.223	0.223	Inhalation ADI based on US EPA RfC of 5mg/m^3. WHO value not used as exposure duration of 1 week less than required averaging times proposed for risk assessment. US EPA value used instead of ATSDR value as more recent, despite ATSDR preferred in hierarchy of sources of toxicological data. Oral RfD based on NHMRC TDI. Same as WHO value. Value is similar, though less conservative than ATSDR intermediate exposure MRL and US EPA RfD. No adjustment for dermal RfD. Toluene reported by WHO (2004) to probably be absorbed completely from the gastrointestinal tract.
Ethylbenzene	0.27	$9.7*10^{-2}$	$9.7*10^{-2}$	Inhalation ADI based on ASTDR chronic duration inhalation exposure MRL of 0.06 ppm. This is more conservative then the US EPA value. Oral RfD based on NHMRC TDI. More conservative than the ATSDR intermediate duration oral toxicity MRL. Value very similar to US EPA value. No adjustment for dermal RfD. Ethylbenzene reported by WHO (2004) to be absorbed easily.
Xylene	0.87	0.179	0.179	Inhalation ADI based on ATSDR chronic MRL of 0.05ppm. Used in preference to NEHF air quality goal as based on more recent data and derived by approach consistent with human health risk assessment. Oral RfD based on NHMRC TDI. More conservative than ASTDR chronic duration oral exposure MRL and US EPA RfD. No adjustment for dermal RfD. Xylene reported by WHO (2004) to well absorbed after inhalation. No data on absorption via ingestion, though anticipated to be sufficiently high base don halation data.
Trimethylbenzenes	0.22	$6.3*10^{-2}$	$6.3*10^{-2}$	As per Ontario Air Standards for trimethylbenzenes in absence of Level 1 data able to be reviewed. RfC used as basis of RfD for oral and dermal effects.
Acenaphthene	0.21	$6.0 * 10^{-2}$	$6.0 * 10^{-2}$	Inhalation ADI set equal to oral RfD in lieu of other data. RfC equal to 0.21mg/m^3. Oral RfD based on US EPA RfD. No adjustment for dermal RfD.
Acenaphthylene	0.21	$6.0 * 10^{-2}$	$6.0 * 10^{-2}$	No values available for Acenaphthylene. Values for Acenaphthene used as surrogate. RfC equal to 0.21mg/m^3.
Anthracene	1.1	0.3	0.3	Inhalation ADI set equal to oral RfD in lieu of other data. RfC equal to 1.1mg/m^3. Oral RfD based on US EPA RfD. No adjustment for dermal RfD.
Fluoranthene	0.14	$4.0*10^{-2}$	$4.0*10^{-2}$	Inhalation ADI set equal to Oral RfD in lieu of other data. Oral RfD based on US EPA RfD. No adjustment for dermal RfD. Typically high levels of absorption of PAHs reported by US EPA (2004).
Fluorene	0.14	$4.0*10^{-2}$	$4.0*10^{-2}$	Inhalation ADI set equal to Oral RfD in lieu of other data. Oral RfD based on US EPA RfD. No adjustment for dermal RfD. Typically high levels of absorption of PAHs reported by US EPA (2004).
2-methylnaphthalene	$1.4*10^{-2}$	$4.0*10^{-3}$	$4.0*10^{-3}$	Inhalation and oral RfD based on US EPA chronic oral exposure RfD.
Naphthalene	$3.5*10^{-3}$	$2.0*10^{-2}$	$2.0*10^{-2}$	Inhalation ADI based on ATSDR chronic duration inhalation exposure MRL of 3.5µg/m^3. Similar to US EPA value. Oral RfD based on US EPA RfD value. ATSDR noted to not provide chronic duration values (acute /

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Constituent	Inhalation RfC[1], mg/m^3	Oral RfD, mg/kg/day	Dermal RfD, mg/kg/day	Discussion / Comments
				intermediate exposure values only). No adjustment for dermal RfD. Typically high levels of absorption of PAHs reported by US EPA (2004).
Phenanthrene	1.1	0.3	0.3	No values available for Phenanthrene. Values for Anthracene used as surrogate. RfC equal to 1.1mg/m^3.
Pyrene	0.1	$3*10^{-2}$	$3*10^{-2}$	Inhalation ADI set equal to Oral RfD in lieu of other data. Oral RfD based on US EPA RfD. No adjustment for dermal RfD. Typically high levels of absorption of PAHs reported by US EPA (2004).
Phenol	0.2	0.3	0.3	Inhalation ADI as per Californian EPA RfC in lieu of other data. RfC equal to 0.2mg/m^3. Oral RfD based on RfD value by US EPA. This is noted to be more recent than the alternate toxicity values presented by enHealth. No adjustment for dermal RfD. Typically high levels of absorption of organic compounds reported by US EPA (2004).
Cresols	0.35	0.1	0.1	Inhalation ADI based on ASTDR chronic duration oral exposure MRL. Oral RfD based on ASTDR chronic duration oral exposure MRL. No adjustment for dermal RfD. Typically high levels of absorption of organic compounds reported by US EPA (2004).
2,4-dimethylphenol	$7.0*10^{-2}$	$2*10^{-2}$	$2*10^{-2}$	Inhalation ADI set equal to oral RfD in lieu of other data. Oral RfD based on US EPA RfD. No adjustment for dermal RfD. Typically high levels of absorption of organic compounds reported by US EPA (2004).
Dibenzofuran	$3.5*10^{-3}$	$1.0*10^{-3}$	$1.0*10^{-3}$	Inhalation ADI as per RfD in lieu of other data. This is equivalent to an RfC of 0.0035mg/m^3. Oral RfD based on US EPA PPRTV.

Note: 1. As generally calculated from Inhalation ADI

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7.8 Odour Thresholds

Potential aesthetic impacts of environmental impact also require consideration. The most likely aesthetic impact will be odours from soils impacted with potentially volatile substances. Assessment is required to ensure that no odours related to environmental impact can be recognised at the redeveloped Barangaroo Central Site surface, or at adjoining off-site locations. This assessment will be undertaken by the comparison of maximum concentrations of each constituent to odour thresholds. Odour thresholds of all potentially malodorous constituents have been summarised in **Table 7.20**. This has been undertaken as per a literature review of several available sources for each constituent.

In reference to odour thresholds, it is noted that coal tar is the likely source of malodorous contaminants on the Barangaroo South and Central sites, and the most likely source of odour within soils brought onto the Barangaroo Central site and used as fill material. It is proposed to undertake an odour assessment of coal tar odours in addition to the speciated assessments proposed. Previous odour analysis of coal tar has been undertaken in Egis Consulting (August 2001) 'Notice of Intention for Demolition and Earthworks Former Platypus Site Neutral Bay, North Sydney'. Measurements reflected the odour strength directly above a coal tar pit. The odour strength was measured at 1,110 odour units (OU). The odour emission rate was further estimated at 290 OU/m^2.s.

Table 7.20: Summary of Odour Thresholds

Constituent	Odour Threshold	Source / Comments
Naphthalene	0.05 – 5.34 mg/m^3 0.0095 – 1.02 ppm Mean: 0.038 ppm	US EPA (1990) 'Reference Guide to Odour Thresholds for Hazardous Air Pollutants Listed in the Clean Air Act Amendments of 1990.' A series of values are given reflecting various studies. The mean value is given as the geometric mean or recommended best estimate.
	0.44 mg/m^3	US EPA Air Toxics Web Site (2000) 'Naphthalene 91-20-3'. Thresholds derived from ATSDR Toxicological Profile and Journal of Applied Toxicology article (1983).
	0.44 mg/m^3 0.021 mg/L (water)	ATSDR (2005) 'Naphthalene, 1-methylnaphthalene and 2-methylnaphthalene'.
	0.0075 - 0.42 mg/m3	WHO (2010) 'WHO Guidelines for Indoor Air Pollutants – Selected Pollutants'. Values taken from review of external studies.
	<0.3 ppm	CDC NIOSH (1978) 'Occupational Health Guideline for Naphthalene'.
	<0.3 ppm	NTP (1992) 'NTP Technical Report on the Toxicology and Carcinogenesis Studies of Naphthalene in BC63F Mice'.
	0.038 ppm	ScienceLab (2010) 'Material Safety Data Sheet: Naphthalene MSDS'.
	2.5 ug/l	Young et al (1996) 'Taste and Odour Thresholds Concentrations of Potential Potable Water Contaminants', Water Research Vol 30.2. Study indicated the odour threshold for contaminants present in water
	0.35 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*0.35mg/m^3*	
Ammonia	0.5 – 42 mg/m^3	Gemert & Nettenbreijer, (2003) 'Odour Thresholds – Compilation of Odour Threshold Values in Air, Water, and Other Media'.
	150 µg/l	US EPA (2002) 'Guide To Field Storage of Biosolids and Other Organic By-Products Used in Agriculture and for Soil Resource Management'.
	25 ppm (18 mg/m^3), 48 ppm (34 mg/m^3), 53 ppm (38 mg/m^3), 1.5ppm (water)	ATSDR (2002) 'Toxicological Profile for Ammonia'. Three sources cited for varying values.
	5.2 µg/l (air), 46.8ppm, 0.0266 -39.6mg/m^3	ToxNet (2005) 'Ammonia CASRN 7664-41-7'
	1 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*1mg/m^3*	
Cyanide	0.58ppm	US EPA Air Toxics Web Site (2000) 'Cyanide

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Constituent	Odour Threshold	Source / Comments
		Compounds 74-90-8'. Threshold for Hydrogen Cyanide.
	0.58ppm, 0.8-4.4ppm, 0.17ppm (water)	ATSDR (2006) 'Toxicological Profile for Cyanide'. Values for Hydrogen Cyanide.
Adopted	*0.64mg/m^3*	
Total Petroleum Hydrocarbons	No values provided	WHO (2004) 'Rolling Revision of the WHO Guidelines for Drinking-Water Quality'. No specific value given – states that drinking water may be unacceptable below guideline values due to odour and taste thresholds.
Benzene	1.5 ppm (5 mg/m^3)	US EPA Air Toxics Web Site (2000) 'Benzene 71-43-2'.
	1.5 ppm (5 mg/m^3)	US EPA 'National Air Toxics Program: The Integrated Urban Strategy Report to Congress'.
	34-119 ppm	ATSDR (2007) 'Toxicological Profile for Benzene'. From AIHA 1989 source.
	4.68ppm (4.9mg/m^3), 2.0mg/L (water)	ToxNet (2005) 'Benzene CASRN 71-43-2' HSCB (2010) 'Benzene 71-43-2'
	8.6 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*5mg/m^3*	
Toluene	1 mg/m^3	WHO (2000) 'Air Quality Guidelines for Europe'.
	40 – 120 µg/l	WHO (1993) 'Guidelines for Drinking Water quality'.
	2.9ppm	US EPA Air Toxics Web Site (2000) 'Toluene 108-88-3'.
	2.9ppm	Von Burg, (1993) 'Toxicology Update: Toluene', Journal of Applied Toxicology.
	8 ppm, 0.04-1ppm (water)	ATSDR (2000) 'Toxicological Profile for toluene'.
	2.14ppm (8mg/m^3)	ToxNet (2006) 'Toluene CASRN 108-88-3'
	1.2 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*1mg/m^3*	
Ethylbenzene	2 - 130 µg/l	WHO (1993) 'Guidelines for Drinking Water quality'
	2.3ppm	US EPA Air Toxics Web Site (2000) 'Ethylbenzene 100-41-4'
	20-100ppb	Von Burg, (1992) 'Toxicology Update: Toluene', Journal of Applied Toxicology Vol 12.1
	2.3ppm ,2-2.6ppm, 0.029mg/L (water), 0.14mg/L (water)	ATSDR (200) 'Toxicological Profile for Ethylbenzene'. Four sources cited for varying values
	140ppm, 0.4mg/m^3, 8.7mg/m^3	ToxNet (2005) 'Ethylbenzene 100-41-4'.
	0.8 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*0.8mg/m^3*	
Xylenes	20-1800 µg/L	WHO (1993) 'Guidelines for Drinking Water quality'.
	100 mg/m^3	AIHA (1997) 'Odor Thresholds for Chemicals with Established Occupational Health Standards'
	1.1 ppm	US EPA Air Toxics Web Site (2000) 'Xylenes (Mixed Isomers)'. M-xylene only
	1 ppm (mixed xylenes), 0.05 ppm (m-, p- or o-xylene)	ATSDR (2007) 'Toxicological Profile for Xylene'.
	6mg/m^3	ToxNet (2001) 'Xylenes CASRN 1330-20-7'.
	0.2-1.7 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*0.2mg/m^3*	
1,2,4-trimethylbenzene	0.6 mg/m^3 (adopted)	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Acenaphthene	0.08 mg/l	Gemert & Nettenbreijer, (2003) 'Odour Thresholds – Compilation of Odour Threshold Values in Air, Water, and Other Media'.
	0.08ppm, 0.02-0.22ppm, 0.51ppm	ToxNet (2001) 'Acenaphthene CASRN 83-32-9'.
	0.08ppm	Speclab (2001) 'Chemical Fact Sheet – Acenaphthene'.
Adopted	*0.5mg/m^3*	
2-methylnaphthalene	0.058–0.29 mg/m3, 0.01 mg/l (water)	ATSDR (2005) 'Toxicological Profile for Naphthalene, 1-methylnaphthalene and 2-methylnaphthalene'.
	0.01ppm, 0.02ppm, 0.05ppm	ToxNet (2005) '2-Methylnaphthalene CASRN 91-57-6'. Varying values from various studies and different air temperatures.
	0.058 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*0.058mg/m^3*	
Phenol	0.04 ppm	US EPA Air Toxics Web Site (2000) 'Phenol 108-95-2'.

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Constituent	Odour Threshold	Source / Comments
	0.040ppm, 7.9ppm (water), 1ppm (water)	ATSDR (2006) 'Toxicological Profile for Phenol'.
	0.022-0.094 mg/m^3 (0.006-0.024 ppm 0.047-0.5 ppm	ToxNet 'Phenol CASRN 108-95-2'
	0.02 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*0.02 mg/m^3*	
Dibenzofuran	1 mg/m3	US EPA Air Toxics Web Site (2000) 'Dibenzofuran 132-64-9'.
	0.78-1.6 mg/m3	ToxNet (2000) 'Dibenzofuran'. Three studies cited for varying odour thresholds.
Adopted	*0.8 mg/m^3*	
Cresol	0.00024-0.00044 mg/m^3 (0.0003 mg/m^3 adopted)	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'

This can be correlated to concentrations of site constituents through reference to the maximum levels of malodorous PAHs in samples of coal tar analysed by investigations to date. Review of **Table 7.20**, indicates the most potentially malodorous PAH constituents will be naphthalene, 2-methylnaphthalene and acenaphthene. The maximum levels of PAH impact, including the maximum summed level of these constituents, was reported in Coffey Environments (2008) 'Preliminary Environmental Investigation at Hickson Road' at sample location MW10, at a depth of 8.6 to 8.7m. Review of the borelog at this sample depth indicates the sample consisted of of tar impacted sandstone. The total concentration of acenaphthene, naphthalene and 2-methylnaphthalene was reported as 18 361 mg/kg.

By assuming a porosity of 0.2 for sandstone, and assuming that porosity was filled with tar, it can be expected that the odour strength of the sandstone sample would have been measured at 20% of the maximum value reported in Egis (2001), equal to 222 OU. This would further imply that a sum concentration of 165mg/kg of naphthalene, 2-methylnaphthalene and acenaphthene would be anticipated to have an odour strength of 2 OU at the surface of the exposed surface. It is recognised that odours would dilute between the location of the occurrence of the 2 odour units, and where the human exposure to odours may occur. A level of 2 OU has been used as this is the lowest odour recognition criteria provided in DEC (2006) 'Assessment and management of odour from stationary sources in NSW'.

An assessment of the odour strength of coal tar shall be undertaken by assessing the odour caused at the site surface by sub-surface soils which have a combined level of acenaphthene, naphthalene and 2-methylnaphthalene of 165 mg/kg or greater. The extent of dilution of vapour from soils above this level of impact (between the source soils and the point of human exposure) will be estimated from the results of the associated fate and transport modelling undertaken for the speciated assessment of each of the constituents. It will be required to be demonstrated that the extent of dilution (measured as a fraction of the source vapour concentration) exceeds the extent by which the sum of the nominated malodorous constituents exceeds 165 mg/kg.

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7.9 Background Concentrations

Background / environmental contributions of each of the COPCs via oral and dermal pathways has generally been characterised by the review of NHMRC/NRMMC (2004) 'Australian Drinking Water Guidelines', Food Standards Australia and New Zealand (2003) 'The 20th Australian Total Diet Survey' and documents for each of the relevant COPCs. Background levels of the COPCs via an inhalation pathway in an Australian setting, were generally not identified in the toxicological review. Estimates of inhalation exposures to COPCs from background sources have been determined by review of:

- NSW DEC (December 2004) 'Ambient Air Quality Research Project (1996-2001) Internal working paper no. 2 Ambient concentrations of toxic organic compounds in NSW';
- NSW DEC (December 2004) 'Ambient Air Quality Research Project (1996-2001) Internal; working paper no. 3 Ambient Concentrations of Polycyclic Aromatic Hydrocarbon Species in NSW'; and
- NSW DEC (December 2004) 'Ambient Air Quality Research Project (1996-2001) Internal working paper no. 4 Ambient concentrations of heavy metals in NSW'.

To remain conservative, airborne levels of COPCs recorded in the Sydney CBD, or the wider Sydney area, have been used for each of the COPCs. These are generally the highest levels for each COPC. A range of measured airborne values is provided for each constituent. In general, the mid-point of the range of values reported in the relevant DEC document has been adopted as the background concentration. However, for the case of benzene and trimethylbenzene, it is noted that the majority of benzene and trimethylbenzene emissions are attributable to the use of petroleum products (i.e. motor vehicle exhaust emissions). It is further noted that with the prevalence of modern fuels, the extent of aromatic constituents, particularly benzene and trimethylbenzenes, has been reduced. On this basis, the lower of the reported values for benzene and trimethylbenzene has been adopted as the background concentration

Background levels of COPCs are summarised in **Table 7.21**.

Table 7.21: Summary of Background Exposures to COPCs

COPC	Background Exposure	
	Oral / Dermal	Inhalation
Arsenic	0.04 mg/day[3] 0.03-0.06mg/day[7]	0.51 ng/m^3 [(1)]
Chromium	0.01 mg/day [3,4]	No data
Copper	1.15 mg/day[11]	No data
Lead	0.1 mg/day[3, 8] 0.001-0.03mg/day[7, 8]	48 ng/m^3 [3, 8]
Cyanide	0.04 mg/day[3,4]	No data
Total petroleum hydrocarbons	No data	No data
Benzene	Negligible[3]	0.4 ppb[9] (1.3µg/m^3)
Toluene	Negligible[3]	4.2 ppb[1] (15.4µg/m^3)
Ethylbenzene	Negligible[3]	0.5 ppb[1] (2.2µg/m^3)
Xylene	Negligible[3]	3.0 ppb[1] (13.1µg/m^3)
Trimethylbenzenes	No data	0.1 ppb[9, 10] (0.5µg/m^3)
PAHs (total)	1 µg/day[3,4,6]	3.90 ng/m^3 [(2)]
Benzo(a)pyrene	As per PAHs[3]	0.40 ng/m^3 [(2)]
Phenols	No data	No data
Asbestos	Nil	Nil

Note: 1. DEC (December 2004) overall average for Sydney CBD
2. DEC average of mean summer (Sydney) and winter (Sydney CBD) concentrations
3. NHMRC/NRMMC (2004)
4. as derived from reported concentration in drinking water of 0.005mg/l and assumption of adults drinking 2L/day.
5. Average of reported range of values
6. Incorporating estimate of food exposure being an order of magnitude higher then water exposure.
7. Food Standards Australia and New Zealand (2003), range of intake from food consumption for adult males and females

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8. Exposure assessment also requires consideration of bioavailability of lead
9. DEC (December 2004) lower range of reported values for Sydney CBD
10. Sum of 1,2,4- and 1,3,5-trimethylbenzene
11. Estimated background intakes provided to enHealth (2001) 'Health Based Soils Investigation Levels', as based on a 2 year old.

For constituents where no data are available, it has been assumed that background / environmental exposures are negligible. The consideration of background exposures into the derivation of risk based criteria for imported fill to Barangaroo Central is detailed further in **Section 9**.

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8 Human Exposure Assessment

8.1 Exposure Scenario(s) Requiring Risk Assessment

A number of potential human exposure scenarios are required to be assessed for the proposed Barangaroo Central developments for the range of identified land-uses. The exposure assessment considers only the potential exposures that may derive from site materials imported as fill to the Barangaroo Central site. These exposure scenarios are summarised in **Table 8.1** following.

Table 8.1: Summary of Required Exposure Scenarios

Source	Exposure Pathway	Location	Receptor
Soil	Inhalation Dermal contact Ingestion (i.e. oral)	Recreational / open space areas	Adult Recreational Receptor Child Recreational Receptor
	Inhalation (dust and vapour) Dermal contact Ingestion (i.e. oral)	Recreational / open space areas	Commercial / industrial (Greenkeeper / Gardener)
	Inhalation (dust and vapour) Dermal contact Ingestion	Services Trench (within Recreational / open space areas / Surface Car Park)	Sub-surface Maintenance Worker
	Inhalation	Surface Car Park (Barangaroo Stage 1 Public Domain only)	Adult Recreational Receptor Child Recreational Receptor
	Inhalation of Indoor air	Basement Car Park	Resident (Adult / Child)
	Inhalation of Indoor air	Residential apartments (overlying basement car park)	Resident (Adult / Child)
	Inhalation of Indoor air	'Cultural Space'	Commercial / industrial Recreational user (Adult / Child)
Groundwater (impacted by imported soils leaching)	Inhalation (pooled seepage water) Dermal contact (pooled seepage water)	Car Park / Basements	Commercial / industrial (car park attendant) – inhalation only Resident (Adult / Child)

Each of these exposure scenarios are required to be assessed by risk modelling. The characterisation and approximation by modelling of the physical parameters for each potential exposure scenario is summarised following.

8.2 Discussion of Exposure Scenarios

8.2.1 Open Space / Recreational Areas

The western portion of the Barangaroo Central will predominantly consist of an open vegetated area of recreational space. The majority of the site, as per the interim Barangaroo Stage 1 Public Domain development plan, will consist of open space area. Recreational receptors, potentially consisting of adults and children, would potentially be exposed to:

- Impact present in surface soils (formed by imported fill) by oral and dermal pathways; and
- Impact present throughout the soil profile (formed by imported fill) by inhalation of vapours.

Potential inhalation of dusts has not been considered for recreational receptors. The likely status of the recreational area within an iconic CBD development would dictate the maintenance of site surfaces to prevent the occurrence of any significant areas generating dusts. However, potential exposure of commercial workers (i.e. gardeners, landscapers etc.) has been considered noting that they will often be engaged in areas of open space areas where ground cover may be reduced.

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Sub-surface maintenance workers, or the commercial workforce provided to the Park (i.e. landscapers, gardeners etc.) may be potentially engaged in open space areas, including sealed surface car park areas proposed with the Barangaroo Stage 1 Public Domain, in the future, for either the installation or repair of sub-surface services. These workers have been assumed to be engaged within trenches with limited ventilation. JBS has been advised by BDA that sub-surface services should not extend below 0.5 m below ground surface in the open space areas of Barangaroo Central. Groundwater is not anticipated to occur in these shallow excavations. Oral / dermal exposure to seepage water / perched water flowing into excavations will therefore not occur.

Sub-surface maintenance workers, or commercial workers undertaking periodic sub-surface works, would be potentially exposed to:

- Impact present in soils (sourced from imported fill) over the depth of the excavation by oral and dermal pathways and inhalation of dusts and vapours; and
- Impact present throughout the soil profile (sourced from imported fill, below the depth of the base of the trench / excavation) by inhalation of vapours.

Residential occupants of the residential buildings would also be anticipated to use the recreational / open space areas. However, risk assessment of recreational receptor exposure to open space areas will be protective of potential residential occupant exposures.

8.2.2 Surface Car Park

A paved car parking area is proposed at the southern portion of the site within the Barangaroo Stage 1 Public Domain development. Recreational users of the car park will be potentially exposed to soil impact underlying the car park area by inhalation pathways only. This area will eventually be developed as predominantly recreational open space in the proposed long term development of the site. Potentially more sensitive exposures will occur with the use of this area for recreational purposes, as potential oral and dermal exposures may occur, and longer exposure durations would be anticipated. On this basis, no specific assessment has been undertaken of exposure scenarios associated with the surface car park. Risk assessment and associated criteria as derived for open recreational spaces are considered adequately protective of potential exposures associated with the surface car park.

8.2.3 Basement Car Park

Potential receptors within the Car Park have been identified as commercial / industrial workers (employed as 'car park attendants') and occasional users including residential adults and children.

It is noted with this design that no imported soils are proposed to be placed underlying the Basements. Substantial excavations are required for the Car Park, indicating that surplus soils would be generated by the development works.

There is potential that imported fill materials will be placed adjoining the Car Park. Vapours from these soils may migrate laterally to the extent of the Car Park. There is also potential that surface water infiltrating through imported fill placed in proximity of the basement will discharge into the basement as seepage water. Where imported fill materials leach impact, they may cause seepage water to be impacted.

Residential users of the car park would also be potentially exposed to infiltrating seepage water via dermal exposure (i.e. splashing in puddles). There is little potential for sufficient infiltrating seepage water to be present to substantiate oral ingestion of

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seepage. Volatile constituents will also potentially volatilise from pooled seepage water and impact basement users. Residential and commercial users of the basement would be potentially exposed via inhalation to vapours from volatilising seepage water and vapours as migrating laterally into the basement.

Noting the anticipated substantial depth of the basements below the depth of groundwater, it is considered highly unlikely that sub-surface services would be constructed below the basements. There has been no consideration of the potential exposure of sub-surface maintenance workers completing work underlying basements.

8.2.4 Residential Apartments

The proposed residential buildings will comprise the construction of multi-storey above-ground residential units above multiple basement car parking levels. Vapours within the basements, as discussed in the preceding section, will potentially migrate into the overlying residential building. Vapours would be diluted in the basement car parks prior to migration into overlying residential buildings.

On this basis, residential occupants of the commercial building will be potentially exposed by inhalation to laterally migrating vapours from imported fill and volatilised constituents from impacted seepage water accumulated within basements.

8.2.5 'Cultural Space'

A 'Cultural Space' is proposed to be constructed on Barangaroo Central. Two options are currently proposed for the Cultural Space including:

- Integration of the Cultural Space within the existing Residential Buildings at the eastern portion of the site; or
- Construction of a Cultural Space as a structure with a concrete slab, potentially partially submerged in sections, with concrete walls as appropriate similar in construction to the concrete slab, by contouring of soils at the perimeter, in the proximity of the current 'Amphitheatre Building' as shown on **Figure 4** at the north-west of the Barangaroo Central Site.

The potential exposure of occupants of a Cultural Space within the existing residential building is anticipated to be less sensitive than the residential occupants of the same building. Hence risk assessment undertaken for residential users of residential buildings will be protective of potential recreational and commercial uses that will occur with a Cultural Space.

Occupants of a Cultural Space constructed as building with a concrete slab will be potentially exposed to impact in imported fill material by inhalation pathways. Vapours will potentially migrate laterally and upwards into the Cultural Space Building. Commercial and recreational users (adult and children) will be required to be assessed for potential inhalation exposure.

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8.3 Exposure Parameters

Exposure parameters are required for each of the potentially exposed populations listed in **Table 8.1**. The exposure parameters selected for risk modelling are summarised in **Tables 8.2** to **8.8**. In developing exposure parameters, it is noted that no specific sub-surface works exposure parameters have been provided for commercial workers (i.e. landscapers / gardeners) within the Park. It is considered that the conservatism of the sub-surface maintenance worker assessment will be protective of the potential incidental sub-surface exposures of the regular Park workforce.

Table 8.2: Global Parameters –Residential Receptor (Adult & Child) – New Residential Buildings / Basement

Exposure Parameter	Units	Factor	Reference
Exposure Frequency	days/year	365	enHealth (2001)
Exposure Frequency (exposure to pooled seepage water in car park)	days/year	24	Assumption of twice per month
Exposure Duration	years	70	enHealth (2001)
Exposure Time (Residential Building)	hours	20	enHealth (2004)
Exposure Time (Car Park)	hours	1 0.5	Conservative assumption for likely maximum time spent in basement for adult. Conservative assumption for likely maximum time spent in basement for child.
Body Weight	kg kg kg	13.2 34.5 70	Child 0-5 years, enHealth (2004) Child 6-15 years, Langley & Sobardo (1996) as per NEPC (1999) mean body weight for 10 year old child Adult 16+ years, NEPC (1999)
Averaging Time - non Threshold	years	70	enHealth (2004)
Averaging Time - Threshold	years	70	enHealth (2004)

Table 8.3: Global Parameters –Recreational Receptor (Adult & Child) – Recreational / Open Space Areas and and 'Cultural Space' User

Exposure Parameter	Units	Factor	Reference
Exposure Frequency	days/year	265	enHealth (2004) – based on 365 days/year as subtracted of a typical number of 100 raindays per year for Park users
	days/year	365	enHealth (2004) used for indoor areas of the Cultural Space – no consideration of rainfall for Cultural Space receptors as building enclosed
Exposure Duration	years	6 10 54	Child 0-5 years, enHealth (2004) Child 6-15 years, enHealth (2004) Adult 16+ years, enHealth (2004)
Exposure Time	hours	2	NEPC (1999)
Body Weight	kg kg kg	13.2 34.5 70	Child 0-5 years, enHealth (2004) Child 6-15 years, Langley & Sobardo (1996) as per NEPC (1999) mean body weight for 10 year old child Adult 16+ years, NEPC (1999)
Averaging Time – non Threshold	years	70	NEPC (1999)
Averaging Time – Threshold	years	70	NEPC (1999)

Table 8.4: Global Parameters – Adult Commercial / Industrial Workers – Car Park Attendants, 'Cultural Space' Staff, and Greenkeepers / Landscapers

Exposure Parameter	Units	Factor	Reference
Exposure Frequency	days/year	240	enHealth (2004)
Exposure Duration	years	30	enHealth (2004)
Exposure Time	hours	8	enHealth (2004)
Body Weight	kg	70	NEPC (1999)
Averaging Time – non Threshold	years	70	NEPC (1999)
Averaging Time – Threshold	years	30	NEPC (1999)

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Table 8.5: Global Parameters – Adult Maintenance Worker

Exposure Parameter	Units	Factor	Reference
Exposure Frequency	days/year	15	Assumption of maximum time spent undertaking maintenance works, three working weeks
Exposure Duration	years	1	Based on single event only
Exposure Time	hours	8	NEPC (1999) as per commercial / industrial worker
Body Weight	kg	70	NEPC (1999)
Averaging Time – non Threshold	years	70	NEPC (1999)
Averaging Time – Threshold	years	1	Based on single event only

Table 8.6: Ingestion Parameters (Soil)

Exposure Parameter	Units	Factor	Reference
Sub-Surface Maintenance Worker	mg/day	330	US EPA (1991)
Commercial / Industrial Worker (Gardener / Landscaper)	mg/day	25	NEPC (1999)
Adult Recreational Receptor	mg/day	25	NEPC (1999)
Child Recreational Receptor (6-15 years)	mg/day	50	enHealth (2004)
Child Recreational Receptor (1-5 years)	mg/day	100	NEPC (1999)

Table 8.7: Dermal Contact Parameters – Skin Area

Exposure Parameter	Units	Factor	Reference
Exposed skin surface Sub-Surface Maintenance Worker	cm^2	3 870	US EPA (1997). 50^{th} percentile male surface areas assuming to be wearing short sleeved shirt and long pants.
Exposed skin surface Adult Recreational Receptor	cm^2	4 700	Langley (1993). 24% body area exposed including head, hands, forearms and lower legs.
Exposed skin surface Commercial Industrial (Gardener)	cm^2	4 700	Langley (1993). 24% body area exposed including head, hands, forearms and lower legs. Used for exposure to soils and exposure to irrigation water when moving sprinklers.
Exposed skin surface Child Recreational Receptor (6-15 years)	cm^2	3 480	Langley (1993). Older child (9-12 years) with total surface area of 11,600cm^2 with 30% exposed.
Exposed skin surface Child Recreational Receptor (0-5 years)	cm^2	2 158	Langley (1993). Young child (3-6 years) with average total surface area of 7,195cm^2 with 30% exposed. Also adopted for park sprinkler irrigation.
Exposed skin surface Adult Residential Car Park User – infiltrating seepage water	cm^2	904	Hands only. 50^{th} percentile values, US EPA (2004)
Exposed skin surface Child Residential Car Park User (6-15 years) – infiltrating seepage water	cm^2	633	Hands only. US EPA (2004) 10-11 year old.
Exposed skin surface Child Residential Car Park User (0-5 years) – infiltrating seepage water	cm^2	313	Hands only. US EPA (2004) 2-3 year old.

Table 8.8: Dermal Contact Parameters – Soil Adherence Rates

Exposure Parameter	Units	Factor	Reference
Soil adherence – Sub-Surface Maintenance Worker	$mg/cm^2/day$	1.5	US EPA (1989)
Soil adherence – Adult Recreational Receptor	$mg/cm^2/day$	0.5	enHealth (2004)
Soil adherence – Commercial / Industrial Worker	$mg/cm^2/day$	0.5	enHealth (2004)
Soil adherence – Child Recreational Receptor (6-15 years)	$mg/cm^2/day$	0.5	enHealth (2004)
Soil adherence – Child Recreational Receptor (0-5 years)	$mg/cm^2/day$	0.5	enHealth (2004)

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8.4 Estimation of Inhalation Exposure

Inhalation exposures have been estimated by the approach in US EPA (January 2009) '*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)*'. Equations are provided here for estimating exposure concentrations for assessing cancer risks and for calculating hazard quotients from chronic exposures as per the following:

EC = (CA * ET * EF * ED)/AT (cancer risks)

EC = (CA * ET * EF * ED)/AT (hazard quotients)

Where: EC – exposure concentration (µg/m^3);

CA – contaminant concentration in air (µg/m^3);

ET – exposure time (hours/day)

EF – exposure frequency (days/year)

ED – exposure duration (years)

AT – averaging time, cancer risks (lifetime in years * 365 days/year * 24 hours/day)

AT – averaging time, hazard quotient (ED in years * 365 days/year * 24 hours/day)

Table 8.9, following, summarises each of the adjustment factors to be used for each of the receptors assessed by the risk assessment.

Table 8.9: Summary of Factors to Adjust Airborne Concentrations for Inhalation Exposure

Receptor	Media	Cancer Risks (EC)	Hazard Quotients (EC)
Residential (Adult and Child) Residential Building	Soil, volatilisation from infiltrating seepage water	0.833 * CA	0.833 * CA
Residential (Adult), Car Park	Soil, volatilisation from infiltrating seepage water	$3.21*10^{-2}$ * CA	$4.17 * 10^{-2}$ * CA
Residential (Child), Car Park	Soil, volatilisation from infiltrating seepage water	$4.76*10^{-3}$ * CA	$2.08*10^{-2}$ * CA
Recreational (Adult and Child) – Open Space	Soil	$6.05*10^{-2}$ * CA	$6.05*10^{-2}$ * CA
Recreational (Adult and Child) – Cultural Space	Soil	$8.33*10^{-2}$*CA	$8.33*10^{-2}$*CA
Sub-Surface Maintenance Worker	Soil	$1.96*10^{-3}$ * CA	$1.37*10^{-2}$ * CA
Commercial / industrial User (Cultural Space / Basement Car Park Attendant)	Soil volatilisation from infiltrating seepage water (basement car park only)	$9.34*10^{-2}$ * CA	0.219 * CA

Assessment of acute risks is advised to be undertaken by direct comparison to the contaminant concentration in air. It is noted that inhalation toxicity data, summarised in **Section 7**, has been converted to slope factors on the basis of a rate of inhalation of 20m^3/day and an adult body weight of 70 kg.

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8.5 Estimation of Oral and Dermal Exposure

Oral and dermal exposures have been adjusted using the exposure parameters in **Section 8.3** as per the relationships provided to the relevant US EPA Risk Assessment Guidance for Superfund guidelines. These calculations have been undertaken using the RISC v4.03 package. Equations used in the RISC v4.03 modelling package are provided as **Appendix B**.

8.6 Estimation of Airborne Concentration

Airborne concentrations have been for constituents as vapour concentrations (by movement of vapours through soils to the area of exposure); as levels contained within particulates for exposure scenarios where dust generation may occur; and by volatilisation of pooled seepage in basements. These calculations have been undertaken as described in the following sections.

8.6.1 Vapour from Soil

Vapour concentrations have only been estimated for constituents that are considered to be volatile. This has been undertaken by a review of Henry's Law constants for each constituent as summarised in **Table 8.10** following. Constituents which are found to have a Henry's Law constant below $1*10^{-5}$ atm-m^3/mol are considered to be non-volatile and unlikely to pose a significant health risk via the vapour intrusion pathway as per US EPA (2004) '*User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings*'.

Table 8.10: Summary of Henry's Law Constants for COPCs

COPC	Henry's Law Constant (atm-m^3/mol)	Reference / Source / Comments
Ammonia	$1.6*10^{-5}$	Risk Assessment Information System, conversion by US EPA On-line Tools for Site Assessment Calculation at 25°C
Arsenic	-	Non volatile
Cadmium	-	Non volatile
Chromium	-	Non volatile
Cobalt	-	Non-volatile
Copper	-	Non-volatile
Lead	-	Non volatile
Nickel	-	Non volatile
Cyanide	$1.33*10^{-4}$	US EPA (November 2010) as based on hydrogen cyanide
Benzene	$5.55*10^{-3}$	US EPA (November 2010)
Toluene	$6.64*10^{-3}$	US EPA (November 2010)
Ethylbenzene	$7.88*10^{-3}$	US EPA (November 2010)
Xylenes	$5.18*10^{-3}$	US EPA (November 2010) as based on xylenes mixture
1,2,4-trimethylbenzene	$6.16*10^{-3}$	US EPA (November 2010)
Styrene	$2.75*10^{-3}$	US EPA (November 2010)
TPH C_6-C_8 (ali)	1.27	TPHCWG (1997), conversion by US EPA On-line Tools for Site Assessment Calculation at 25°C
TPH C_8-C_{16} (ali)	3.24	TPHCWG (1997), conversion by US EPA On-line Tools for Site Assessment Calculation at 25°C
TPH C_8-C_{16} (aro)	$3.50*10^{-3}$	TPHCWG (1997), conversion by US EPA On-line Tools for Site Assessment Calculation at 25°C
TPH $C_{>16}$ (ali)	159	TPHCWG (1997), conversion by US EPA On-line Tools for Site Assessment Calculation at 25°C. Considered to be non-volatile for the purposes of vapour modelling.
TPH $C_{>16}$ (aro)	$3.24*10^{-4}$	TPHCWG (1997), conversion by US EPA On-line Tools for Site Assessment Calculation at 25°C. Considered to be non-volatile for the purposes of vapour modelling.
Acenaphthene	$1.84*10^{-4}$	US EPA (November 2010)
Acenaphthylene	$1.14*10^{-4}$	Risk Assessment Information System, conversion by US EPA On-line Tools for Site Assessment Calculation at 25°C
Anthracene	$5.56*10^{-5}$	US EPA (November 2010)
Benzo(a)pyrene	$4.57*10^{-7}$	US EPA (November 2010)
Fluoranthene	$8.86*10^{-6}$	US EPA (November 2010)
Fluorene	$9.62*10^{-5}$	US EPA (November 2010)
2-methylnaphthalene	$5.18*10^{-5}$	US EPA (November 2010)
Naphthalene	$4.40*10^{-4}$	US EPA (November 2010)
Phenanthrene	$4.25*10^{-5}$	Risk Assessment Information System, conversion by US

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COPC	Henry's Law Constant (atm-m^3/mol)	Reference / Source / Comments
		EPA On-line Tools for Site Assessment Calculation at 25°C
Pyrene	$1.19*10^{-5}$	US EPA (November 2010)
Phenol	$3.33*10^{-5}$	US EPA (November 2010)
2,4-dimethylphenol	$9.51*10^{-7}$	US EPA (November 2010)
Cresols	$1.20*10^{-6}$	US EPA (November 2010) as based on o-cresol
Dibenzofuran	$2.13*10^{-4}$	US EPA (November 2010)

On the basis of **Table 8.11**, inhalation of vapours assessment is not required for the heavy metals, TPH $C_{>16}$ fractions, 2,4-dimethylphenol, cresols and heavier PAHs which are being assessed as benzo(a)pyrene and TEFs, and fluoranthene.

8.6.2 Particulates

NHMRC (1996) 'Ambient Air Quality Goals Recommended by National Health and Medical Research Council' recommends an annual level of 90 µg/m^3 of total suspended particulates. This has been adopted in NSW DEC (2005) 'Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales' as an air quality impact assessment criteria. On this basis it has been assumed that dust levels within an excavation for the maintenance of sub-surface services will be at a consistent maximum concentration of 90 µg/m^3. Constituent concentrations have been assumed to be present within particulates as occur in the soils (i.e. a soil constituent present in soils at a concentration of 1 mg/kg will occur in the excavation atmosphere at $9*10^{-8}$ mg/m^3).

8.6.3 Volatilised Constituents from Seepage Water in Basement

Seepage water may potentially accumulate in localised areas of the Basement Car Park due to infiltration through cracks and joints in the basement walls. Contaminants which are present in seepage water will potentially volatilise into the Car Park atmosphere. Exposure to seepage water may occur by direct contact of Car Park occupants, or volatilisation of constituents out of the pooled water into human breathing zones.

Volatilisation of constituents out of pooled seepage water in the car park has been undertaken using the method in US EPA (November 1994) 'Air Emissions Models for Waste and Wastewater' (US EPA 1994). US EPA (1994) provides equations for estimation of organic constituent emissions from pooled water. The equations provided to the emissions model for impoundments and open tanks which are flowing have been adopted for the calculations here. Details of equations and associated calculations are provided in **Appendix B**.

Estimated airborne concentrations of each of the potentially volatile constituents are provided in **Table 8.11**. It is noted that no calculations have been undertaken for TPH. This is consequent of the combined effect of the uncertaintites of the theoretical leaching relationships and Henry's Law constants for the approximated TPH fractions. It is considered for this scenario that consideration of the each of the potentially volatile speciated constituents will be protective of TPH.

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Table 8.11: Summary of Estimated Airborne Concentrations from Volatilisation from Pooled Seepage Water as based on unit Concentration in Seepage Water

Potentially Volatile Constituent	Airborne Concentration as Predicted Based on Unit Concentration (1 mg/L) of Constituent in Seepage Water (mg/m^3)
Ammonia	$6.03*10^{-4}$
Cyanide	$7.84*10^{-3}$
Benzene	$5.78*10^{-2}$
Toluene	$5.61*10^{-2}$
Ethylbenzene	$5.50*10^{-2}$
Xylenes	$5.53*10^{-2}$
1,2,4-trimethylbenzene	$4.88*10^{-2}$
Acenaphthene	$4.14*10^{-3}$
Acenaphthylene	$2.42*10^{-3}$
Anthracene	$1.10*10^{-3}$
Fluorene	$2.03*10^{-3}$
2-methylnaphthalene	$1.25*10^{-3}$
Naphthalene	$1.02*10^{-2}$
Phenanthrene	$7.73*10^{-4}$
Pyrene	$1.94*10^{-4}$
Phenol	$1.11*10^{-5}$
Dibenzofuran	$4.15*10^{-3}$

8.7 Use of RISC Modelling Package

The RISC v4.03 modelling package has been used for modelling to estimate airborne concentrations of constituent vapours.

RISC uses risk equations based on those provided in US EPA Risk Assessment guidance (RAGS Guidelines). These are noted in NEPC (1999) as being appropriate for use in human health risk assessment. Chemical parameters provided to the RISC model have been updated to comply with NEPC (1999) and NSW DECCW guidance where specific guidance is provided (i.e. source of toxicity data). Exposure parameters have likewise also been based on NEPC and enHealth guidance where available. Updated parameters are detailed throughout this risk assessment document. Other parameters, as provided within the RISC package (i.e. physical properties of modelled constituents), have not been altered in use of the RISC package.

In undertaking modelling of vapour migration into buildings a default value of 5 L/min as advised in US EPA (2004) '*User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings*' for all indoor modelling scenarios (i.e. Car Park) has been used to estimate the rate of soil gas flow into a building.

The RISC model uses Johnson & Ettinger relationships in estimating transport of volatile constituents into human breathing zones. US EPA (2003) reports that the use of Johnson & Ettinger relationships is appropriate in undertaking human health risk assessments. The amendments to the RISC model described above ensure that RISC is behaving as closely as possible to the most recent guidance for the use of the Johnson & Ettinger relationships.

8.8 Characterisation of Open Space / Recreational Outdoor Areas

Outdoor areas in RISC are characterised by a box model. The default parameters provided to RISC for outdoor air exposures will be used in the modelling here. It is noted that an outdoor wind speed of 2 m/s has been used in the modelling.

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8.9 Characterisation of Sub-Surface Maintenance Trench/ Excavation

Sub-surface maintenance trenches have been assumed to be placed to a maximum depth of 0.5 m in accordance with the advice from BDA. A trench of this depth that is excavated in a fashion that is safe for a sub-surface maintenance worker to enter will most likely be subject to normal rates of ambient ventilation. The trench has been modelled as being subject to rates of ventilation consistent with normal outdoor wind speeds.

8.10 Characterisation of Indoor Spaces

8.10.1 Car Park

The Car Park has been assumed to be constructed with a pavement thickness of 150 mm. Default crack width and porosity parameters provided to the RISC model have been used to characterise the pavement.

Residential and commercial / industrial receptors will potentially be exposed within the Car Park. The majority of commercial / industrial exposures are anticipated to be restricted to the Car Park Attendants Office. Residential users of the Car Park would have exposures across the area of the Car Park and within the Car Park Attendants Office. On this basis, in undertaking volatilisation modelling, it has been assumed for both receptors that the exposures occur within the Car Park Attendant's Office.

Noting that finalised designs are not available for the proposed construction of a Car Park Attendant's Office, the standard building dimensions as provided to RISC have been used to characterise this space / building. This is a small office within the larger Car Park structure. These are summarised following:

- Building volume – 400 m^3;
- Building cross-sectional area – 150 m^2;
- Fraction of foundation present as cracks – 0.001;
- Porosity in foundation cracks – 0.25; and
- Water content in foundation cracks – 0.

It is noted that these dimensions are not representative of the volume of the Car Park structure as a whole, but an office / room that may be constructed within the Car Park.

The proposed ventilation of the Car Park has been determined in accordance with AS1668.2-2002 '*The use of ventilation and air conditioning in buildings Part 2: Ventilation design for indoor air contaminant control (excluding requirements for the health aspects of tobacco smoke exposure)*'. The ventilation calculations for the Car Park have been based on a consideration of the whole volume of the Car Park, which is distinct from the Car Park Attendant's Office described above.

It has been assumed that the Car Park will be provided with sufficient ventilation to achieve a fresh / outdoor air flow rate of 3 L/s per m^2. BDA have advised that the car park will be constructed with a typical roof height of 3m. On this basis, an air exchange rate of 3.5 volume changes per hour is estimated for the car park.

Car Park users have also been modelled as being potentially exposed to impacted seepage water, which may migrate through the walls of the Car Park, as discussed in **Section 8.6.3**.

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8.10.2 'Cultural Space'

The proposed design of the 'Cultural Space' is the subject of a future planning application, and final design plans are not available. Default building dimensions and porosity parameters provided to the RISC model have been used to characterise the Cultural Space building for the purposes of risk modelling, as summarised in **Section 8.10.1**.

The project ventilation consultant to the adjacent Headland Park Site previously advised that the Cultural Space building to be constructed in the Headland Park would be ventilated at a rate of 0.7 volume changer per hour, as per JBS (2011). This rate of ventilation has been adopted for the modelling here.

8.10.3 Residential Building

Little information is available on the proposed design of residential buildings. It is anticipated that dwelling dimensions within the residential building will be similar to the default building dimensions provided in the RISC model, as summarised in **Section 8.10.1**. The default values have, therefore, been adopted to characterise the buildings pavements along with default porosity parameters and fraction of pavement cracks to characterise vapour movement through pavements. In adopting these values it is assumed that the Residential Building will be constructed with suspended concrete slabs, which is considered appropriate in the absence of detailed design plans.

A ventilation rate of 0.5 volume changes per hour, as recommended by ASTM (2002) for a residential building (based on an air exchange rate of 0.00014/s) has been used for the residential building occupancies.

It is noted that sub-surface vapours which enter the residential building will firstly migrate into the underlying basement car park. Hence, assessment of potential vapour levels in the residential apartments will be required to recognise vapour dilution that occurs in the underlying car parks by the ventilation rate of 3.5 volume changes per hour.

8.10.4 Vapour Flow into Buildings

BDA has advised that there will be no provision for vapour controls on the proposed buildings. Soils which will potentially generate contaminant vapours will be placed as fill material both adjoining and underlying a Cultural Space Building as constructed at the north-west of Barangaroo Central, and as fill material adjoining basements / car parks.

Vapours are anticipated to migrate upwards into Buildings from underlying soils. Imported fill materials will potentially be placed underlying the Cultural Space.

A review has been undertaken of the potential for lateral migration of vapours to occur to buildings. Recent three dimensional sub-surface soil vapour migration studies reported in Bozkurt O, Pennell K and Suubery E (2009) '*Simulation of the Vapor Intrusion Process for Nonhomogeneous Soils Using a Three Dimensional Numerical Model*' in Ground Water Monitoring & Remediation (Boskurt et al 2009) and Pennell K, Bozkurt and Suuberg E (2009) '*Development and Application of a Three Dimensional Finite Element Vapor Intrusion Model*' in Journal of the Waste Management Association (Pennell et al 2009) indicate that significant lateral migration of soil vapours may occur in the proximity of buildings.

Vapour migration into buildings is reported to occur by advection where there is a pressure differential between the building interior and the sub-surface. Commercial buildings, such as the 'Cultural Space' of the residential buildings, are reported to commonly be at negative pressures relative to the surrounding environment. This relative negative pressure draws sub-surface soil vapours into the structures through

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cracks and joins that occur in the building pavement / slab. Pennell et al (2009) describe this as a 'chimney effect' that results in a flow of soil gas into the building through breaches in the foundation. This causes a concentration gradient-driven upward diffusion of a sub-surface contaminant toward the ground surface in the proximity of the building. A portion of the upward diffusing contaminant is captured by and carried with the advective flow entering the structure. Diffusion of the contaminant through building foundation cracks also occurs.

Soil vapour flow modelling is reported by Bozkurt et al (2009) using a small building at a negative pressure within a large area of contamination (100 m * 100 m). Soil gas outside the area of the structure was reported to be drawn toward a structure. Where the airflow of soil gas crossed an area of nonzero contaminant vapour concentration, it was reported that the contaminant vapour was carried with the soil gas into the structure.

Lowell P S and Eklund B (April 2004) '*VOC Emission Fluxes as a Function of Lateral Distance from the Source*' in Environmental Progress provide an assessment of the extent of potential lateral movement of soil vapours into buildings. Lowell and Eklund state that emission flux and the soil-gas concentration are insignificant within a relatively short distance from the source. A conservative upper estimate of the potential lateral migration of vapours is nominated as 100 feet within the paper (approximately 30 m). This is consistent with guidance provided in several US documents.

8.10.5 Impacts of Soil Types on Vapour Movement into Buildings

Soils and fill materials within the open space areas of the Barangaroo Central site can be vertically differentiated into the following soils:

- Upper depth Root Zone Soils, present at a depth of 0.5 to 1.8m, which are characterised as being loose and sandy and generally optimised for the support of vegetation. These soils are anticipated to consist of imported fill materials, likely to be specifically manufactured to support plant life on the site;
- Compacted fill materials underlying the growing soils. These soils will potentially consist of imported fill materials; and
- In-situ soils generally located underlying any imported fill materials, and at lower Park elevations at the site boundaries outside the area of the drainage layer.

The 'root zone soils', present at the site surface, will be relatively well oxygenised. This would indicate that vapours that may be present in these surface soils (used as growing medium) would preferentially migrate to outdoor air by a 'convective sweep' effect that occurs through the relatively well aerated soils. The convective sweep is caused by wind movement over the near surface penetrating into the permeable soil horizons. These 'root zone soils', where occurring within 30 m of buildings, can be excluded from consideration of potential lateral vapour migration into the buildings.

Fill materials will be placed underlying the root zone soils. These soils are anticipated to be well compacted, to achieve geotechnical specifications and prevent root penetration to underlying saline groundwater. The extent of compaction is anticipated to exclude atmospheric effects. On this basis, it is assumed that the fill materials will potentially be a source of vapour inflow into the 'Cultural Space' and Basement Car Park structures to a distance of 30 m as measured laterally from the enclosed part of these buildings.

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8.11 Characterisation of Site Geology

A range of soil and fill types will potentially be used to form the proposed landform of the Barangaroo Central site. Based on the extent of information available for the proposed Park design, geological parameters are required for:

- Soils to be present at near surface depths to be used as root zone soils; and
- Soils to be present as general fill material throughout the Barangaroo Central Site, as placed underlying root zone soils, or directly underlying the proposed Cultural Space if constructed at the north-west portion of the site.

8.11.1 Root Zone Soils

Surface soils to a depth of at least 0.5m on the Park, required to be characterised for the purposes of human health risk assessment to near surface soils, will consist of 'root zone soils'. Parameters for sands have been used for the 'root zone soils'. It is anticipated that 'root zone soils' will be relatively loose and well aerated to facilitate vegetation growth.

Parameters as based on dry sand have been used, as per the values provided to US EPA (2003), to characterise the root zone soils, to ensure conservatism. Organic carbon has been assumed to be present at a level of 0.3% to ensure conservatism in calculations. This is well below a level of organic carbon that would be anticipated in soils used to support significant flora.

8.11.2 Fill Materials

Fill materials will be sourced from on-site soils. These soils are anticipated to be compacted, either to achieve geotechnical standards in proximity of structures, or to prevent root penetration to underlying saline groundwater.

Limited analysis of geological parameters of existing soils on the Barangaroo Site has been undertaken in AECOM (2010a and 2010b), DP (2010) and/or the additional analysis of AECOM (2010) samples as reported in **Appendix A**. Levels of organic carbon in site soils have been found to range from 0.15% to 2.8%.

To remain conservative, the general fill materials have been characterised as dry sand similar to that undertaken for the 'root zone soils'. Organic carbon has been assumed to be present at a typical concentration of 0.3%, biased towards the lower end of the scale of site measurements.

Vapour migration will only potentially occur from unsaturated horizons of fill based soils.

8.11.3 Summary of Geological Properties

Geological properties adopted for modelling are summarised in **Table 8.12**.

Table 8.12: Summary of Soil Properties

Soil Property	Sand – Unsaturated
Total Porosity	0.375
Water Porosity	0.053
Height of Capillary Zone (cm)	-
Bulk Density	1.66
Organic Carbon Content (%)	0.3
Vapour Permeability (cm^2)	$1*10^{-7}$ (1)

Note: 1. Based on upper range value for medium sand and low range value for fine sand

For the purposes of modelling vapours from soils sources, it has been assumed that soils are unsaturated.

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8.11.4 Leaching

Some of the exposure scenarios have required an assessment of potential COPC concentrations in seepage water consequent of direct leaching from impacted imported fill soils. This has included assessment of leachate impacted seepage water into the Basement Car Park.

Risk based criteria developed as allowable levels of seepage water impact will not be able to be applied to imported fill materials to enter the site in lieu of extensive soil leachability testing. Further, risk and hazard estimates for the derivation of risk based criteria cannot be derived on the basis of risk and hazard estimates for exposure to multiple media (i.e. residential user of Basement Car Park with inhalation exposure to vapours from soil impact and dermal exposure to leached impact present in pooled seepage water). Instead, leaching relationships can be used to convert risk based criteria derived on the basis of allowable levels in groundwater and seepage water, to total levels of COPCs in soils that may cause the equivalent levels in seepage water / groundwater.

This has been undertaken using site specific leaching relationships developed for soils across the Barangaroo site. Leachability data for site soils is provided in the ecological risk assessment provided as **Appendix D**. The median leachability estimate for each of the constituents has been adopted for use in the risk assessment. Leachability data from across the whole of the Barangaroo Project Site has been used to generate the estimates of leachability.

It is noted that leaching relationships are not available from field generated data for the full extent of COPCs assessed as potentially leaching to seepage water / groundwater. Theoretical estimates of potential leachability of these constituents were required.

Heemsbergen D, Warne M, McLaughlin M and Kookana R CSIRO (October 2009) '*The Australian Methodology to Derive Ecological Investigation Levels in Contaminated Soils*' (CSIRO, 2009) provides the following to derive soil criteria on the basis of soil leaching and target water concentrations for inorganic constituents:

$EIL = C_w.[K_d + (\theta_W + \theta_a.H') / \rho_b)].DAF$

Where: EIL – ecological investigation level (mg/kg)'

C_w – target leachate concentration, set equal to ANZECC/ARMCANZ 95% protection marine value unless use of 99% advised (mg/l);

K_d – soil to water partition coefficient (L/kg);

θ_a – air filled porosity;

θ_w – water filled porosity;

H' – Henry's Law Constant (unitless);

ρ_b – soil bulk density (kg/l); and

DAF – dilution attenuation factor including dilution from catchment and tidal dilution at discharge

The following relationship is similarly provided for organic constituents.

$EIL = C_w.[(K_{OC}.f_{OC}) + (\theta_W + \theta_a.H') / \rho_b)].DAF$

Where: EIL – ecological investigation level (mg/kg)'

C_w – target leachate concentration, set equal to ANZECC/ARMCANZ 95% protection marine value unless use of 99% advised (mg/l);

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K_{OC} – organic carbon to water partition coefficient (L/kg);

f_{OC} – fraction of organic carbon (g/g)

θ_a – air filled porosity;

θ_w – water filled porosity;

H' – Henry's Law Constant (unitless);

ρ_b – soil bulk density (kg/l); and

DAF – dilution attenuation factor including dilution from catchment and tidal dilution at discharge

These relationships have been used to derive the equivalent soil criteria to meet the risk based seepage water criteria for each COPC where field based estimates are not available. Geological and chemical data used in the calculations are summarised in **Tables 8.14** and **8.15**. The dilution attenuation factor has been set equal to one for all calculations (i.e. no dilution has been considered).

Leaching estimates as derived for site soils and used in the risk assessment are summarised in **Table 8.13** following. Further details of calculations to generate leachability are provided in the ERA as **Appendix D**.

Table 8.13: Summary of Adopted Constituent Leachabilities

COPC	Leachability (mg/l / mg/kg)	Comments
Arsenic	$5.0*10^{-4}$	From field data
Chromium (total)	$2.5*10^{-4}$	From field data
Copper	$1.9*10^{-4}$	From field data
Lead	$9.5*10^{-5}$	From field data
Cyanide (free)	$1.0*10^{-2}$	Theoretical estimate
Ammonia (as N)	13	Theoretical estimate
Benzene	1.95	Theoretical estimate
Toluene	1.24	Theoretical estimate
Ethylbenzene	0.70	Theoretical estimate
Xylenes	0.82	Theoretical estimate
Trimethylbenzenes	0.52	Theoretical estimate
Acenaphthene	$3.0*10^{-3}$	From field data
Acenaphthylene	$1.7*10^{-3}$	From field data
Anthracene	$5.9*10^{-4}$	From field data
Benzo(a)pyrene	$5.68*10^{-4}$	Theoretical estimate
Fluorene	$2.6*10^{-3}$	From field data
Fluoranthene	$1.7*10^{-4}$	From field data
Naphthalene	$8.7*10^{-3}$	From field data
Phenanthrene	$1.0*10^{-3}$	From field data
Pyrene	$1.5*10^{-4}$	From field data
Phenol	0.65	Theoretical estimate
Cresols (2,3&4-methylphenol)	1.05	Theoretical estimate
2,4-dimethylphenol	0.66	Theoretical estimate
TPH	Not estimated	Highly variable physical properties to characterise TPH mixtures prevent estimation of a reliable leaching factor. Assessment of speciated constituents will be protective of potential impacts of TPH.
Dibenzofuran	$3.63*10^{-2}$	Theoretical estimate
2-methylnaphthalene	0.13	Theoretical estimate

All risk and hazard results derived on the basis of unit concentration (1 mg/l) seepage water or groundwater exposure have been converted to equivalent risk and hazard estimates as would be caused by the leaching of a unit concentration (1 mg/kg) soil impact.

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8.12 Assessment of Total Petroleum Hydrocarbons

Toxicological data for total petroleum hydrocarbons (TPH) are provided for the aliphatic and aromatic fractions of $C_{>6}$-C_8, $C_{>7}$-C_8, $C_{>8}$-C_{16} and $C_{>16}$-C_{35}. However the TPH analytical data available for the site are provided as non speciated TPH fractions of C_6-C_9, C_{10}-C_{14}, C_{15}-C_{28} and C_{29}-C_{36}, as provided by Australian laboratories. Australian laboratories are able to provide speciated TPH data for TPH fractions $C_{>16}$. It is proposed to correlate TPH toxicological data with TPH data able to be readily generated by Australian laboratories in the following manner:

- Based on the selection of monocyclic aromatic hydrocarbons including benzene, toluene, ethylbenzene and xylenes as COPCs it is not proposed to undertake risk assessment for TPH aromatic fractions $<C_{10}$;
- A TPH C_6-C_9 (aliphatic) criterion shall be derived using data for the TPH $C_{>6}$-C_8 (aliphatic) fraction. This is intended to be compared to the total TPH C_6-C_9 concentration as reported by the laboratory, with the sum of speciated aromatic constituents (determined by BTEX or VOC analysis or similar) subtracted;
- A TPH C_{10}-C_{14} criterion has been derived using the toxicological data for the TPH $C_{>8}$-C_{16} (aliphatic and aromatic) fractions and using fraction specific physical-chemical properties for the TPH $C_{>10}$-C_{12} (aliphatic and aromatic) fractions as provided in Table 8 of TPHCWG (1997) Volume 3. It has been assumed that TPH C_{10}-C_{14} is present as a 50:50 mixture of aliphatic and aromatic fractions. The criteria have been derived by using the criteria for the aliphatic and aromatic fractions, respectively, within an inverse weighted mean relationship; and
- Speciated TPH $C_{>16}$ criteria have been derived using toxicological data for TPH $C_{>16}$-C_{35} (aliphatic and aromatic) fractions and using fraction specific physical-chemical properties for TPH $C_{>16}$-C_{21} (aliphatic) and TPH $C_{>16}$-C_{21} (aromatic) fractions, respectively. It is intended that the sum of the laboratory reported TPH C_{15}-C_{28} and C_{29}-C_{36} levels would be compared to the lowest of these criteria as a screening assessment, with speciated analysis only necessary where direct comparison is required. However, a combined TPH $C_{>15}$ criteria has been prepared on the basis that TPH $C_{>15}$ is present as a 50:50 mixture of aliphatic and aromatic fractions. The criteria have been derived by using the criteria for the aliphatic and aromatic fractions respectively within an inverse weighted mean relationship as per the guidance provided to CCME (March 2006) '*Guidance Manual for Developing Site-Specific Soil Quality Remediation Objectives for Contaminated Sites in Canada*'.

8.13 Characterisation of Physical and Chemical Properties of COPCs

A range of physical and chemical properties are required to be identified for each of the COPCs to allow the risk modelling to occur. This have been summarised in **Table 8.14** for physical properties and **Table 8.15** for properties affecting the dermal availability of the COPC. All values have been sourced from the most recent values available to the on-line Risk Assessment Information System (RAIS). Where values for a particular property are not available within RAIS, the default values provided to the RISC model have been adopted.

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Table 8.14: Summary of Physical Properties of COPCs

COPC	Diffusivity in air	Diffusivity in water	Henry's Law constant	Soil-water partition coefficient	Organic carbon partition coefficient	Log of octonal water partition coefficient
	D_a (cm^2/s)	D_w (cm^2/s)	H	K_D (cm^3/g)	K_{OC} (L/kg)	Log K_{OW}
Ammonia	0.1	$1*10^{-5}$	$6.58*10^{-4}$	0.4	-	-
Arsenic	-	-	-	29	-	-
Chromium	-	-	-	19 (VI) $1.8*10^5$ (total)	-	-
Copper	-	-	-	35	-	-
Lead	-	-	-	900	-	-
Cyanide	0.211	$2.46*10^{-5}$	$5.44*10^{-3}$	9.9	2.84	0.25
Benzene	$8.95*10^{-2}$	$1.03*10^{-5}$	0.227	-	146	2.13
Toluene	$7.78*10^{-2}$	$9.2*10^{-6}$	0.271	-	234	2.73
Ethylbenzene	$6.85*10^{-2}$	$8.46*10^{-6}$	0.322		446	3.15
Xylenes	$8.74*10^{-2}$	$9.90*10^{-6}$	0.212	-	383	3.12
1,2,4-trimethylbenzene	$6.07*10^{-2}$	$7.92*10^{-6}$	0.252	-	614	3.63
TPH C_6-C_8 (ali)	0.1	$1*10^{-5}$	51	-	$4*10^3$	4.0
TPH C_8-C_{16} (ali)	0.1	$1*10^{-5}$	130	-	$2.5*10^5$	5.6
TPH C_8-C_{16} (aro)	0.1	$1*10^{-5}$	0.14	-	$2.5*10^3$	3.5
TPH $C_{>16}$ (ali)	0.1	$1*10^{-5}$	$6.4*10^3$	-	$1*10^9$	8.9
TPH $C_{>16}$ (aro)	0.1	$1*10^{-5}$	$1.3*10^{-2}$	-	$1.6*10^4$	4.7
Acenaphthene	$5.06*10^{-2}$	$8.33*10^{-6}$	$7.52*10^{-3}$	-	$5.03*10^3$	3.92
Acenaphthylene	$4.50*10^{-2}$	$6.98*10^{-6}$	$4.66*10^{-3}$	-	$5.03*10^3$	3.94
Anthracene	$3.90*10^{-2}$	$7.85*10^{-6}$	$2.27*10^{-3}$	-	$1.64*10^4$	4.45
Benzo(a)pyrene	$4.3*10^{-2}$	$9.0*10^{-6}$	$1.87*10^{-5}$	-	$5.87*10^5$	6.13
Fluoranthene	$3.0*10^{-2}$	$6.4*10^{-6}$	$3.62*10^{-4}$	-	$5.55*10^4$	5.16
Fluorene	$4.40*10^{-2}$	$7.89*10^{-6}$	$3.93*10^{-3}$	-	$5.55*10^4$	5.16
2-methylnaphthalene	$5.24*10^{-2}$	$7.78*10^{-6}$	$2.12*10^{-3}$	-	$2.48*10^3$	3.86
Naphthalene	$6.05*10^{-2}$	$8.38*10^{-6}$	$1.80*10^{-2}$	-	$1.54*10^3$	3.30
Phenanthrene	$3.45*10^{-2}$	$6.69*10^{-6}$	$1.73*10^{-3}$	-	$1.67*10^4$	4.46
Pyrene	$2.87*10^{-2}$	$7.25*10^{-6}$	$4.87*10^{-4}$	-	$5.43*10^4$	4.88
Dibenzofuran	$4.1*10^{-2}$	$7.38*10^{-6}$	$8.71*10^{-3}$	-	$9.16*10^3$	4.12
Phenol	$8.34*10^{-2}$	$1.03*10^{-5}$	$1.36*10^{-5}$	-	187	1.46
2,4-dimethylphenol	$6.22*10^{-2}$	$8.31*10^{-6}$	$3.89*10^{-5}$	-	492	2.3
Cresols	$8.37*10^{-2}$	$9.78*10^{-6}$	$4.91*10^{-5}$	-	307	1.95

Skin permeability coefficients and dermal absorption factors for each of the COPCs as used in the modelling are summarised in **Table 8.15** following.

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Table 8.15: Summary of Skin Adsorption Properties of COPCs

COPC	Skin permeability coefficient	Dermal absorption factor	Source
	K_p (cm/h)	Dermal ABS (-)	
Ammonia	$1 * 10^{-3}$	-	Risk Assessment Information System No RAGS Part E ABS factor.
Arsenic	$1 * 10^{-3}$	0.03	Risk Assessment Information System
Chromium	$1 * 10^{-3}$	-	Risk Assessment Information System as based on value for 'total chromium'. No RAGS Part E ABS factor.
Copper	$1.0 * 10^{-3}$	-	Risk Assessment Information System. No RAGS Part E value available
Lead	$1 * 10^{-4}$	0.1	Risk Assessment Information System. ABS based on RAGS Part E value for 'lead alkyls'.
Cyanide	$7.5*10^{-4}$	-	Risk Assessment Information System
Benzene	$1.49 * 10^{-2}$	-	Risk Assessment Information System. No RAGS Part E value available
Toluene	$4.53 * 10^{-2}$	-	Risk Assessment Information System. No RAGS Part E value available
Ethylbenzene	$7.39 * 10^{-2}$	-	Risk Assessment Information System. No RAGS Part E value available
Xylenes	$7.04 * 10^{-2}$	-	Risk Assessment Information System as based on value for 'xylene, mixture'. No RAGS Part E ABS factor.
1,2,4-trimethylbenzene	$8.57*10^{-2}$	-	Risk Assessment Information System. No RAGS Part E value available
TPH C_6-C_9 (ali)	0.75	-	Value provided in RISC chemical database. No RAGS Part E value available.
TPH C_{10}-C_{14} (ali)	1.9	0.1	RAGS Part E for semivolatile organics
TPH C_{10}-C_{14} (aro)	$8.7 * 10^{-2}$	0.1	RAGS Part E for semivolatile organics
TPH C_{15}-C_{28}	0.3	0.1	RAGS Part E for semivolatile organics
TPH C_{29}-C_{36}	1.5	0.1	RAGS Part E for semivolatile organics
Acenaphthene	$8.60*10^{-2}$	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Acenaphthylene	$9.11*10^{-2}$	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Anthracene	0.142	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Benzo(a)pyrene	0.713	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Fluoranthene	0.308	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Fluorene	0.11	0.13	Risk Assessment Information System. RAGS Part E ABS factor
2-methylnaphthalene	$9.17*10^{-2}$	0.13	Risk Assessment Information System. RAGS Part E ABS factor for PAHs
Naphthalene	$4.66*10^{-2}$	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Phenanthrene	0.144	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Pyrene	0.201	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Dibenzofuran	$9.75*10^{-2}$	0.13	Risk Assessment Information System. RAGS Part E adopted as per PAH factors
Phenol	$4.34*10^{-3}$	0.1	Risk Assessment Information System. RAGS Part E ABS factor
2,4-dimethylphenol	$1.09*10^{-2}$	0.1	Risk Assessment Information System. RAGS Part E ABS factor
Cresols	$7.66*10^{-3}$	0.1	Risk Assessment Information System. RAGS Part E ABS factor

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8.14 Asbestos Exposure

8.14.1 Characterisation of Potential Occurrence of Asbestos

Limited assessments have been completed on the site for occurrence of asbestos containing materials. Based on previous assessments of historically filled industrial sites completed by JBS, asbestos containing materials (ACM) are commonly present in fill materials. These typically occur as asbestos fibres bound within a cement matrix (i.e. bonded asbestos).

It is noted that asbestos may also occur in insulation / lagging provided to historical gasworks infrastructure. This typically comprises asbestos fibres in a tar matrix. This is considered unlikely for the case of the former gasworks on the Barangaroo Project Site as the development of the gasworks was prior to the commercial availability of asbestos products in NSW. Where asbestos products are present in a tar matrix, this would be considered to be substantially more environmentally stable than asbestos fibres present in a cement matrix, consequent of the design and application for a specialised high temperature purpose. The assessment of the matrix in which asbestos occurs is important as it controls the rate at which asbestos fibres are released and may become available to site users.

Assessment of asbestos occurring in a cement matrix for the remainder of the exposure assessment is considered to be sufficiently protective of asbestos that may occur in other matrices on the Barangaroo Project Site.

8.14.2 Identification of Potential Exposure Pathways

The inhalation of asbestos fibres is the primary pathway of concern. By the toxicological review completed in **Section 7.6.16**, there is limited evidence that asbestos fibres are toxic through pathways other than inhalation (i.e. ingestion).

8.14.3 Estimation of Exposure Concentration for Pathways

For asbestos fibres to pose a potential inhalation risk, asbestos fibres need to be released from:

- The fibre cement matrix in which they most likely occur, necessitating a process of asbestos fibre release from the fibre cement matrix, followed by asbestos fibre dispersal to a human breathing zone; or
- Asbestos fibre release from soils contaminated with free asbestos fibres (i.e. friable asbestos) similarly followed by asbestos fibre dispersal to a human breathing zone.

To estimate an exposure concentration for a human receptor:

1. The quantity of asbestos fibres in the soils is required to be determined. This can include:
    - The extent of free asbestos fibres currently present in soils. This has not been quantified for the site and is not substantially considered further; or
    - Where asbestos containing fibre cement sheet is present on the site (i.e. asbestos containing material – ACM), which is considered likely, the extent of asbestos fibres potentially released from the ACM in the future (**Section 8.15.5**);
2. The rate at which asbestos fibres move out of soils into human breathing zones requires to be quantified. This will include:

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- The rate at which asbestos fibres become airborne from asbestos contaminated soils (**Section 8.15.6** to **8.15.8**); and
- The extent of dilution of airborne asbestos fibres that will occur between the soil surface and the human breathing zone (**Section 8.15.9**).

Each of the factors has been discussed in turn for Barangaroo Central. As noted throughout the following sections, there is an absence of site specific data for particularly the second part of the required assessment. In absence of site specific data a literature review has been undertaken.

8.14.4 Occurrence of Free Asbestos Fibres at Barangaroo

On the basis of the limited investigations completed to date, no free asbestos fibres have been identified on the Barangaroo Project Site.

It is considered that asbestos fibres are unable to be readily quantified in soils. No NATA accredited laboratory method is available to reliably report a quantified number / weight of asbestos fibres in a soil sample. enHealth (2005) further states that current asbestos in soil analytical methods should be considered as 'qualitative' only.

On this basis, any soils which are reported to have free asbestos fibres present will be considered to be unsuitable for use as imported fill on the Barangaroo Central site. A quantified level of asbestos fibres in soils, that would be able to be compared to an asbestos criterion derived by risk assessment, is considered unable to be determined.

8.14.5 Occurrence of ACM at Barangaroo Central

As discussed earlier, it is considered most conservative to assume that asbestos potentially occurs in a fibre cement matrix (anticipated as fibre cement fragments) across the Barangaroo Project Site.

Free fibres are typically not identified in the proximity of ACM on contaminated sites. Free fibres have not been identified in the proximity of the limited detections of ACM on the Barangaroo Project Site. In the absence of detection of free asbestos fibres in the proximity of ACM, there is no site specific premise to develop a relationship between the asbestos contained in the ACM, and asbestos that may potentially be released from ACM impacted soils as free asbestos fibres.

8.14.6 Generation of Asbestos Fibres from Asbestos Cement Materials

Asbestos on the Barangaroo Project Site is anticipated to be most conservatively characterised in the form of bound asbestos fibre cement sheet. Asbestos cement is commonly reported to be a mixture of about 10% asbestos fibres and 90% Portland cement (although enHealth 2005 and WA DoH 2009 recommend that it is assumed asbestos cement materials have a 15% content of asbestos). The product's performance requires that the cement matrix adheres to the outside of the fibres and fibre bundles so that the high tensile strength of the fibres is used to create a stronger product. The asbestos is added to the cement and wet mixed before being formed, compressed and cured to produce the end fibre cement product. This process is intended to prevent the release of asbestos fibres from the ACM. For releases of asbestos fibres to occur, processes are required to occur to compromise the ACM properties. These processes would be anticipated to be limited to:

- Weathering of ACM; and/or
- Mechanical damage to the ACM.

Weathering

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All materials are subject to weathering when exposed to the atmosphere and moisture. A range of processes takes place as the surface is exposed to electromagnetic waves, moisture, frost fracture, chemicals, gases and biological organisms. Chrysotile is known to have limited resistance to acid attack and both acid rain (sulphuric acid) and organic acids from moulds, mosses and lichen will react with the exposed chrysotile asbestos to remove magnesium hydroxide from the structure (Hodgson 1979 and Favero-Longo 2005).

Cement is also subject to weathering and a number of chemical reactions will occur. The most water soluble component of cement is calcium hydroxide and this is dissolved and washed out by water. Calcium hydroxide also reacts with carbon dioxide to form less soluble calcium carbonate, with further reactions causing calcium carbonate to be turned into more soluble calcium bicarbonate.

Increasing acidity, and the presence of sulphate and carbonate ions, will increase the solubility and removal of all chemical components of cement from the exposed surface layer of fibre cement sheet. The duration of exposure and the acidity of the environment will largely determine the rate of dissolution and wash out of the surface cement matrix, leaving asbestos fibres only loosely attached to the surface and more able to become airborne. The rate of corrosion of the surface of asbestos cement has been estimated at 0.024 mm/year in clean environments (Spurney, 1989) and 0.1 mm/year in urban environments where higher acidity is expected (UK Health & Safety Laboratory, 2007).

EnHealth (2005) reports that:

- Concentrations of asbestos fibres in air above weathered asbestos cement sheeting have been measured at up to 0.0012 f/ml. The area or extent of the sheeting was not reported;
- Fibre emission factors of 106 – 109 f/m^2/h have been measured from weathered asbestos cement products. Meteorological conditions or other factors which may have affected the generation of the asbestos fibres have not been able to be appropriately reported, presumably as the measurements have been undertaken over an extended sampling period where these factors are variable; and
- Measurements of asbestos fibre concentrations in the vicinity of buildings containing corroded and weathered asbestos cement products have recorded airborne asbestos fibre concentrations in the range of 0.0002 – 0.0012 f/ml. The area or extent of the sheeting was not reported.

Mechanical Damage

Any physical breaking and cracking of ACM exerts high mechanical forces to the fracture surface and tends to pull out asbestos fibres and bundles making them more able to become airborne. A proportion of the fibres disturbed during mechanical breakage will be made airborne at the time. Mechanical attrition of the cement will also lead to the release of asbestos fibres and cutting of the cement sheets with saws and angle grinders is particularly able to release fibres from inside the asbestos cement.

It has been demonstrated in UK Health & Safety Laboratory (2007) '*Investigation of the chrysotile fibres in an asbestos cement sample*' that individual asbestos fibres are released during the breaking of asbestos cement products with a hammer. A range of other studies have also measured the airborne release of asbestos fibres during agitation of asbestos cement products. These are summarised in **Table 8.16**. It is noted in **Table 8.16** that the reported concentrations have been measured in the proximity of the ACM material, generally as personal levels (i.e. collected by sample inlets on worker clothing in the proximity of breathing zone).

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Table 8.16: Published Rates of Asbestos Fibre Generation (Presented as Personal Sample Levels)

Activity	Range	Reference
Roof repair "representative"	<0.01 – 0.3 f/ml	CONSAD, 1990
Roof Removal "representative"	<0.01 – 0.2 f/ml	CONSAD, 1990
Replacing corrugated asbestos cement	<0.01 f/ml	Roberts, 1985
Collecting sheets and cleaning	0.24 f/ml	Roberts, 1985
Removal of corrugated sheets (detachment and sliding to gutter)	0.047 f/ml	Preart, 1993
Throwing sheets into lorry	0.161 f/ml	Preart, 1993
Removal of corrugated sheets (detachment, stacking on elevator, placing in pallets)	0.028, 0.038 f/ml	Preart, 1993
Removal of corrugated sheets (detachment)	0.018 f/ml	Preart, 1993
Stacking of sheets on pallets	0.032 f/ml	Preart, 1993
Removal of slates (detached with hammer)	0.064 f/ml	Preart, 1993
Sliding slates to gutter; throwing to ground	0.195 f/ml	Preart, 1993
Removal of slates (detachment and stacking)	0.037, 0.044 f/ml	Preart, 1993
Removal of slates (detachment and placing in container on roof)	0.050, 0.176 f/ml	Preart, 1993
Removal of slates (pulling off, stacking on elevator, broken slates thrown to ground)	0.100, 0.122 f/ml	Preart, 1993
Removal of slates (detachment with hammer, sliding to gutter)	0.068 f/ml	Preart, 1993
Bringing slates down and throwing into container	0.056 f/ml	Preart, 1993
Dry replacement (severely weathered) – unfastening, removal, stacking, disposal, installation of new roofing	0.03-0.24 f/ml	Brown, 1987
Dry unfastening, removal, disposal, installation of new roofing (no stacking)	0.03 f/ml	Brown, 1987
Dry replacement (severely weathered)	0.04-0.27 f/ml	Brown, 1987
Dry removal (painted)	0.07-0.32 f/ml	Brown, 1987
Wet removal (painted) and replacement (careful handling and wetting as stacked)	<0.01 – 0.07 f/ml	Brown, 1987
Replacement (severely weathered) after lignin sulphonate treatment	0.23 f/ml	Brown, 1987
Replacement (severely weathered) after sealing with acrylic resin	0.03 – 0.08 f/ml	Brown, 1987
Replacement (severely weathered) after sealing with acrylic resin	0.04 – 0.26 f/ml	Brown, 1987
Roof removal by demolition, building collapsed	0.10 – 0.47 f/ml	Brown, 1987
Roof removal by placement onto scissor lift	0.04 – 0.12 f/ml	Brown, 1987
Roof removal with roof sheets stacked in a confined space	0.30 – 0.53 f/ml	Brown, 1987
Roof removal with roof sheets stacked in confined space (accumulated dust under laps and ridges)	0.34 – 1.1 f/ml	Brown, 1987
Wet roof removal	0.05 – 0.06 f/ml	Brown, 1987
Wet roof removal with roof sheets stacked in a confined space	0.10 – 0.13 f/ml	Brown, 1987
Wet roof removal with roof sheets stacked in confined space (accumulated dust under laps and ridges)	0.29 – 0.68 f/ml	Brown, 1987
Roof removal with roof sheets sealed with acrylic resin	0.11 – 0.32 f/ml	Brown, 1987
Roof removal with roof sheets sealed with acrylic resin (sheets stacked in confined space; accumulated dust under laps and ridges)	0.41 – 0.76 f/ml	Brown, 1987

By review of **Table 8.16**, each of the activities listed are highly unlikely to be replicated in the urban environment of Barangaroo Central. However, the range of positive measurements confirms that fibre release will happen when bound asbestos within fibre cement matrices are agitated and these processes are required to be considered when estimating the potential future release of asbestos fibres from ACM.

8.14.7 Estimate of Free Asbestos Fibre Generation Rate from ACM

To allow the quantified risk assessment calculations to be completed, a rate of potential asbestos fibre generation from ACM needs to be determined. For the purposes of this assessment this has been set at 0.024 mm/year as per the anticipated rate of weathering of ACM in a clean environment.

This has been further quantified using an 'asbestos powder' bulk density of 0.45 g/cm^3 and assuming that 15% of the weathered ACM is present as asbestos fibres as recommended by enHealth (2005) and WA DoH (2009), this equates to a mass of weathered asbestos fibres of 1.6 mg asbestos fibres / m^2 asbestos sheet / year.

The conservatism of this value can be assessed by comparison to the enHealth (2005) published rate of asbestos fibre generation of 106 – 109 f/m^2/h from weathered ACM. To allow the comparison to be undertaken a conversion factor is required to convert mass of asbestos fibres to actual fibre counts. The correlation between fibre counts and mass measurements of asbestos fibres is reported by US EPA to be very poor. Six data sets

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are reported to be available in US EPA (1998) that include both fibre and mass measurements which show a conversion between TEM mass and PCM fibre count that ranges from 5-150 (ug/m^3)/(f/mL). The geometric mean of these results is reported to be 30 (ug/m^3) / (f/mL). This indicates that one asbestos fibre weighs 3 * 10^{-11}g. Using the factor, the adopted rate of weathering (0.024 mm/year) is found to be equivalent to a release of 6.2 * 10^7 f/m^2/h from ACM. This is substantially higher than the enHealth (2005) measured values.

The adoption of this value is further considered highly conservative as it assumes that the complete ACM sheet / fragment to be constantly exposed to weathering. The nature of site surface use as will occur with human occupation would prevent this from ever occurring on a significant scale (i.e. establishment and maintenance of lawn areas and gardens as anticipated with an iconic Sydney parkland etc.). This factor is also considered sufficient to account for potential short term fibre releases as may occur by mechanical damage to ACM on Barangaroo Central. Fibre release by mechanical damage would be observed to occur from comparatively very small surface areas, when compared to the assumption of the occurrence of weathering on the largest side of the sheet, by the nature of cracking caused by damage occurring orthogonal to the largest area of the sheet volume.

The minimum thickness of ACM as detected on historically filled sites is typically found to be equal to 4 mm, with average thicknesses of 6 mm and thicknesses as great as 12 mm found where historical asbestos roofing products are encountered. Based on the assumed weathering rate, this would indicate that a maximum of 40% of the mass of the smallest ACM fragment anticipated would be 'broken down' (facilitating the release of fibres) over a 70 year exposure period.

8.14.8 Generation of Asbestos Fibres from Asbestos Fibre Contaminated Soils

As discussed in **Section 8.15.3**, two factors are required to cause exposure to asbestos fibres, the current or potential future presence of asbestos fibres in soils, as discussed in **Section 8.15.4**, and the rate at which asbestos fibres are released from soils into potential human breathing zones.

Two published studies are known to be available which have attempted to quantify the rate of asbestos fibre release from soils. These include:

- Addison, J., Davies, L.S.T., Robertson, A., and Willey, R.J. (1988) '*The Release of Dispersed Asbestos Fibres from Soils Technical Memoranda*', TM/88/14, Institute of Occupational Medicine: 50, Edinburgh, UK; and
- Swartjes, F.A., Tromp, P.C. (2008). *A Tiered Approach for the Assessment of Human Health Risks of Asbestos in Soils*. Soil and Sediment Contamination, Volume 14, Issue 4, pp. 137 – 149 incorporating Swartjes F.A, Tromp P.C, Wezenbeek J.M (2003). *Assessment of the Risks of Soil Contamination with Asbestos*. National Health and Environmental Institute, Netherlands, RIVM Report 711701034/2003.

Each is discussed following.

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Addison *et al* (1988)

Assessment of the potential for asbestos generation from asbestos contaminated soils has been undertaken in Addison *et al* (1988). This study assessed the potential generation of free asbestos fibres from asbestos contaminated soils.

It was found that potentially high concentrations of asbestos fibres could be present in dust generated from contaminated soils. It was found that soils with concentration of free asbestos fibre of 1% by weight could generate airborne fibre concentrations greater than 20 f/ml where dust levels were below 5 mg/m^3. Dry loose soils with 0.001% asbestos fibres reported respirable asbestos concentrations greater than 0.01 f/ml while dust levels were below 5 mg/m^3.

The potential generation of asbestos fibres was found to be reduced for chrysotile forms of asbestos when compared with amphibole forms. Increasing moisture content of soils reduced potential asbestos fibre generation. Clayey soils generated less asbestos fibres than loose sandy soils.

On the basis of the tests completed by Addison *et al* (1988) a relationship between the normalised airborne fibre concentration (f/ml / mg/m^3) and the proportion of asbestos in soil was produced (**Diagram 8.2**).

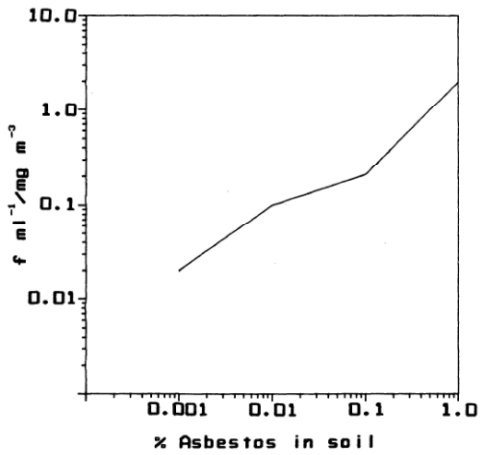


Diagram 8.2: The relationship between the normalised airborne fibre concentration (f/ml / mg/m^3) and the proportion of asbestos in soil; average results from all test runs (Addison et al 1988)

Swartjes *et al* (2003) and Swartjes & Tromp (2008)

A more recent assessment of the generation of asbestos fibres from soils has been undertaken by Swartjes & Tromp (2008) incorporating the findings of Swartjes *et al* (2003). An inventory of more than 1000 measurements of asbestos fibre generation from asbestos impacted soils is reported to have been reviewed. These data resulted from:

- Worse case simulation experiments (wind blower with dry soil and loose asbestos fibres);
- Field experiments consisting of daily practice activities including driving on contaminated roads, digging and dumping and sifting of humid soil on sites contaminated with:
    - Friable asbestos in soils; and
    - Bound asbestos (i.e. ACM) in soils.

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Diagram 8.3, following, shows the data obtained by Swartjes et al (2003) and Swartjes & Tromp (2008) showing the relationship between soil and air concentrations of asbestos. The graph shows the airborne asbestos concentration during the simulation experiments and field measurements with friable and bound asbestos impact in soils. 95% confidence intervals are also shown.

It is noted by the authors in the preparation of the graph that the worst case simulation experiments give higher airborne asbestos concentrations.

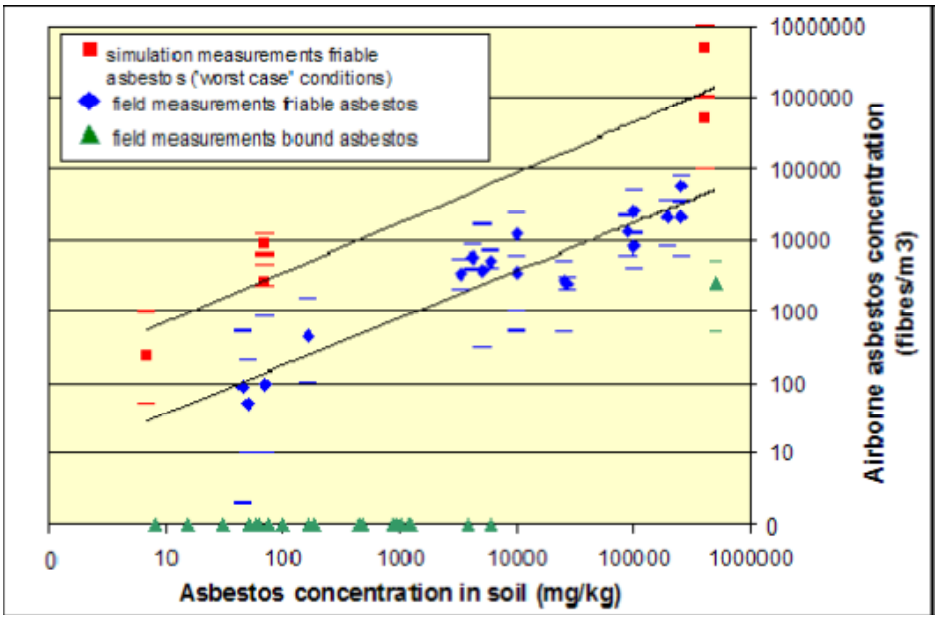


Diagram 8.3: Results showing the relationship developed between soil and air concentrations of asbestos

Estimate of Free Asbestos Fibre Generation Rate from ACM

The Swartjes *et al* (2003) and Swartjes & Tromp (2008) method for estimating asbestos fibre generation from soils has been preferred for use in this risk assessment on the following basis:

- Data have been collected from actual contaminated sites and are more representative of what may occur in real-life scenarios as compared to the controlled environment simulations of Addison *et al* (1988);
- Use of the Addison *et al* (1988) relationship requires an estimate of future dust emissions from soils on the site. Dust emissions would be anticipated to be highly variable and subject to many factors. It is considered that reliable estimates of future site dust emissions are not possible; and
- The Swartjes *et al* (2003) and Swartjes & Tromp (2008) data contain a range of levels of friable asbestos as may be reasonably encountered in the field.

The Swartjes *et al* (2003) and Swartjes & Tromp (2008) data are further noted to have been adopted by other regulators for the derivation of asbestos criteria.

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8.14.9 Dispersion of Asbestos Fibres between Soil Surface and Human Exposure

It is reported in Swartjes & Tromp (2008) that measurements of airborne asbestos fibres were undertaken by both personal air samples (in the breathing zone of assessed workers) and stationary air samples near the asbestos fibre generating activities. On this basis, it is considered that the adopted sampling and measurement approach has incorporated the dilution of asbestos fibre concentrations as may occur between the source of asbestos fibres and breathing zones. No further assessment of dispersion of asbestos fibres is required.

8.14.10 Estimation of Contaminant Intakes for Pathways

The contaminant, asbestos fibres, becomes available when released from an asbestos cement matrix. This may occur on Barangaroo Central by gradual weathering of ACM fragments causing break down of the cement component of bound ACM allowing fibres to be released as fugitive emissions, and by mechanical impact of bound ACM fragments as may occur with future excavation activities.

Fibres released during these scenarios need to be inhaled by human receptors for an exposure pathway to be considered complete. Hence, the estimation of the contaminant intake is a function of:

- The dilution of asbestos currently occurring within the ACM to future levels of airborne asbestos fibres as present within human breathing zones as estimated by the methods assessed in **Sections 8.14.3** to **8.14.9**; and
- The intake of the exposed human receptor (defined following).

8.14.11 Intake Estimation

The approach undertaken to determine the intake of asbestos for each of the potentially exposed populations is summarised following.

The estimated exposure (or intake) of a person is normalised for time and body weight and is generally calculated as:

$$\text{Intake} = \frac{\text{Concentration} \times \text{Contact Rate} \times \text{Exposure Frequency} \times \text{Exposure Duration}}{\text{Body Weight} \times \text{Averaging Time}}$$

Concentration is able to be defined by the procedures detailed in **Sections 8.14.5** to **8.14.9**. Each of the other parameters are characterised by exposure estimation. Exposure estimation has been undertaken by the consideration of a reasonable maximum exposure (RME) on a particular site (USEPA, 1989a). The goal of RME is to combine upper bound and average exposure factors in a manner such that the result represents an exposure scenario that is both protective and reasonable. This is not one which is the absolute worst case but that which represents a reasonable maximum exposure.

The approach for exposure assessment used here is based on the procedures developed by the US EPA (1989 and 1991). Exposure parameters have been defined in **Section 8.3**.

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8.15 Risk Modelling

As site specific criteria are intended to be derived which can be used to validate the quality of material coming into the proposed Barangaroo Central, and the suitability of current in-situ soils with the proposed site-uses, risk modelling has been required to be based on a number of default exposure parameters. The exposure scenarios and parameters have required that Barangaroo Central be divided into a number of soil zones. These soil zones are based on the proposed long term concept plan of Barangaroo Central, exposed populations, distances from proposed structures, and the anticipated vapour flows through soils into indoor building spaces. These soil zones are defined in **Table 8.17**.

Table 8.17: Summary of Soil Zones for Setting of Site Specific Criteria

Zone ID	Location / Depth	Description / Comments
Zone 1	0-0.5m below Open / Recreational Areas	Consist of 'root zone soils' to a minimum depth of 0.5m. Criteria derived to a depth of 0.5m will be protective of 'root zone soils' potentially placed as deep as 1.8m.
Zone 2	>0.5m below Open / Recreational Areas	Consists of all imported fill materials placed below a depth of 0.5m across the Barangaroo Central site. Inhalation is the only pathway assessed. On this basis, human health risk based criteria do not require application to soils placed in the saturated zone. This zone will potentially overlap with Zones 3 to 6. Lowest of criteria in areas of overlap will be required to be adopted.
Zone 3	0-10m away from Basement Car Park	Requires consideration of potential leaching and migration of impacted seepage water into Basement Car Park. Unsaturated soils only assessed. Placement of imported fill materials below depth of water considered highly unlikely and not assessed. This zone will potentially overlap with Zone 2. Lowest of criteria in areas of overlap will be required to be adopted.
Zone 4	>10-30m away from Basement Car Park	Does not require consideration of potential leaching and migration of impacted seepage water into Basement Car Park. Unsaturated soils only assessed. Placement of imported fill materials below depth of water considered highly unlikely and not assessed. This zone will potentially overlap with Zones 2 and 6. Lowest of criteria in areas of overlap will be required to be adopted.
Zone 5 (not required if Cultural Space not constructed at north-west of site)	Below Cultural Space (Unsaturated) 0-10m away from Cultural Space	Requires assessment of inhalation exposure only. This zone will potentially overlap with Zone 2. Lowest of criteria in areas of overlap will be required to be adopted.
Zone 6 (not required if Cultural Space not constructed at north-west of site)	>10-30m away from Cultural Space	Requires assessment of inhalation exposure only. This zone will potentially overlap with Zones 2 and 4. Lowest of criteria in areas of overlap will be required to be adopted.

As per the guidance provided to NZ Ministry for the Environment (1999) for modelling of impact at near surface depths underlying maintenance excavations, a diffusion length of 0.1 m has been used for the inhalation exposure modelling for scenarios where impact is potentially present at a near surface depth.

Site specific criteria have been derived for each constituent by back calculation of the risk and hazard results as derived for a unit concentration (1 mg/kg or 1 mg/l).

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8.16 Models

Each of the potential exposure scenarios for each of the appropriate soil zones has been assessed by modelling. Modelling outputs are provided as **Appendix C**. **Table 8.18** summarises each of the populations, media and exposure pathways assessed by the risk modelling.

In reviewing **Table 8.18**, it should be noted that the soil zones will potentially overlap throughout the Park, consequent of the consideration of potential lateral migration of vapours.

Table 8.18: Summary of Risk Modelling

Soil Zone	Population	Media	Exposure Pathways			
			Inhalation - Particulates	Inhalation – Vapour	Oral	Dermal
1	Recreational (Park User)	Soil		•	•	•
	Sub-Surface Maintenance	Soil	•	•	•	•
	Commercial / Industrial (Gardener)	Soil	•	•	•	•
2	Recreational (Park User)	Soil		•		
	Sub-Surface Maintenance	Soil		•		
	Commercial / Industrial (Gardener)	Soil		•		
3	Resident (Car Park and Residence Exposure)	Soil		•		
		Seepage Water		•		•
	Commercial / Industrial Worker (Car Park Attendant)	Soil		•		
		Seepage Water		•		•
4	Resident (Car Park and Residence Exposure)	Soil		•		
		Seepage Water		•		
	Commercial / Industrial Worker (Car Park Attendant)	Soil		•		
		Seepage Water		•		
5	Recreational user	Soil		•		
	Commercial / Industrial Worker	Soil		•		
6	Recreational user	Soil		•		
	Commercial / Industrial Worker	Soil		•		

8.17 Adoption of Published Criteria

Health investigation levels from NEPC (1999) 'National Environment Protection (Assessment of Site Contamination) Measure' as provided for a 'E – parks, recreational open space and playing fields' human exposure setting have been adopted for benzo(a)pyrene in Zone 1 soils.

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9 Assessment of Human Health Risk

9.1 Risk Measurement

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen. The slope factor (SF) converts estimated daily intakes averaged over a lifetime of exposure directly to incremental risk of an individual of developing cancer. Because relatively low intakes (compared to those experienced by test animals) occur with exposures on most contaminated sites, it can generally be assumed that the dose response relationship is linear in the low-dose portion of the multistage model dose-response curve. Under this assumption the slope factor is constant and risk is directly related to intake. Thus the following linear based carcinogenic risk equation is used:

Risk = CDI * SF

where: Risk – unitless probability of an individual developing cancer;

CDI – chronic daily intake averaged over 70 years (mg/kg-day); and

SF – slope factor expressed in $(mg/kg\text{-}day)^{-1}$.

The slope factor is often an upper 95% percentile confidence limit of the probability of response based on experimental animal data used in the multistage model. Consequently, the carcinogenic risk estimate will often be an upper bound estimate (US EPA, 1989).

The measure used to describe the potential for non carcinogenic toxicity to occur in an individual is not expressed as the probability of an individual suffering an adverse effect. Instead, the potential for non carcinogenic effects is evaluated by comparing an exposure level over a specific time period with a reference dose derived for a similar exposure period. The ratio of exposure to toxicity is called a hazard quotient and is calculated as:

Noncancer hazard quotient = E / RfD

where: E – exposure level (or intake); and

RfD – reference dose (E and RfD are expressed in the same units (US EPA, 1989).

At most sites the potential health effects of more than one chemical are required to be assessed. Potential additive effects of exposure to multiple chemicals are required to be considered in risk assessment. US EPA (1989) recommends that carcinogenic risks are added.

To assess the overall potential for non-carcinogenic effects posed by more than one chemical a hazard index approach is used. This is undertaken by summing of all hazard quotients to determine a hazard index.

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9.2 Adopted Risk Criteria

Acceptable risk guidelines are available from a range of national and international environmental agencies. These include:

- US EPA (1991) states that "*Where the cumulative site risk to an individual based on an reasonable maximum exposure for both current and future land use is less than 10^{-4},… action is generally not warranted unless there are adverse environmental impacts*". Where the level of risk exceeds 10^{-4} it is recommended that remediation goals are developed based on a 10^{-6} cancer risk;
- WHO (1996) '*Guidelines for Drinking Water Quality*' are based on a risk of 1 in 100 000 (1×10^{-5}); and
- NHMRC/ARMCANZ (1996) '*Australian Drinking Water Guidelines*' nominate a negligible level of risk of 1 in 1 000 000 (1×10^{-6}).

No formal policy exists for the acceptable level of cancer risk, however it has been the experience of JBS that NSW, ACT and Victorian Environmental Auditors generally consider risks in the range of 1 in 100 000 (1×10^{-5}) to be acceptable. This level of acceptable risk will be adopted for this site.

For the purposes of this risk assessment an acceptable level of risk is defined as risk less than 1×10^{-5} incremental lifetime risk of cancer.

9.3 Assessment of Background Contributions

Background levels of a range of constituents were nominated in **Table 7.21** and are shown in **Table 9.1** following. An additional assessment has been undertaken on the basis of a recreational receptor to determine the level of risk / hazard posed by these constituents at the background concentrations, to determine the potential significance of the background levels. This has been undertaken by a comparison of the background dose of each constituent to the relevant RfD or RfC available for the constituent. It is noted that this comparison has been undertaken for COPCs with threshold toxicological data only. An assessment of background contributions is not strictly needed for non-threshold chemicals, as assessment is based on incremental risk (i.e. risk in addition to existing exposure).

Table 9.1: Estimation of Potential Background Levels of Hazard and Risk

COPC	Background Levels		% of RfD[1]	% of RfC
	Oral / Dermal	Inhalation		
Arsenic	0.04 mg/day	0.51 ng/m^3	30%	3.4%
Chromium	0.01 mg/day	No data	<1%	-
Copper	1.1mg/day	No data	17%[3]	-
Lead	0.1 mg/day	48 ng/m^3	41%[2]	9.6%[2]
Cyanide	0.04 mg/day	No data	4.8%	-
Benzene	Negligible	0.4 ppb (1.3µg/m^3)	-	13%
Toluene	Negligible	4.2 ppb (15.4µg/m^3)	-	<1%
Ethylbenzene	Negligible	0.5 ppb (2.2µg/m^3)	-	<1%
Xylene	Negligible	3.0 ppb (13.1µg/m^3)	-	6.0%
Trimethylbenzenes	No data / negligible	0.1 ppb (0.5µg/m^3)		7%
Styrene	No data / negligible	0.1 ppb (0.4µg/m^3)		<1%
Benzo(a)pyrene	As per PAHs (1µg/day)	0.40 ng/m^3	Non threshold criteria only	Non threshold criteria only
Other PAHs	1µg/day	No data	Generally <1%, apart from naphthalene at	-

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COPC	Background Levels		% of RfD[1]	% of RfC
	Oral / Dermal	Inhalation		
			1.4%	

Note: 1. Based on 70 kg receptor
2. Requires to be reduced by bioavailability of lead of 50%
3. Based on 2 year old, assumed to be 13.2 kg as per **Table 8.2**.

Based on review of **Table 9.1**, significant background exposures have been identified for arsenic, cadmium, lead, nickel and benzene. Other constituents are generally found to be below 10%. The following adjustments have been made to the risk based criteria for the imported fill, to be protective of existing exposures:

- Reduction of risk based arsenic criteria by a factor of 30%;
- Reduction of risk based cadmium criteria by a factor 90% (i.e. one order of magnitude). It is noted that this does not account for the complete background exposure to cadmium, but a reduction by an order of magnitude is considered a significant correction to the criteria;
- Reduction of risk based copper criteria by a factor of 17%;
- Reduction of lead criteria by a factor of 20%, taking into account the 50% bioavailability of the background sources of lead;
- Reduction of all benzene criteria as derived by threshold toxicological data by a factor of 13%; and
- Reduction of trimethylbenzene criteria by 7%.

It is noted that background levels are not available for all the COPCs assessed. The COPCs with background data available are found to be the most prevalent in the environment. Other COPCs would be anticipated to be present at substantially reduced levels and more than likely not have significant levels of background exposure.

9.4 Assessment of Mixtures

The risk based criteria as derived for the imported fill to be used on the site have been based on the level of the particular constituent that causes the maximum allowable level of hazard or risk. There is a potential that, where combinations of constituents occur at concentrations near to the risk based criteria, the total level of risk or hazard may exceed the maximum allowable limit of risk and hazard. To this effect, and based on review of historical soil data for the Barangaroo site, it would be reasonably assumed that PAH constituents, monocyclic aromatic hydrocarbon (MAHs) constituents and TPH constituents may each occur in combinations. On this basis, the risk based criteria for these constituents have been derived on the basis of lower level of acceptable risk and hazard as described following:

PAHs

- Carcinogenic PAH constituents have been assessed as a benzo(a)pyrene. On this basis, TEF's requires to be used to be used for benzo(a)pyrene and the other carcinogenic PAH constituents to derive a weighted sum and compared to the criteria derived on the basis of benzo(a)pyrene; and
- Remaining PAHs which are assessed as per threshold toxicological values have each had risk criteria derived on the basis of an acceptable hazard index of 0.2.

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MAHs

MAHs identified as COPCs including benzene, toluene, ethylbenzene, xylene, styrene and trimethylbenzenes require risk criteria based on a sum of hazard indexes of 1.0. On this basis, the risk based criteria have been derived for each constituent based on adjusted target hazard indexes as follows:

- Benzene – 0.5
- Trimethylbenzene – 0.25
- Xylenes – 0.1
- Ethylbenzene – 0.075
- Toluene – 0.075

TPH

As adopted for BTEX constituents, the sum of the TPH fractions also requires to add to a total hazard index of 1.0. This has been undertaken by deriving criteria for each of the TPH fractions (TPH C_6-C_9, C_{10}-C_{14}, C_{15}-C_{28} and C_{29}-C_{36}) that meet a hazard index of 0.25.

9.5 Estimation of Risk

The findings of the each of the modelling scenarios using unit concentrations of COPCs for each exposure scenario, potentially exposed population and exposure pathway are provided as **Appendix C**. A summary of all modelling results is provided in **Appendix C**. Results are summarised as per the adopted zones of soil criteria in **Tables 9.2** to **9.7**.

Some of the exposure scenarios have considered exposures to potential groundwater impact caused by contaminated leachate, including pooled seepage water evaporation within a Basement Car Park. Risk calculations for these exposure scenarios have been initially undertaken on the basis of the occurrence of unit concentrations of the constituents in water. Risk based criteria have been determined for the constituents in water on the basis of back calculation of these risk estimates. Equivalent soil concentrations, which may generated sufficient leachate to cause the water based concentrations, have then been estimated using leachability factors for the constituents as discussed in **Section 8.11.4**. This has allowed risk based total soil concentrations to be derived for the seepage water based exposure scenarios.

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Table 9.2: Summary of Human Health Based Criteria for 0-0.5m Soil Horizon (Zone 1)

Constituent	Criteria (mg/kg)	Basis of Criteria
	Imported Soils to be Used on Barangaroo Central	
Acenaphthene	900	Recreational user
Acenaphthylene	900	Recreational user
Ammonia	5 200	Aesthetics
Anthracene	4500	Recreational user
Arsenic	190	Recreational user
Benzo(a)pyrene	2.0	NEPC (1999)
Benzene	0.9	Commercial / industrial (gardener)
Chromium	630	Recreational user
Copper	6 400	Recreational user
Cyanide	310	Recreational user
Dibenzofuran	4 400	Recreational user
2,4-dimethylphenol	1 800	Recreational user
Ethylbenzene	130	Aesthetics
Fluoranthene	610	Recreational user
Fluorene	600	Recreational user
Lead	480	Recreational user
2-methylnaphthalene	60	Recreational user
Cresols	4 300	Recreational user
Naphthalene	33	Commercial / industrial (gardener)
Phenanthrene	4 500	Recreational user
Phenol	25 000	Aesthetics
Pyrene	460	Recreational user
Toluene	92	Aesthetics
TPH C_6-C_8 (ali)	890	Commercial / industrial (gardener)
TPH C_8-C_{16} (ali)	660	Commercial / industrial (gardener)
TPH $C_{>16}$ (ali)	175 000	Recreational user
TPH C_8-C_{16} (aro)	1100	Commercial / industrial (gardener)
TPH $C_{>16}$ (aro)	2600	Commercial / industrial (gardener)
1,2,4-trimethylbenzene	6.3	Recreational user
Xylenes	33	Aesthetics

It is also noted that phytotoxicity criteria protective of plants, and soil criteria protective of groundwater / surface water have also been derived for upper depth soils as detailed in the ecological risk assessment provided as **Appendix C** and summarised in **Section 11**.

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Table 9.3: Summary of Human Health Based Criteria for Soils >0.5m below site surface (Zone 2)

Constituent	Criteria (mg/kg)	Basis of Criteria
	Imported Soils to be Used on Barangaroo Central	
Acenaphthene	49 000	Aesthetics
Acenaphthylene	170 000	Commercial / Industrial (gardener)
Ammonia	16 000	Aesthetics
Anthracene	NC	Insufficient volatility / toxicity
Arsenic	NC	No complete exposure pathway
Benzo(a)pyrene	NC	No complete exposure pathway
Benzene	4.8	Commercial / Industrial (gardener)
Chromium	NC	No complete exposure pathway
Copper	NC	No complete exposure pathway
Cyanide	14 000	Aesthetics
Dibenzofuran	150 000	Aesthetics
2,4-dimethylphenol	NC	No complete exposure pathway
Ethylbenzene	130	Aesthetics
Fluoranthene	NC	No complete exposure pathway
Fluorene	250 000	Commercial / Industrial (gardener)
Lead	NC	No complete exposure pathway
2-methylnaphthalene	9 600	Aesthetics
Cresols	NC	No complete exposure pathway
Naphthalene	170	Commercial / Industrial (gardener)
Phenanthrene	NC	Insufficient volatility / toxicity
Phenol	25 000	Aesthetics
Pyrene	NC	Insufficient volatility / toxicity
Toluene	92	Aesthetics
TPH C_6-C_8 (ali)	4 400	Commercial / Industrial (gardener)
TPH C_8-C_{16} (ali)	3 600	Commercial / Industrial (gardener)
TPH $C_{>16}$ (ali)	NC	No complete exposure pathway
TPH C_8-C_{16} (aro)	6 000	Commercial / Industrial (gardener)
TPH $C_{>16}$ (aro)	NC	No complete exposure pathway
1,2,4-trimethylbenzene	215	Aesthetics
Xylenes	33	Aesthetics

NC – no criteria

It is also noted that soil criteria protective of groundwater / surface water have also been derived for fill based soils to be used on the site as detailed in the ecological risk assessment provided as **Appendix C** and summarised in **Section 11**.

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Table 9.4: Summary of Human Health Based Criteria for Soil Within 10m of Basement Car Park (Zone 3)

Constituent	Criteria (mg/kg)	Basis of Criteria
	Imported Soils to be Used on Barangaroo Central	
Acenaphthene	540	Resident
Acenaphthylene	880	Resident
Ammonia	12	Resident
Anthracene	30 000	Resident
Arsenic	NC	Insufficient toxicity
Benzo(a)pyrene	62	Resident
Benzene	0.1	Resident. Set equal to detection limit.
Chromium	59 000	Resident
Copper	NC	Insufficient toxicity
Cyanide	230	Resident
Dibenzofuran	0.5	Resident. Set equal to detection limit.
2,4-dimethylphenol	3 300	Resident
Ethylbenzene	8	Resident
Fluoranthene	180 000	Resident
Fluorene	1200	Resident
Lead	NC	Insufficient toxicity
2-methylnaphthalene	16	Resident
Cresols	7 200	Resident
Naphthalene	1.2	Resident
Phenanthrene	39 000	Resident
Phenol	2 800	Aesthetics
Pyrene	38 000	Resident
Toluene	7	Aesthetics
TPH C_6-C_8 (ali)	50	Resident
TPH C_8-C_{16} (ali)	37	Resident
TPH $C_{>16}$ (ali)	NC	No complete exposure pathway
TPH C_8-C_{16} (aro)	68	Resident
TPH $C_{>16}$ (aro)	NC	No complete exposure pathway
1,2,4-trimethylbenzene	1.9	Resident
Xylenes	2.5	Resident

NC – no criteria

It is noted that these criteria do not apply within the upper 0.5m of the soil profile (root zone soils). Zone 1 criteria should be referred to for these soils.

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Table 9.5: Summary of Human Health Based Criteria for Unsaturated Soil Within 30m and Greater than 10m from Basement Car Park (Zone 4)

Constituent	Criteria (mg/kg)	Basis of Criteria
	Imported Soils to be Used on Barangaroo Central	
Acenaphthene	4 000	Resident
Acenaphthylene	7 100	Resident
Ammonia	1 200	Resident
Anthracene	280 000	Resident
Arsenic	NC	No complete exposure pathway
Benzo(a)pyrene	NC	No complete exposure pathway
Benzene	0.1	Resident. Set equal to detection limit.
Chromium	NC	No complete exposure pathway
Copper	NC	No complete exposure pathway
Cyanide	1 200	Resident
Dibenzofuran	5 600	Resident
2,4-dimethylphenol	NC	No complete exposure pathway
Ethylbenzene	44	Resident
Fluoranthene	NC	No complete exposure pathway
Fluorene	10 000	Resident
Lead	NC	No complete exposure pathway
2-methylnaphthalene	450	Resident
Cresols	NC	No complete exposure pathway
Naphthalene	7.3	Resident
Phenanthrene	420 000	Resident
Phenol	20 000	Aesthetics
Pyrene	540 000	Resident
Toluene	41	Resident
TPH C_6-C_8 (ali)	210	Resident
TPH C_8-C_{16} (ali)	160	Resident
TPH $C_{>16}$ (ali)	NC	No complete exposure pathway
TPH C_8-C_{16} (aro)	290	Resident
TPH $C_{>16}$ (aro)	NC	No complete exposure pathway
1,2,4-trimethylbenzene	16	Resident
Xylenes	15	Resident

NC – no criteria

It is noted that these criteria do not apply within the upper 0.5m of the soil profile (root zone soils). Zone 1 criteria should be referred to for these soils.

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Table 9.6: Summary of Human Health Based Criteria for Unsaturated Soil Within 10m of Cultural Space (Zone 5)

Constituent	Criteria (mg/kg)	Basis of Criteria
	Imported Soils to be Used on Barangaroo Central	
Acenaphthene	380	Commercial / Industrial
Acenaphthylene	630	Commercial / Industrial
Ammonia	202	Commercial / Industrial
Anthracene	22 000	Commercial / Industrial
Arsenic	NC	No complete exposure pathway
Benzo(a)pyrene	NC	No complete exposure pathway
Benzene	0.1	Recreational. Set equal to detection limit.
Chromium	NC	No complete exposure pathway
Copper	NC	No complete exposure pathway
Cyanide	330	Commercial / Industrial
Dibenzofuran	86	Commercial / Industrial
2,4-dimethylphenol	NC	No complete exposure pathway
Ethylbenzene	3	Aesthetics
Fluoranthene	NC	No complete exposure pathway
Fluorene	900	Commercial / Industrial
Lead	NC	No complete exposure pathway
2-methylnaphthalene	45	Commercial / Industrial
Cresols	NC	No complete exposure pathway
Naphthalene	0.8	Commercial / Industrial
Phenanthrene	30 000	Commercial / Industrial
Phenol	850	Aesthetics
Pyrene	32 000	Commercial / Industrial
Toluene	2.8	Aesthetics
TPH C_6-C_8 (ali)	35	Commercial / Industrial
TPH C_8-C_{16} (ali)	26	Commercial / Industrial
TPH $C_{>16}$ (ali)	NC	No complete exposure pathway
TPH C_8-C_{16} (aro)	48	Commercial / Industrial
TPH $C_{>16}$ (aro)	NC	No complete exposure pathway
1,2,4-trimethylbenzene	1.8	Commercial / Industrial
Xylenes	1.1	Aesthetics

NC – no criteria

It is noted that these criteria do not apply within the upper 0.5m of the soil profile (root zone soils). Zone 1 criteria should be referred to for these soils.

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Table 9.7: Summary of Human Health Based Criteria for Unsaturated Soil Within 30m and Greater than 10m from Cultural Space (Zone 6)

Constituent	Criteria (mg/kg)	Basis of Criteria
	Imported Soils to be Used on Barangaroo Central	
Acenaphthene	2 800	Commercial / Industrial
Acenaphthylene	5 000	Commercial / Industrial
Ammonia	860	Commercial / Industrial
Anthracene	200 000	Commercial / Industrial
Arsenic	NC	No complete exposure pathway
Benzo(a)pyrene	NC	No complete exposure pathway
Benzene	0.2	Recreational, Commercial / Industrial
Chromium	NC	No complete exposure pathway
Copper	NC	No complete exposure pathway
Cyanide	860	Commercial / Industrial
Dibenzofuran	4 000	Commercial / Industrial
2,4-dimethylphenol	NC	No complete exposure pathway
Ethylbenzene	20	Aesthetics
Fluoranthene	NC	No complete exposure pathway
Fluorene	7 300	Commercial / Industrial
Lead	NC	No complete exposure pathway
2-methylnaphthalene	320	Commercial / Industrial
Cresols	NC	No complete exposure pathway
Naphthalene	5.1	Commercial / Industrial
Phenanthrene	300 000	Commercial / Industrial
Phenol	4 000	Aesthetics
Pyrene	400 000	Commercial / Industrial
Toluene	15	Aesthetics
TPH C_6-C_8 (ali)	150	Commercial / Industrial
TPH C_8-C_{16} (ali)	110	Commercial / Industrial
TPH $C_{>16}$ (ali)	NC	No complete exposure pathway
TPH C_8-C_{16} (aro)	200	Commercial / Industrial
TPH $C_{>16}$ (aro)	NC	No complete exposure pathway
1,2,4-trimethylbenzene	11	Commercial / Industrial
Xylenes	5.4	Aesthetics

NC – no criteria as no complete exposure pathway identified for constituent and soil zone

It is noted that these criteria do not apply within the upper 0.5m of the soil profile (root zone soils). Zone 1 criteria should be referred to for these soils.

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9.6 Assessment of Potential Coal Tar Odours

A methodology for assessing coal tar odours was derived in **Section 7.8** based on the sum of the naphthalene, 2-methylnaphthalene and acenaphthene criteria within each soil zone. The coal tar odour recognition criterion is based on direct exposure to the impacted soils. The criterion does not consider dilution that occurs between the source of the odour and the exposure point. The amount of dilution of each of the vapours is able to be estimated from the RISC modelling results by the comparison of the predicted concentration at the exposure zone and the predicted air concentration at the source.

Table 9.8, following, summarises each of the risk based criteria derived for each of the malodorous constituents as for each of the soil zones. The model predicted dilution of the vapours between the source and the exposure point are also summarised in **Table 9.8**. The sum of the constituents has been combined with the predicted level of dilution and then divided by coal tar odour recognition soil criteria of 165 mg/kg as derived in **Section 7.8**. A potential odour strength has been determined on the basis of the calculations. Potential concentrations within excavations have also been considered in the modelling.

By review of **Table 9.8**, each of the predicted equivalent odour concentrations at the exposure point is well below an odour level that may be detectable. It is considered that the assessment of odour thresholds for each of the constituents has been adequately protective of the occurrence of potential coal tar odours.

9.7 Asbestos

A criterion for asbestos of 1% present as fibre cement sheet has been adopted for a sub-surface maintenance worker exposure. This is below the actual level derived for a sub-surface maintenance exposure. No criterion has been derived for surface receptor exposure as it is considered aesthetically unacceptable for asbestos to be present in surface soils on the park.

The criterion of 1% mass of fibre cement sheet fragments will be adopted for soils below 0.5 m and soils below buildings across the site. An aesthetic based criterion will be adopted for all accessible surface soils to a depth of 0.5 m.

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Table 9.8: Summary of Sum of Potentially Malodorous PAH Constituents

Soil Zone	Sum of Malodorous PAH Constituent (mg/kg)			Reduction from Source Vapour to Surface / Exposure Vapour	Predicted Tar Odour Strength (OU/m^3)
	Naphthalene	2-methylnaphthalene	Acenaphthene	Naphthalene, 2-methylnaphthalene and Acenaphthene	
1	33	60	890	40 000	$1.5 * 10^{-4}$
2	170	9600	49 000	40 000	$8.9 * 10^{-3}$
3	1.2	16	540	4 000	$8.4 * 10^{-4}$
4	7.3	450	4 000	30 000	$9.0 * 10^{-4}$
5	0.82	45	380	1000	$2.6 * 10^{-3}$
6	5.1	320	2 800	6 000	$3.2 * 10^{-3}$

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9.8 Preparation of Combined TPH Criteria

TPH criteria are provided in **Tables 9.2** to **9.7** as based on aliphatic and aromatic fractions. These risk based criteria are required to be applied to complete TPH fractions as reported by analytical laboratories. This has been undertaken as per the guidance in **Section 8.13**, by assuming that each of the aliphatic and aromatic TPH fractions are present at a 1:1 mixture. Calculations have been using an inverse weighted means of criteria for each constituent as per approach advised in CCME (January 2008) 'Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil: Scientific Rationale Supporting Technical Document'.

Calculations are detailed following for each of the TPH fractions in each of the soil zones in **Table 9.9** following.

Table 9.9: Summary of Calculation of Combined TPH Criteria

Zone	TPH Fraction	Speciated Criteria	Calculation	Combined Criteria
1	C_{10}-C_{14}	Aliphatic – 660	1 / (0.5/660 + 0.5/1100)	830 mg/kg
		Aromatic – 1100		
	$C_{>15}$	Aliphatic – 175000	1 / (0.5/175000 + 0.5/2600)	5 100 mg/kg
		Aromatic – 2600		
2	C_{10}-C_{14}	Aliphatic – 3600	1 / (0.5/3600 + 0.5/6000)	4500 mg/kg
		Aromatic – 6000		
	$C_{>15}$	Aliphatic – NC		
		Aromatic – NC		
3	C_{10}-C_{14}	Aliphatic – 37	1 / (0.5/37 + 0.5/68)	48 mg/kg
		Aromatic – 68		
	$C_{>15}$	Aliphatic – NC		
		Aromatic – NC		
4	C_{10}-C_{14}	Aliphatic – 160	1 / (0.5/160 + 0.5/290)	210 mg/kg
		Aromatic – 290		
	$C_{>15}$	Aliphatic – NC		
		Aromatic – NC		
5	C_{10}-C_{14}	Aliphatic – 26	1 / (0.5/26 + 0.5/48)	34 mg/kg
		Aromatic – 48		
	$C_{>15}$	Aliphatic – NC		
		Aromatic – NC		
6	C_{10}-C_{14}	Aliphatic – 110	1 / (0.5/110 + 0.5/200)	140 mg/kg
		Aromatic – 200		
	$C_{>15}$	Aliphatic – NC		
		Aromatic – NC		

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10 Sensitivity Analysis

An assessment has been required to be undertaken of the sensitivity of the risk assessment outcomes. Risk assessment calculations have been based on:

- Levels of COPCs as estimated by soil sampling programs completed across the Barangaroo Project Site;
- Toxicological parameters used to characterise COPCs;
- Anticipated and assessed current and future land-uses;
- Exposure parameters used to characterise future population behaviours on the site;
- Physical parameters used to characterise site areas and buildings where exposures may occur; and
- Equations and related relationships used to estimate levels of COPCs from reported levels in soils and groundwater to points of exposure.

Each of these is discussed further following.

10.1 Sampling Programs

Soil and soil leachate data used for the risk assessment have been obtained from sampling programs previously completed by ERM, AECOM and Douglas Partners. The soil data has been used for the selection of constituents of potential concern. Soil data is required to be appropriately representative of site conditions. The soil data are considered to more than likely overstate the extent of impact on the site because assessment locations have been targeted only to areas of the site where site impact is most likely. This has caused the extent of the data to positively bias the actual extent of impact that may be present on the site. This is magnified by the use of analytical data as collected from the declaration area to assess potential levels of impact in soils.

A potentially limited analytical suite has been undertaken by the previous consultants. This has included analysis for a limited range of monocyclic aromatic hydrocarbons (MAHs). It is noted that other monocyclic aromatic hydrocarbons will most likely also be present with site contamination, potentially including trimethylbenzenes, propyl benzenes, etc. Limited analysis has been undertaken for detailed volatile and semivolatile organic compound lists. However, the criteria proposed for the primary COPCs identified and analysed are considered to appropriately account for other constituents that may be present. It is noted for the limited samples analysed for a wide range of analytes, that the primary COPCs were present at the higher concentrations.

This potential under-representation of the full extent of hydrocarbon constituents is considered to have at least been partially accounted for by the inclusion of assessment for TPH fractions. It is also noted that regulators in Australia commonly provide only speciated criteria and advise assessment for the limited range of MAHs as assessed by this risk assessment.

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10.2 Toxicological Parameters

Toxicological data are generally derived by the conversion of dose factors as developed based on animal studies to appropriate levels for human exposure. The conservatism of these values is achieved through the use of uncertainty factors. An uncertainty factor of 100 is commonly applied in converting measured animal toxicity data for use for humans, comprising:

- A factor of 10 to allow for differences that affect the way a chemical behaves in humans rather than the animal species tested; and
- Another factor of 10 adequate to allow for differences in the way the chemical might affect different people, to allow for the most sensitive individuals.

Though the two processes most likely act in two separate ways, indicating a summed factor of 20 should be used, the factors are multiplied to generate an uncertainty factor of 100. It is also noted that most agencies will incorporate an additional factor of 10 where long term toxicity data are not available for a particular constituent, resulting in a total factor of 1000.

Actual conversion factors used in the derivation of toxicological values has been extensively detailed in **Section 7**. Toxicological data used in the risk assessment has incorporated these uncertainty factors. This is considered an appropriately conservative process for the site.

A highly conservative Level 2 source has been adopted as the source of the toxicological data to characterise dermal risks of benzo(a)pyrene in soils. The use of this Level 2 source has resulted in derivation of a soil and irrigation water criteria that are approximately an order of magnitude lower than criterion that would have been derived by applying the oral slope factor (to assess dermal exposure) as recommended by the Level 1 sources.

10.3 Land-Use

The risk assessment outcomes are only valid for the assumed future land-use of the site. Potentially sensitive land-uses such as the use of Barangaroo Central for agricultural purposes, or the beneficial use of seepage water / groundwater have not been considered. The risk assessment would be required to be revised where the site was used for a future use other than a high density residential / recreational use.

10.4 Exposure Parameters

Exposure parameters have been derived for the range of receptors as based on published guidance provided in Australian guidelines. Exposure parameters are based on reasonably maximum exposed persons and are considered to be conservative. For example, for the recreational and residential scenarios, a constant exposure to site impact over a 70 year period has been used for the modelling.

Risk results are generally found to adjust linearly with adjustments in exposure parameters.

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10.5 Building Parameters

The most potentially sensitive parameters for characterisation of the Car Park, Residential Building and 'Cultural Space' buildings for the risk assessment is the rate of ventilation of the buildings and the rate of vapour inflow through the pavement / walls.

The minimum required rate of ventilation for a Car Park, as recommended by the appropriate Australian Standard, has been adopted in the modelling. The ventilation of the Car Park is likely to exceed the Australian Standard, particularly noting that site conceptual designs indicate that the eastern side of the Car Park will be open to ambient ventilation.

The rate of ventilation adopted for the Cultural Space was set as equal to 0.7 volumes changes per hour. In contrast, NZ Ministry for the Environment (1999) recommends that 2 volume changers per hour be adopted for a commercial building. ASTM (2002) recommends a higher rate of ventilation of 0.83 volume changer per hour, than that adopted.

A low rate of ventilation of 0.5 volume changes per hour has been adopted for the residential buildings. This is likewise considered to be low for a high density residential building will be provided with a forced ventilation system. This value is more commonly applied to low density residential buildings where no forced ventilation occurs.

The default US EPA (2003) value for vapour inflow has been adopted in the modelling. This is based on coarse grained soils being present below a building foundation. The use of this default value is found to substantially increase estimates of vapour inflow, and result in substantially more conservative risk based criteria. It is noted that the RISC modelling package contains algorithms to estimate rates of soil vapour inflow based on specific soil and building properties. Site specific estimates of vapour inflow would be anticipated to be substantially lower than the adopted default value, causing associated risk base criteria for volatile constituents to be higher.

10.6 Modelling Equations

Modelling for the risk assessment has been undertaken using the RISC modelling package. The modified Johnson and Ettinger model is used by the RISC package. Johnson and Ettinger (1991) developed a model for estimating indoor air concentrations resulting from contaminated soil. The non-depleting (infinite) source model developed by Johnson and Ettinger was used in the RBCA protocol. The Johnson and Ettinger model incorporates a simplification of the conceptual model that allows solution of a depleting source model. This model was historically modified to consider slab on ground construction and allow use of the same model to assess transport to outdoor air. The risk results as derived by the modified Johnson and Ettinger model are found to be more conservative than comparative models. For example, NZ Ministry for the Environment (1999) notes that results generated by the Johnson and Ettinger model are generally a factor of 2 more conservative than similar results as derived by the Jury (1983) modified behaviour assessment model.

Modifications have been made to the RISC modelling where necessary to ensure that the model undertakes calculations in accordance with the most recent published guidance for the use of Johnson and Ettinger relationships.

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10.6.1 Application of Johnson & Ettinger Relationships

The appropriateness of the application of the Johnson & Ettinger relationships for undertaking vapour intrusion modelling, and the associated adopted parameter physical properties, has been assessed by repetition of modelling scenarios using modelling spreadsheets as issued by the US EPA. This has been undertaken for Zone 6 (vapour intrusion to the Cultural Space at a distance of 10m) models using benzene and naphthalene. Two modelling runs have been undertaken for each of the constituents:

- Using the RISC model as adopted for use in the risk assessment, as shown in the second and third columns of **Table 10.1**; and
- Using vapour modelling spreadsheets as issued by the US EPA, as shown in the fourth and fifth columns of **Table 10.1**.

A default vapour inflow of 83.3 cm^2/s has been used in each of the models. The results of the comparative modelling are summarised in **Table 10.1** following.

Table 10.1: Summary of Comparison of Johnson & Ettinger Based Model Results using Default Rate of Vapour Inflow in Each Model (mg/m^3)

Model Scenario	Result using RISC		Result using US EPA Spreadsheets	
	Benzene	Naphthalene	Benzene	Naphthalene
Zone 6	$9.4 * 10^{-2}$	$6.2 * 10^{-4}$	0.2	$4.3*10^{-4}$

The RISC predicted concentrations of each constituent can be observed to be similar to those provided by the US EPA issued spreadsheets, confirming that the RISC model is appropriate to be used for the risk calculations.

A further comparison has been undertaken using the US EPA issued spreadsheets where the spreadsheet calculates the rate of vapour inflow. A default pressure differential of 40 $g/cm\text{-}s^2$ has been assessed with a crack width of 0.1 cm in the US EPA based spreadsheet, as per the assumptions for the slab to the Cultural Space building.

The results of the original RISC modelling for benzene and naphthalene are summarised in the second and third columns of **Table 10.2**. The results of the modelling using the pressure differential of 40 $g/cm\text{-}s^2$ instead of the default vapour inflow rate are summarised in the fourth and fifth columns of **Table 10.2**. This is summarised in **Table 10.2** following. Results are again observed to be similar, confirming the reliability of the adopted approach.

Table 10.2: Summary of Comparison of Johnson & Ettinger Based Model Results using Default Rate of Vapour Inflow for RISC only (mg/m^3)

Model Scenario	Result using RISC		Result using US EPA Spreadsheets	
	Benzene	Naphthalene	Benzene	Naphthalene
Zone 6	$9.4 * 10^{-2}$	$6.2 * 10^{-4}$	0.84	0.2

10.6.2 Biodegradation

Importantly, the Johnson and Ettinger model, and the risk assessment calculations, do not take into account potential degradation of hydrocarbon vapours as would occur by oxidation in the sub-surface. Potential vapour generation by contaminated soils and groundwater has been reported in several sources to be controlled by sub-surface oxygen levels, as discussed following.

An assessment of attenuation of hydrocarbon vapours by sub-surface oxygen has been undertaken in Abreu L and Johnson P (2006) '*Simulating the effect of aerobic biodegradation on soil vapor intrusion into buildings: Influence on degradation rate, source concentration and depth*' in Environmental Science and Technology. It was concluded that significant attenuation of petroleum hydrocarbons with depth can occur beneath and adjacent to foundations provided there is sufficient atmospheric O_2 replenishment to the sub-surface.

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An assessment of the occurrence and levels of oxygen below buildings in hydrocarbon impacted sands has been undertaken in Lundegard P, Johnson P and Dahlen P (2008) '*Oxygen Transport From the Atmosphere to Soil Gas Beneath a Slab-on-Grade Foundation Overlying Petroleum Impacted Soil*' in Environmental Science & Technology. The study site consisted of a slab on grade house constructed over a fine to medium sand with tar like petroleum hydrocarbon impact present at a depth of 1.5 to 1.8m below the slab. It was found that soils between the depths of 0 and 1 m below the building had near atmospheric levels of O_2. Below this was an aerobic / anaerobic transition zone that occurred somewhere between 1.0 and 1.8 m, considered to be through the upper region of the hydrocarbon impacted soil zone. It was further demonstrated in the study that oxygen in shallow soils underlying this structure were rapidly replenished on purging of soils. Oxygen was further considered to rapidly move downwards by diffusion.

An assessment of soil-gas distribution beneath and around a slab-on-grade building overlying shallow petroleum hydrocarbon impacted coarse alluvial soils, consisting of fine and medium sands, has been reported in Luo H, Dahlen P, Johnson P, Peargin T and Creamer T (2009) '*Spatial Variability of Soil-Gas Concentrations near and beneath a Building Overlying Shallow Petroleum Hydrocarbon-Impacted Soils*' in Ground Water Monitoring & Remediation. The study site consisted of a slab on grade warehouse constructed on silty medium to fine sands with petroleum hydrocarbon impact recorded as shallow as 0.15 m below the base of the building. It was found in this study that levels of sub-surface petroleum hydrocarbon soil vapour were inversely related to levels of subsurface O_2, with levels of TPH in soil gas generally being at or near the study detection limits where levels of O_2 were above 5%.

Were models to incorporate sub-surface oxygen levels and associated degradation of hydrocarbon vapours, much lower estimates of vapour migrating to the surface would be anticipated to be predicted. However, in lieu of certainty as to the potential level of oxygenation of compacted fill based soils on the site, biodegradation has been omitted.

10.7 Geological Parameters

Geological parameters can substantially influence vapour migration estimates using Johnson & Ettinger based models. This is most prevalent for volatile constituents. A sensitivity analysis on the model results has been undertaken using alternate geological parameters. A dry sand soil has been assumed for the majority of the modelling undertaken. The sensitivity of the modelling to the assumed geology can be assessed by undertaking additional modelling for the Zone 6 calculations (10 m below/away from Cultural Space). **Table 10.3** following summarises the modelling result for the dry sand as used in the modelling. Additional modelling has been undertaken using alternate geological parameters for:

- Gravels;
- Silty sand; and
- Silty clay.

Default geological parameters for each of the geologies of gravels, silty and silty clay, as provided to RISC, were used in the additional modelling.

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Table 10.3: Additional Modelling of Benzene Levels from Soils 10m Away from Cultural Space (mg/m^3)

Geology	Predicted Airborne Concentration
Sand (as modeled)	$9.4 * 10^{-2}$
Gravels	$5.0 * 10^{-2}$
Silty Sand	$3.4 * 10^{-3}$
Silty Clay	$2.4 * 10^{-4}$

It can be observed from **Table 10.3** that the geological parameters adopted for the assessment are conservative. Less conservative results were obtained for all scenarios using recommended default geological parameters provided to the RISC modelling package.

10.8 Potential Synergistic / Additive Effects

The risk based criteria, as based on human health effects, have been derived by correction of unit concentration results to a hazard index of 1.0 or a risk level of $1*10^{-5}$ for the majority of the constituents. However, it is noted that some of these constituents may occur in combinations. Where several of these constituents are present at levels close to the risk based criteria, the overall level of risk or hazard may be found to exceed the acceptable levels. On this basis, reduced levels of hazard have been used to derive criteria for monocyclic aromatic hydrocarbons, polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons. Carcinogenic PAHs have been assessed as a benzo(a)pyrene TEF, which also takes into account potential additive effects.

10.9 Conclusion

There are several factors which may have caused the risk and hazard estimates provided in this risk assessment, which have premised the derivation of the risk based criteria for the site, to be underestimated. However, it is more than likely that any underestimation caused by the risk assessment process and limitations of available data and modelling techniques has been overcome by the use of conservative assumptions throughout the assessment. Examples of conservative assumptions provided in this assessment include:

- Consideration of maximum values for contaminant concentrations across the whole of the Barangaroo Project Site in the selection of constituents of potential concern;
- Conservative assumption of potential substantial leaching of seepage water from imported soils and significant discharge into basement car parks into areas accessible by adult and children residents;
- Omission of degradation of hydrocarbon vapours in the sub-surface in estimating rates of vapour migration;
- Used of a conservative modelling package and associated physical parameters to characterise COPCs;
- Adoption of lower target hazard indexes for the derivation of risk based criteria for constituents which may occur in combinations;
- Allowance for additive effects of carcinogenic PAHs by assessment of benzo(a)pyrene by a TEF approach;
- Use of RME (reasonable maximum exposure) based exposure parameters for receptors where locally available data are not present; and
- Assumption of all potential pathways.

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It is concluded that the risk estimates provided are overestimates of actual risk levels and can be used for future decision making for the site. Considering the degree of conservative assumptions and outcomes of alternative modelling scenarios in **Section 10**, it is considered that the proposed criteria are appropriate for the use in assessing imported fill to be used on Barangaroo Central.

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11 Ecological Risk Assessment

The ecological risk assessment (ERA) as completed for the site has been provided as **Appendix D**. In addition to the zones and criteria identified for the protection of human health, additional zones and criteria are provided in the ERA for the protection of proposed on-site ecological communities, and ecological communities within the surrounding environment.

The ERA has considered a range of ecological exposure scenarios for the proposed development of Barangaroo Central. The key facets of the proposed Barangaroo Central development plans that have been considered in the risk assessment include:

- Provision of root zone soils to areas of site plantings designated as lawn areas, shrubs, or large tree plantings; and
- Potential leaching of imported fill materials and discharge of leachate through seepage water / groundwater to the marine environment of Darling Harbour.

On the basis of these land-use parameters and the conceptual plans for Barangaroo Central and with consideration of the limitations provided in **Section 12**, the following risk based ecological criteria have been derived for use on the site as summarised in **Table 10.1**. It is intended that each of the criteria are to be applied as follows:

- Ecological Investigation Level (EIL) Protective of Potential Phytotoxicity Effects – to be applied to soils classified as root zone soils;
- EIL Protective of Surface Water – Saturated Zone – to be applied to imported fill materials that are proposed to be used below the depth of groundwater (assumed to be 1.9 m AHD based on the predicted 2100 high water mark); and
- EIL Protective of Surface Water – Unsaturated Zone – to be applied to imported fill materials used above the depth of groundwater (assumed to be 1.9m AHD).

Table 10.1: Summary of Ecological Risk Based Criteria for Imported Fill to be Used at Barangaroo Central

Constituent	Ecological Criteria		
	Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Ecological Investigation Level Protective of Surface Water – Saturated Soils	Ecological Investigation Level Protective of Surface Water – Unsaturated Soils
	mg/kg	mg/kg	mg/kg
Arsenic	20	4.6	18
Cadmium	3	0.1	0.2
Chromium (VI)[1]	-	18	70
Chromium (total)	190	-	-
Cobalt	-	1.7	6.7
Copper	60	6.8	27
Lead	1100	46	190
Mercury	1	0.2	0.9
Nickel	30	210	850
Vanadium	-	300	1200
Zinc	200	20	79
Cyanide (free)	0.9	0.4	1.6
Ammonia	20	<LOR	<LOR
Benzene	0.2	0.1	0.3
Toluene	0.3	<LOR	0.1
Ethylbenzene	0.8	<LOR	0.1
Xylene	-	<LOR	0.1
Styrene	-	<LOR	0.4
Acenaphthene	29 (sum)	0.4	1.5
Acenaphthylene		0.7	2.7
Anthracene		<LOR	<LOR
Fluorene		1.2	4.7
Naphthalene		1.6	6.4

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Constituent	Ecological Criteria		
	Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Ecological Investigation Level Protective of Surface Water – Saturated Soils	Ecological Investigation Level Protective of Surface Water – Unsaturated Soils
	mg/kg	mg/kg	mg/kg
Phenanthrene		0.1	0.5
2-methylnaphthalene	-	<LOR	<LOR
Benz(a)anthracene	18 (sum)	-	-
Benzo(a)pyrene		0.2[2]	0.7[2]
Benzo(b)fluoranthene		-	-
Benzo(g,h,i)perylene		-	-
Benzo(k)fluoranthene		-	-
Chrysene		-	-
Dibenz(a,h)anthracene		-	-
Fluoranthene		1.2	4.7
Indeno(1,2,3-c,d)pyrene		-	-
Pyrene		<LOR	0.1
Dibenzofuran	-	<LOR	<LOR
Phenol	3.8	-	-
Cresols	3.8	<LOR	<LOR
2,4-dimethylphenol	3.8	<LOR	<LOR
TPH C_6-C_9	210	<LOR	<LOR
TPH C_{10}-C_{14}	150	<LOR	<LOR
TPH C_{15}-C_{36}	300	-	-

Note: <LOR – below typical laboratory limit of reading

1. Criteria for chromium (VI)
2. To be assessed as per equivalent toxicity equivalence factor (TEF) to benzo(a)pyrene. Sum of carcinogenic PAHs to be summed, with multiplication of TEF, and assessed to benzo(a)pyrene criteria. As per WHO (2003) 'Polynuclear aromatic hydrocarbons in Drinking-water' relative potencies of Benz(a)anthracene – 0.1; Benzo(a)pyrene – 1.0; Benzo(b)fluoranthene – 0.1; Benzo(g,h,i)perylene – 0.01; Benzo(k)fluoranthene – 0.1; Chrysene – 0.01; Dibenz(a,h)anthracene – 1.0; and Indeno(1,2,3-c,d)pyrene – 0.1.

In addition to these risk based criteria for soils, all discharges from the site are required to meet water quality limits as protective of Darling Harbour. For the majority of constituents, these water quality limits have been provided to the Barangaroo Protection of the Environment Operations Act 1997 Licence Variation Application – EPL 13336. For constituents assessed in the risk assessment that are not listed in the environmental licence, reference has been made to the marine water quality criteria adopted during the ecological risk assessment, as based on EPA endorsed guidelines and standards and adjusted for some constituents by a mixture modifying factor. Surface water protection criteria are summarised in **Table 10.2**.

Table 10.2: Surface Water Protection Criteria for Discharges from Barangaroo Central (µg/L)

Constituent	Protection of Surface Water Quality Criteria
Arsenic	2.3[2]
Cadmium	0.7[2]
Chromium (III)	27[2]
Chromium (VI)	4.4[2]
Cobalt	1[3]
Copper	1.3[2]
Lead	4.4[2]
Mercury	0.1[2]
Nickel	7[2]
Vanadium	100[3]
Zinc	15[2]
Ammonia	910[3]
Cyanide	4[3]
Benzene	500[2]
Toluene	180[2]
Ethylbenzene	80[2]
m&p-Xylene	75[2]
o-Xylene	350[2]
Styrene	72[3]
Acenaphthene	2[1, 2]

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Constituent	Protection of Surface Water Quality Criteria
Acenaphthylene	2[1, 2]
Anthracene	2[1, 2]
Benzo(a)pyrene	2[1, 2]
Benzo(a)anthracene	2[1, 2]
Benzo(b)fluoranthene	2[1, 2]
Benzo(k)fluoranthene	2[1, 2]
Benzo(g,h,i)perylene	2[1, 2]
Dibenz(a,h)anthracene	2[1, 2]
Fluoranthene	2[1, 2]
Fluorene	2[1, 2]
Indeno(1,2,3-c,d)pyrene	2[1, 2]
Naphthalene	50[2]
Phenanthrene	2[1, 2]
Pyrene	2[1, 2]
2-methylnaphthalene	0.42[3]
Phenol	400[2]
Cresols	4.29[3]
2,4-dimethylphenol	0.66[3]
Dibenzofuran	0.74[3]
TPH C_6-C_9	20[1, 2]
TPH C_{10}-C_{14}	50[1, 2]
TPH C_{15}-C_{28}	100[1, 2]
TPH C_{29}-C_{36}	50[1, 2]

Note: 1. Based on limit of reporting.
2. As per Licence limits.
3. As per OHE provided protection of marine water quality criteria with mixture modifying factors included where appropriate.

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12 Application of Risk Based Criteria

Depth and location specific criteria have been derived for the site for the protection of human health (**Section 9**) and for the protection of on-site and off-site ecological populations (**Section 11**). As described in **Section 1.4**, the criteria must be considered together in application to the certification of imported fill materials to be used on Barangaroo Central.

The application of proposed Barangaroo Central Stage 1 Public Domain Design has been undertaken on a depth basis only, as the whole of the site is proposed to be used for open space / recreational; uses. **Figure 5** has been provided which has delineated the proposed Barangaroo Central High Density / Recreational development into a number of sub-areas.

The location and extent of the sub-areas is based on the factors controlling the soil zones as relevant to each of the human health and ecological criteria. **Tables 12.1** and **12.2** following summarise each of the sub-areas identified on Barangaroo central, on the basis of the Barangaroo Central Stage 1 Public Domain and the high density residential / recreational development schemes respectively, for the purposes of applying the risk based criteria. **Tables 12.1** and **12.2** nominate the relevant risk based criteria (as per zoned criteria in **Sections 9** and **11**) and decision rules to apply the risk based criteria to be applied to each depth range of soils within the sub-area. It is noted that existing soil data available for Barangaroo Central may also be considered with soil data generated for imported fills to assess against the statistical measure based assessment criteria.

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Table 12.1: Summary of Application of Human Health and Ecological Based Criteria to Proposed Barangaroo Central Stage 1 Public Domain

Depth Range	General Description of Soils	Applicable Criteria	Decision Rule to Apply Criteria
0-0.5m bgs	Root Zone Soils / Surface Soils	Zone 1 HHRA	95% $UCL_{average}$
		Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Maximum
		Ecological Investigation Level Protective of Surface Water – Unsaturated Soils	Average
>0.5m bgs to 1.9m AHD	General Fill Material above Groundwater	Zone 2 HHRA	95% $UCL_{average}$
		Ecological Investigation Level Protective of Surface Water – Unsaturated Soils	Average
>1.9m AHD	General Fill Material Below Groundwater	Ecological Investigation Level Protective of Surface Water – Saturated Soils	Average

Table 12.2: Summary of Application of Human Health and Ecological Based Criteria to Proposed High Density Residential / Recreational Development

Site Area[1]	Basis for Delineation of Site Area	Depth Range	General Description of Soils	Applicable Criteria	Decision Rule to Apply Criteria
A	>30m from Cultural Space and Residential Building Basements	0-0.5m bgs	Root Zone Soils / Surface Soils	Zone 1 HHRA	95% $UCL_{average}$
				Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Maximum
				Ecological Investigation Level Protective of Surface Water – Unsaturated Soils	Average
		>0.5m bgs to 1.9m AHD	General Fill Material above Groundwater	Zone 2 HHRA	95% $UCL_{average}$
				Ecological Investigation Level Protective of Surface Water – Unsaturated Soils	Average
		>1.9m AHD	General Fill Material Below Groundwater	Ecological Investigation Level Protective of Surface Water – Saturated Soils	Average
B	<10m away from / below Cultural Space	0-0.5m bgs, excluding soils below Cultural Space	Root Zone Soils / Surface Soils	Zone 1 HHRA	95% $UCL_{average}$
				Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Maximum
				Ecological Investigation Level Protective of Surface Water – Unsaturated Soils	Average
		>0.5m bgs to 1.9m AHD and all soils below <1.9m AHD	General Fill Material above Groundwater	Zone 5 HHRA	95% $UCL_{average}$
				Ecological Investigation Level Protective of Surface Water – Unsaturated Soils	Average
		>1.9m AHD	General Fill Material Below Groundwater	Ecological Investigation Level Protective of Surface Water – Saturated Soils	Average
C	>10m and <30m away from Cultural Space	0-0.5m bgs, excluding soils below Cultural Space	Root Zone Soils / Surface Soils	Zone 1 HHRA	95% $UCL_{average}$
				Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Maximum
				Ecological Investigation Level Protective of Surface Water –	Average

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Site Area[1]	Basis for Delineation of Site Area	Depth Range	General Description of Soils	Applicable Criteria	Decision Rule to Apply Criteria
				Unsaturated Soils	
		>0.5m bgs to 1.9m AHD and all soils below <1.9m AHD	General Fill Material above Groundwater	Zone 6 HHRA	95% $UCL_{average}$
				Ecological Investigation Level Protective of Surface Water – Unsaturated Soils	Average
		>1.9m AHD	General Fill Material Below Groundwater	Ecological Investigation Level Protective of Surface Water – Saturated Soils	Average
D	<10m away from Residential Building Basements	0-0.5m bgs	Root Zone Soils / Surface Soils	Zone 1 HHRA	95% $UCL_{average}$
				Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Maximum
				Ecological Investigation Level Protective of Surface Water – Unsaturated Soils	Average
		>0.5m bgs to 1.9m AHD and all soils below <1.9m AHD	General Fill Material above Groundwater	Zone 3 HHRA	95% $UCL_{average}$
				Ecological Investigation Level Protective of Surface Water – Unsaturated Soils	Average
		>1.9m AHD	General Fill Material Below Groundwater	Zone 3 HHRA	95% $UCL_{average}$
				Ecological Investigation Level Protective of Surface Water – Saturated Soils	Average
E	>10m and <30m away from Residential Building Basements	0-0.5m bgs, excluding soils below Cultural Space	Root Zone Soils / Surface Soils	Zone 1 HHRA	95% $UCL_{average}$
				Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Maximum
				Ecological Investigation Level Protective of Surface Water – Unsaturated Soils	Average
		>0.5m bgs to 1.9m AHD and all soils below <1.9m AHD	General Fill Material above Groundwater	Zone 4 HHRA	95% $UCL_{average}$
				Ecological Investigation Level Protective of Surface Water – Unsaturated Soils	Average
		>1.9m AHD	General Fill Material Below Groundwater	Ecological Investigation Level Protective of Surface Water – Saturated Soils	Average

Note: 1. Refer to **Figure 5**

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13 Conclusions and Recommendations

A human health risk assessment has been completed for the assessment of imported fill materials to be used with the proposed development of the Barangaroo Central as:

- Barangaroo Central Stage 1 Public Domain; and
- Combined high density residential / recreational development as consistent with the proposed Masterplan for Barangaroo.

The risk assessment has considered a range of human health exposure scenarios for imported fill as used on Barangaroo Central. The key facets of the proposed development that have been considered in the risk assessment include:

- Construction of basement car park with overlying residential building;
- Construction of a 'Cultural Space' building;
- Recreational / open space areas; and
- Sub-surface services / infrastructure over the open space area of Barangaroo Central typically to a maximum depth of 0.5 m.

On the basis of these land-use parameters, the conceptual plans for Barangaroo Central, consideration of human exposure scenarios only, consideration of existing levels of exposure of human receptors to background levels of constituents and the limitations provided in **Section 15**, risk based criteria have been derived for use on the site as summarised in **Table 13.1**. **Table 13.1** provides a range of criteria for potential soil zones. Imported fill materials are required to be assessed as per the proposed soil zone where the materials will be placed. These soils zones are required to be interpreted as per the following rules:

- Zone 1 – Soils within 0.5 m of the finished surface of the Park;
- Zone 2 – Soils located below a depth of 0.5m bgs and located more than 30m from basements / Cultural Space;
- Zone 3 – Soils used as fill material within 10m of the basements to the residential buildings;
- Zone 4 – Soils used as fill materials greater than 10m and less than 30m from the basements to the residential buildings;
- Zone 5 – Soils used as fill material within 10m of the Cultural Space Building; and
- Zone 6 – Soils used as fill materials greater than 10m and less than 30m from the Cultural Space Building.

An ecological risk assessment has also been completed for the site. The risk assessment has considered a range of ecological exposure scenarios for the proposed development of Barangaroo Central that may be impacted by imported fill materials bought to the site. The key facets of the proposed open space areas of Barangaroo Central that have been considered in the risk assessment include:

- Provision of root zone soils to areas of site plantings designated as lawn areas, areas of shrubs and trees, or large tree plantings;
- Potentially leaching of chemical constituents within imported fill materials and migration to Darling Harbour.

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On the basis of these land-use parameters and the conceptual plans for each of the development scenarios for Barangaroo Central and with consideration of the limitations provided in **Section 15**, the following risk based ecological criteria have been derived for use on the site as summarised in **Table 13.2**. It is intended that each of the criteria are to be applied as follows:

- Ecological Investigation Level (EIL) Protective of Potential Phytotoxicity Effects – to be applied to soils classified as root zone soils;
- EIL Protective of Surface Water – Saturated Zone – to be applied to soils that are proposed to be used as fill materials below the depth of groundwater (assumed to be 1.9 m AHD based on the predicted 2100 high water mark);
- EIL Protective of Surface Water – Unsaturated Zone – to be applied to be used as fill materials that are present above the depth of groundwater (assumed to be 1.9 m AHD based on the potential future high water mark).

The inter-relationship of human health and ecological based criteria to the Barangaroo Central design, with the relevant decision rules for the use of environmental data and comparison to the risk based criteria, has been detailed in **Section 12**.

Surface water discharges from the site are required to meet the protection of surface water criteria in **Table 13.3**.

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Table 13.1: Summary of Human Health Risk Based Criteria to Assess Imported Fill Materials to be Used on Barangaroo Central

Constituent	Zone 1 Risk Based Criteria (mg/kg)	Zone 2 Risk Based Criteria (mg/kg)	Zone 3 Risk Based Criteria (mg/kg)	Zone 4 Risk Based Criteria (mg/kg)	Zone 5 Risk Based Criteria (mg/kg)	Zone 6 Risk Based Criteria (mg/kg)
Acenaphthene	900	49 000	540	4 000	380	2 800
Acenaphthylene	900	170 000	880	7 100	630	5 000
Ammonia	5 200	16 000	12	1 200	202	860
Anthracene	4500	NC	30 000	280 000	22 000	200 000
Arsenic	190	NC	NC	NC	NC	NC
Benzo(a)pyrene	2.0	NC	62	NC	NC	NC
Benzene	0.9	4.8	0.1	0.1	0.1	0.2
Chromium	630	NC	59 000	NC	NC	NC
Copper	6 400	NC	NC	NC	NC	NC
Cyanide	310	14 000	230	1 200	330	860
Dibenzofuran	4 400	150 000	0.5	5 600	86	4 000
2,4-dimethylphenol	1 800	NC	3 300	NC	NC	NC
Ethylbenzene	130	130	8	44	3	20
Fluoranthene	610	NC	180 000	NC	NC	NC
Fluorene	600	250 000	1200	10 000	900	7 300
Lead	480	NC	NC	NC	NC	NC
2-methylnaphthalene	60	9 600	16	450	45	320
Cresols	4 300	NC	7 200	NC	NC	NC
Naphthalene	33	170	1.2	7.3	0.8	5.1
Phenanthrene	4 500	NC	39 000	420 000	30 000	300 000
Phenol	25 000	25 000	2 800	20 000	850	4 000
Pyrene	460	NC	38 000	540 000	32 000	400 000
Toluene	92	92	7	41	2.8	15
TPH C_6-C_8 (aliphatic)	890	4 400	50	210	35	150
TPH C_{10}-C_{14}	830	4 500	48	210	34	140
TPH $C_{>15}$	5 100	NC	NC	NC	NC	NC
1,2,4-trimethylbenzene	6.3	215	1.9	16	1.8	11
Xylenes	33	33	2.5	15	1.1	5.4

Note: 1. To be assessed as per equivalent toxicity equivalence factor (TEF) to benzo(a)pyrene. Sum of carcinogenic PAHs to be summed, with multiplication of TEF, and assessed to benzo(a)pyrene criteria. As per WHO (2003) 'Polynuclear aromatic hydrocarbons in Drinking-water' relative potencies of Benz(a)anthracene – 0.1; Benzo(a)pyrene – 1.0; Benzo(b)fluoranthene – 0.1; Benzo(g,h,i)perylene – 0.01; Benzo(k)fluoranthene – 0.1; Chrysene – 0.01; Dibenz(a,h)anthracene – 1.0; and Indeno(1,2,3-c,d)pyrene – 0.1.

Zone 1 – 0-0.5m Soil Horizon

Zone 2 – Soils >0.5m below site surface

Zone 3 –Soil Within 10m of Basement Car Park

Zone 4 – Unsaturated Soil Within 30m and Greater than 10m from Basement Car Park

Zone 5 – Unsaturated Soil Within 10m of Cultural Space

Zone 6 – Unsaturated Soil Within 30m and Greater than 10m from Cultural Space

NC – no criteria as no complete exposure pathway identified for constituent and soil zone, or risk based level beyond maximum possible level

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Table 13.2: Summary of Ecological Risk Based Criteria for Imported Fill to be Used at Barangaroo Central

Constituent	Ecological Criteria		
	Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Ecological Investigation Level Protective of Surface Water – Saturated Soils	Ecological Investigation Level Protective of Surface Water – Unsaturated Soils
	mg/kg	mg/kg	mg/kg
Arsenic	20	4.6	18
Cadmium	3	0.1	0.2
Chromium (VI)[1]	-	18	70
Chromium (total)	190	-	-
Cobalt	-	1.7	6.7
Copper	60	6.8	27
Lead	1100	46	190
Mercury	1	0.2	0.9
Nickel	30	210	850
Vanadium	-	300	1200
Zinc	200	20	79
Cyanide (free)	0.9	0.4	1.6
Ammonia	20	<LOR	<LOR
Benzene	0.2	0.1	0.3
Toluene	0.3	<LOR	0.1
Ethylbenzene	0.8	<LOR	0.1
Xylene	-	<LOR	0.1
Styrene	-	<LOR	0.4
Acenaphthene	29 (sum)	0.4	1.5
Acenaphthylene		0.7	2.7
Anthracene		<LOR	<LOR
Fluorene		1.2	4.7
Naphthalene		1.6	6.4
Phenanthrene		0.1	0.5
2-methylnaphthalene	-	<LOR	<LOR
Benz(a)anthracene	18 (sum)	-	-
Benzo(a)pyrene		0.2[2]	0.7[2]
Benzo(b)fluoranthene		-	-
Benzo(g,h,i)perylene		-	-
Benzo(k)fluoranthene		-	-
Chrysene		-	-
Dibenz(a,h)anthracene		-	-
Fluoranthene		1.2	4.7
Indeno(1,2,3-c,d)pyrene		-	-
Pyrene		<LOR	0.1
Dibenzofuran	-	<LOR	<LOR
Phenol	3.8	-	-
Cresols	3.8	<LOR	<LOR
2,4-dimethylphenol	3.8	<LOR	<LOR
TPH C_6-C_9	210	<LOR	<LOR
TPH C_{10}-C_{14}	150	<LOR	<LOR
TPH C_{15}-C_{36}	300	-	-

Note: <LOR – below typical laboratory limit of reading

1. Criteria for chromium (VI)
2. To be assessed as per equivalent toxicity equivalence factor (TEF) to benzo(a)pyrene. Sum of carcinogenic PAHs to be summed, with multiplication of TEF, and assessed to benzo(a)pyrene criteria. As per WHO (2003) 'Polynuclear aromatic hydrocarbons in Drinking-water' relative potencies of Benz(a)anthracene – 0.1; Benzo(a)pyrene – 1.0; Benzo(b)fluoranthene – 0.1; Benzo(g,h,i)perylene – 0.01; Benzo(k)fluoranthene – 0.1; Chrysene – 0.01; Dibenz(a,h)anthracene – 1.0; and Indeno(1,2,3-c,d)pyrene – 0.1.

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Table 13.3: Surface Water Protection Criteria for Discharges from Barangaroo Central (µg/L)

Constituent	Protection of Surface Water Quality Criteria
Arsenic	2.3[2]
Cadmium	0.7[2]
Chromium (III)	27[2]
Chromium (VI)	4.4[2]
Cobalt	1[3]
Copper	1.3[2]
Lead	4.4[2]
Mercury	0.1[2]
Nickel	7[2]
Vanadium	100[3]
Zinc	15[2]
Ammonia	910[3]
Cyanide	4[3]
Benzene	500[2]
Toluene	180[2]
Ethylbenzene	80[2]
m&p-Xylene	75[2]
o-Xylene	350[2]
Styrene	72[3]
Acenaphthene	2[1, 2]
Acenaphthylene	2[1, 2]
Anthracene	2[1, 2]
Benzo(a)pyrene	2[1, 2]
Benzo(a)anthracene	2[1, 2]
Benzo(b)fluoranthene	2[1, 2]
Benzo(k)fluoranthene	2[1, 2]
Benzo(g,h,i)perylene	2[1, 2]
Dibenz(a,h)anthracene	2[1, 2]
Fluoranthene	2[1, 2]
Fluorene	2[1, 2]
Indeno(1,2,3-c,d)pyrene	2[1, 2]
Naphthalene	50[2]
Phenanthrene	2[1, 2]
Pyrene	2[1, 2]
2-methylnaphthalene	0.42[3]
Phenol	400[2]
Cresols	4.29[3]
2,4-dimethylphenol	0.66[3]
Dibenzofuran	0.74[3]
TPH C_6-C_9	20[1, 2]
TPH C_{10}-C_{14}	50[1, 2]
TPH C_{15}-C_{28}	100[1, 2]
TPH C_{29}-C_{36}	50[1, 2]

Note: 1. Based on limit of reporting.
2. As per Licence limits.
3. As per OHE provided protection of marine water quality criteria with mixture modifying factors included where appropriate.

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WHO (2003) 'Ethylbenzene in Drinking Water'

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15 Limitations

This report has been prepared for use by the client who commissioned the works in accordance with the project brief only and has been based in part on information obtained from other parties. The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

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Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements and site history, not on sampling and analysis of all media at all locations for all potential contaminants.

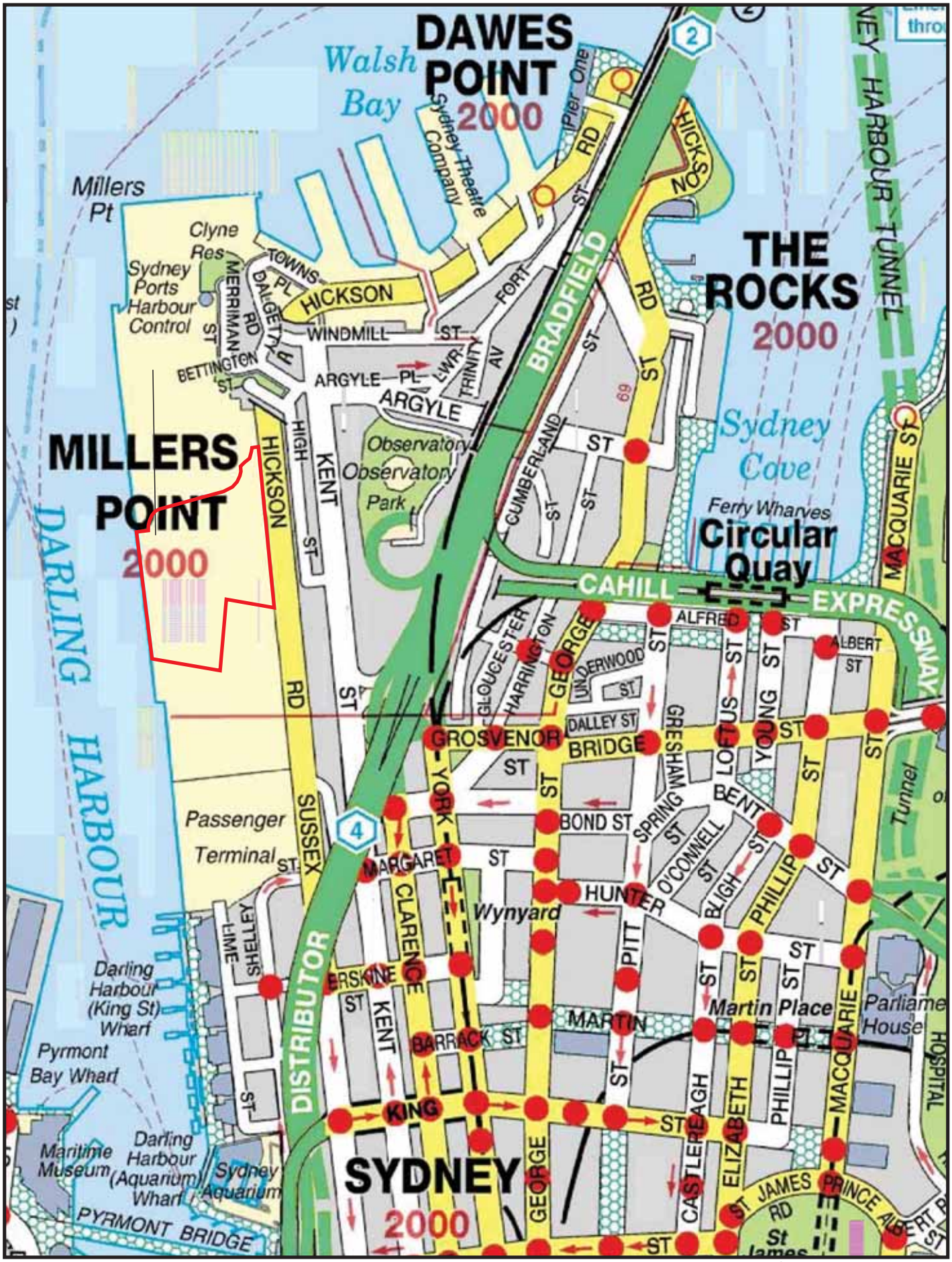
Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS Environmental Pty Ltd reserves the right to review the report in the context of the additional information.

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Figures

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Source: Base Image - © 2008 Universal Publishers Pty Ltd

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0 75 125 250 m

Scale: Approximate

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date
A4			
A	Issue - R01	RF	27-1-2012

Legend:

Approximate Boundary - Barangaroo Central

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Figure 1: Site Location

Client: Barangaroo Delivery Authority

Project: Barangaroo Central

Job No: 42021 File Name: 42021_01



Source: Base Image www.nearmap.com (23-10-2011)

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0 15 30 60 m

Scale: 1:1,500

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
B	Original Issue - R01	RF	21-2-2012

Legend:

- Approximate Site Boundary - Barangaroo Central
- Inaccessible for soil and groundwater sampling

JBS ENVIRONMENTAL

Figure 2: Barangaroo Central Site Plan

Client: Barangaroo Delivery Authority

Project: Barangaroo - Central

Job No: 42021 File Name: 42021_02



Source: Base Image www.nearmap.com (23-10-2011)

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0 20 40 80 m

Scale: 1:2,200

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
B	Original Issue - R01	RF	21-2-2012

Legend:

- Approximate Site Boundary - Barangaroo Central
- DECCW Declared Area
- Approximate 500m2 Pavillion
- Consider 50m floating connection
- Provide area for temporary car parking
- Provide flat areas for events
- View and Access Corridors

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Figure 3: Barangaroo Central Concept Plan - Barangaroo Central Stage 1 Public Domain

Client: Barangaroo Delivery Authority

Project: Barangaroo - Central

Job No: 42021 File Name: 42021_03



Source: JPW / PWP 110712_Outline Design Plan (11-07-2011)

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0 20 40 80 m

Scale: 1:2,200

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
B	Original Issue - R01	RF	21-2-2012

Legend:

- Approximate Site Boundary - Barangaroo Central
- DECCW Declared Area
- Approximate 500m2 Pavillion
- Consider 50m floating connection
- Residential Building Basements / Carparks
- Provide area for temporary car parking
- Provide flat areas for events

JBS ENVIRONMENTAL

Figure 4: Barangaroo Central Concept Plan - Barangaroo Residential / Open Space Development

Client: Barangaroo Delivery Authority

Project: Barangaroo - Central

Job No: 42021 File Name: 42021_04



Source: JPW / PWP 110712_Outline Design Plan (11-07-2011)

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0 20 40 80 m

Scale: 1:2,200

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
A	Original Issue - R02	RF	28-2-2012

Legend:

- Approximate Site Boundary - Barangaroo Central
- Assumed Cultural Space
- Area A
- Area B (<10m from Cultural Space)
- Area C (10 to 30m from Cultural Space
- Area D (<10m from Residential Building Basements/Carparks)
- Area E (10 to 30m from Residential Building Basements/Carparks)
- Declared Area
- Residential Building Basements / Carparks

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Figure 5: Barangaroo Central Concept Plan - Barangaroo Residential / Open Space Development Proposed Application of Risk Criteria

Client: Barangaroo Delivery Authority

Project: Barangaroo - Central

Job No: 42021 File Name: 42021_05

Appendix A

Soil and Groundwater Results Summary Tables

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Table 1: Heavy Metals
All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH01	0.3	12/2/09	Area A	333622	6251528	2.09	-	-	<5	20	1	<1	-	2	12	331	-	6	725	<0.1	6	-	-	106	46
AECOM	BH01	10	12/2/09	Area A	333622	6251528	-7.61	-	-	6	60	<1	<1	-	7	2	13	-	104	159	<0.1	4	-	-	14	47
AECOM	BH01	1	12/2/09	Area A	333622	6251528	1.39	-	-	<5	40	<1	<1	-	7	3	17	-	19	152		4	-	-	16	38
AECOM	BH01	12	12/2/09	Area A	333622	6251528	-9.61	-	-	<5	40	<1	<1	-	7	2	30	-	47	132	<0.1	6	-	-	19	96
AECOM	BH01	17.65	12/3/09	Area A	333622	6251528	-15.26	-	-	<5	10	<1	<1	-	31	<2	<5	-	28	<5	<0.1	3	-	-	118	<5
AECOM	BH01	20.5	12/3/09	Area A	333622	6251528	-18.11	-	-	<5	<10	<1	<1	-	3	<2	<5	-	<5	<5	<0.1	<2	-	-	6	<5
AECOM	BH01	2	12/2/09	Area A	333622	6251528	0.39	-	-	<5	70	<1	<1	-	18	5	44	-	30	329	<0.1	8	-	-	32	2070
AECOM	BH01	25	12/10/09	Area A	333622	6251528	-22.61	-	-	27	<10	<1	<1	-	37	<2	8	-	13	5	<0.1	<2	-	-	57	10
AECOM	BH01	4	12/2/09	Area A	333622	6251528	-1.61	-	-	<5	40	<1	<1	-	10	6	92	-	16	355	<0.1	5	-	-	51	42
AECOM	BH01	7	12/2/09	Area A	333622	6251528	-4.61	-	-	12	40	<1	1	-	7	<2	44	-	132	160	0.2	10	-	-	8	115
AECOM	BH01	9	12/2/09	Area A	333622	6251528	-6.61	-	-	14	60	<1	<1	-	5	2	21	-	74	147	<0.1	4	-	-	13	47
AECOM	BH02	11.5	12/4/09	Area C	333618	6251492	-9.03	-	-	<5	<10	<1	<1	-	7	<2	<5	-	6	18	<0.1	<2	-	-	<5	15
AECOM	BH02	14.5	12/4/09	Area C	333618	6251492	-12.03	-	-	<5	30	<1	<1	-	8	2	20	-	100	99	<0.1	6	-	-	15	44
AECOM	BH02	19	12/7/09	Area C	333618	6251492	-16.53	-	-	<5	<10	<1	<1	-	6	<2	<5	-	<5	<5	<0.1	<2	-	-	9	<5
AECOM	BH02	3	12/4/09	Area B	333618	6251492	-0.53	-	-	<5	10	<1	<1	-	6	<2	6	-	22	<5	<0.1	<2	-	-	14	30
AECOM	BH02	5	12/4/09	Area B	333618	6251492	-2.53	-	-	<5	<10	<1	<1	-	7	<2	<5	-	23	<5	<0.1	<2	-	-	15	12
AECOM	BH02	7	12/4/09	Area B	333618	6251492	-4.53	-	-	<5	20	<1	<1	-	5	<2	9	-	13	68	<0.1	<2	-	-	8	23
AECOM	BH03	3	12/10/09	Area B	333648	6251518	-0.91	-	-	<5	40	<1	<1	-	8	4	<5	-	8	226	<0.1	5	-	-	15	24
AECOM	BH03	17.3	12/10/09	Area C	333648	6251518	-15.21	-	-	<5	10	<1	<1	-	2	<2	<5	-	<5	<5	<0.1	<2	-	-	6	<5
AECOM	BH03	9	12/10/09	Area C	333648	6251518	-6.91	-	-	<5	50	<1	<1	-	12	<2	<5	-	17	26	<0.1	3	-	-	22	19
AECOM	BH04	1	12/9/09	Area B	333662	6251527	1.16	-	-	<5	40	<1	<1	-	8	3	<5	-	13	163	<0.1	4	-	-	14	24
AECOM	BH04	16	12/9/09	Area C	333662	6251527	-13.84	-	-	<5	10	<1	<1	-	8	<2	<5	-	6	<5	<0.1	<2	-	-	8	<5
AECOM	BH04	20	12/9/09	Area C	333662	6251527	-17.84	-	-	<5	<10	<1	<1	-	4	<2	<5	-	6	<5	<0.1	<2	-	-	<5	<5
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	-	-	<5	10	<1	<1	-	4	<2	<5	-	9	<5	<0.1	<2	-	-	7	<5
AECOM	BH04	22	12/10/09	Area C	333662	6251527	-19.84	-	-	<5	<10	<1	<1	-	2	<2	<5	-	<5	<5	<0.1	<2	-	-	7	<5
AECOM	BH04	8	12/9/09	Area B	333662	6251527	-5.84	-	-	<5	<10	<1	<1	-	6	2	<5	-	10	83	<0.1	2	-	-	11	14
AECOM	BH05	0.25	12/2/09	Area B	333692	6251518	1.84	-	-	<5	20	<1	<1	-	2	13	284	-	6	735	<0.1	6	-	-	118	48
AECOM	BH05	4.1	12/2/09	Area B	333692	6251518	-2.01	-	-	<5	30	<1	<1	-	21	5	20	-	12	226	<0.1	7	-	-	27	49
AECOM	BH05	6.4	12/2/09	Area B	333692	6251518	-4.31	-	-	<5	20	<1	<1	-	6	3	27	-	5	164	<0.1	3	-	-	20	18
AECOM	BH05	1.7	12/2/09	Area B	333692	6251518	0.39	-	-	<5	20	<1	<1	-	8	3	<5	-	8	131	<0.1	3	-	-	12	18
AECOM	BH06	0.5	12/2/09	Area B	333702	6251506	1.69	-	-	<5	30	<1	<1	-	6	8	107	-	16	454	<0.1	7	-	-	70	44
AECOM	BH06	2.5	12/2/09	Area B	333702	6251506	-0.31	-	-	13	40	<1	1	-	10	4	28	-	50	125	<0.1	10	-	-	12	121
AECOM	BH06	5	12/2/09	Area B	333702	6251506	-2.81	-	-	8	80	<1	<1	-	14	2	15	-	75	73	0.2	4	-	-	22	172
AECOM	BH07	1	12/8/09	Area B	333727	6251509	1.42	-	-	5	30	<1	<1	-	12	8	9	-	16	464	<0.1	11	-	-	24	60
AECOM	BH07	5	12/8/09	Area B	333727	6251509	-2.58	-	-	<5	20	<1	<1	-	14	3	114	-	143	46	<0.1	4	-	-	9	691
AECOM	BH07	7.4	12/8/09	Area B	333727	6251509	-4.98	-	-	7	70	<1	<1	-	16	2	69	-	180	88	0.1	5	-	-	23	221
AECOM	BH08	1	12/8/09	Area B	333717	6251528	1.22	-	-	<5	20	<1	<1	-	10	<2	<5	-	13	17	<0.1	<2	-	-	9	28
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	-	-	<5	<10	<1	<1	-	13	<2	<5	-	<5	<5	<0.1	<2	-	-	36	<5
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	-	-	<5	30	<1	<1	-	4	<2	<5	-	9	<5	<0.1	<2	-	-	6	<5
AECOM	BH08	5	12/8/09	Area B	333717	6251528	-2.78	-	-	10	60	<1	<1	-	16	<2	15	-	22	83	0.1	4	-	-	25	51
AECOM	BH08	9	12/8/09	Area B	333717	6251528	-6.78	-	-	<5	<10	<1	<1	-	11	<2	<5	-	<5	<5	<0.1	<2	-	-	26	<5
AECOM	BH09	1	12/7/09	Area B	333709	6251541	1.23	-	-	6	40	<1	<1	-	12	5	10	-	30	244	<0.1	8	-	-	22	54

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH09	5	12/7/09	Area B	333709	6251541	-2.77	-	-	7	60	<1	<1	-	11	8	8	-	19	448	<0.1	12	-	-	18	66
AECOM	BH10	1	12/11/09	Area B	333692	6251540	1.22	-	-	<5	30	<1	<1	-	10	6	13	-	26	355	<0.1	8	-	-	20	62
AECOM	BH10	12	12/11/09	Area C	333692	6251540	-9.78	-	-	<5	40	<1	<1	-	10	4	6	-	27	246	<0.1	5	-	-	21	40
AECOM	BH11	1.4	2/5/10	Area B	333757	6251517	1.6	-	-	6	150	<1	<1	-	14	5	141	-	465	148	0.1	7	-	-	30	18
AECOM	BH11	1.6	2/5/10	Area B	333757	6251517	1.4	-	-	<5	20	<1	<1	-	11	<2	<5	-	19	16	<0.1	<2	-	-	23	6
AECOM	BH11	2.6	2/5/10	Area B	333757	6251517	0.4	-	-	8	50	<1	<1	-	14	<2	425	-	2050	20	0.5	5	-	-	23	26
AECOM	BH11	3.2	2/5/10	Area B	333757	6251517	-0.2	-	-	<5	30	<1	<1	-	31	12	34	-	261	13	0.1	<2	-	-	11	5
AECOM	BH12	12.2	2/10/10	Area B	333735	6251488	-9.54	-	-	<5	<10	<1	<1	-	21	<2	<5	-	6	<5	<0.1	<2	-	-	48	<5
AECOM	BH12	3	2/10/10	Area B	333735	6251488	-0.34	-	-	<5	40	<1	<1	-	13	<2	25	-	128	41	0.8	2	-	-	19	87
AECOM	BH12	7	2/10/10	Area B	333735	6251488	-4.34	-	-	9	<10	<1	<1	-	5	<2	<5	-	<5	24	<0.1	<2	-	-	14	<5
AECOM	BH13	1	2/5/10	Area B	333692	6251488	1.5	-	-	<5	130	<1	<1	-	12	3	36	-	74	99	0.3	6	-	-	20	86
AECOM	BH13	12.7	2/5/10	Area C	333692	6251488	-10.2	-	-	<5	<10	<1	<1	-	3	<2	<5	-	11	<5	<0.1	<2	-	-	<5	6
AECOM	BH13	2.4	2/5/10	Area B	333692	6251488	0.1	-	-	6	200	<1	<1	-	14	<2	79	-	792	43	0.6	4	-	-	21	272
AECOM	BH13	3	2/5/10	Area B	333692	6251488	-0.5	-	-	<5	170	<1	<1	-	7	<2	14	-	714	202	0.2	5	-	-	9	863
AECOM	BH13	7.2	2/5/10	Area B	333692	6251488	-4.7	-	-	<5	110	<1	<1	-	7	<2	7	-	370	70	<0.1	4	-	-	11	150
AECOM	BH14	13	2/10/10	Area C	333648	6251482	-10.44	-	-	<5	20	<1	<1	-	16	<2	139	-	28	96	0.1	<2	-	-	32	33
AECOM	BH14	2.5	2/10/10	Area B	333648	6251482	0.06	-	-	15	30	<1	<1	-	11	<2	10	-	14	43	<0.1	2	-	-	26	27
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	-	-	<5	20	<1	<1	-	3	<2	<5	-	19	54	<0.1	<2	-	-	5	15
AECOM	BH15	2	2/9/10	Area B	333758	6251459	0.71	-	-	20	390	<1	<1	-	11	19	233	-	1630	278	2	40	-	-	19	224
AECOM	BH15	5	2/9/10	Area B	333758	6251459	-2.29	-	-	16	<10	<1	<1	-	10	<2	<5	-	<5	29	<0.1	3	-	-	19	6
AECOM	BH16	1	2/9/10	Area B	333720	6251456	1.66	-	-	5	40	<1	<1	-	11	4	69	-	95	133	0.4	5	-	-	34	82
AECOM	BH16	4.2	2/9/10	Area B	333720	6251456	-1.54	-	-	<5	20	<1	<1	-	8	5	34	-	22	214	<0.1	4	-	-	14	78
AECOM	BH17	10	2/10/10	Area B	333732	6251416	-7.45	-	-	6	<10	<1	<1	-	11	<2	<5	-	<5	<5	<0.1	<2	-	-	25	<5
AECOM	BH17	4	2/9/10	Area B	333732	6251416	-1.45	-	-	20	<10	<1	<1	-	21	<2	9	-	25	11	<0.1	<2	-	-	62	23
AECOM	BH18	14	2/10/10	Area B	333753	6251380	-11.71	-	-	<5	20	<1	<1	-	43	4	7	-	20	728	<0.1	4	-	-	125	12
AECOM	BH18	2.5	2/10/10	Area B	333753	6251380	-0.21	-	-	<5	80	<1	<1	-	9	9	32	-	117	80	1	15	-	-	19	53
AECOM	BH18	7	2/10/10	Area B	333753	6251380	-4.71	-	-	7	<10	<1	<1	-	12	<2	<5	-	<5	6	<0.1	<2	-	-	29	<5
AECOM	BH19	1	2/9/10	Area B	333736	6251372	1.53	-	-	<5	20	<1	<1	-	5	<2	14	-	35	47	<0.1	<2	-	-	9	57
AECOM	BH19	11.5	2/9/10	Area B	333736	6251372	-8.97	-	-	<5	10	<1	<1	-	7	<2	<5	-	<5	<5	<0.1	<2	-	-	17	<5
AECOM	BH19	6.9	2/9/10	Area B	333736	6251372	-4.37	-	-	12	70	<1	<1	-	10	<2	38	-	180	109	0.1	4	-	-	12	99
AECOM	BH20	1	2/11/10	Area B	333733	6251328	1.76	-	-	<5	120	<1	<1	-	6	4	40	-	489	119	<0.1	6	-	-	20	158
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	-	-	15	200	<1	2	-	32	5	391	-	1070	110	3.4	26	-	-	29	702
AECOM	BH20	4	2/11/10	Area B	333733	6251328	-1.24	-	-	<5	<10	<1	<1	-	4	<2	<5	-	10	<5	<0.1	<2	-	-	5	<5
AECOM	BH21	1	2/11/10	Area B	333718	6251310	1.56	-	-	<5	30	<1	<1	-	12	<2	27	-	50	82	0.2	5	-	-	28	51
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	-	-	11	80	<1	<1	-	16	<2	52	-	183	44	1.1	4	-	-	24	200
AECOM	BH21	4	2/11/10	Area B	333718	6251310	-1.44	-	-	<5	10	<1	<1	-	6	<2	8	-	77	10	<0.1	<2	-	-	17	14
AECOM	BH22	4	2/10/10	Area B	333639	6251295	-1.8	-	-	<5	20	<1	<1	-	6	<2	30	-	61	8	0.2	<2	-	-	14	20
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	-	-	6	<10	<1	<1	-	7	<2	6	-	26	10	<0.1	<2	-	-	11	16
AECOM	BH23	1.6	2/5/10	Area B	333640	6251297	0.84	-	-	<5	80	<1	<1	-	8	2	14	-	414	67	0.2	3	-	-	18	137
AECOM	BH23	4.7	2/5/10	Area B	333640	6251297	-2.26	-	-	<5	40	<1	<1	-	8	8	35	-	39	246	<0.1	20	-	-	24	40
AECOM	BH23	7.8	2/5/10	Area B	333640	6251297	-5.36	-	-	<5	50	<1	<1	-	8	2	18	-	56	116	<0.1	6	-	-	15	42
AECOM	BH24	0.75	2/12/10	Area B	333655	6251338	1.56	-	-	<5	30	<1	<1	-	5	8	90	-	27	304	<0.1	12	-	-	52	43
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	-	-	<5	80	4	<1	-	22	2	18	-	338	54	<0.1	30	-	-	18	118
AECOM	BH24	13	2/12/10	Area C	333655	6251338	-10.69	-	-	<5	<10	<1	<1	-	6	<2	<5	-	9	<5	<0.1	<2	-	-	<5	<5
AECOM	BH24	5	2/12/10	Area B	333655	6251338	-2.69	-	-	<5	20	<1	<1	-	9	<2	<5	-	38	48	<0.1	3	-	-	20	16

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH25	1	19/2/10	Area B	333697	6251356	1.87	-	-	<5	-	-	<1	-	7	-	20	-	27		<0.1	4	-	-	-	25
AECOM	BH25	15	19/2/10	Area C	333697	6251356	-12.13	-	-	<5	-	-	<1	-	7	-	<5	-	11		<0.1	<2	-	-	-	5
AECOM	BH25	5.2	19/2/10	Area B	333697	6251356	-2.33	-	-	18	-	-	<1	-	8	-	19	-	221		<0.1	3	-	-	-	38
AECOM	BH25	7.2	19/2/10	Area B	333697	6251356	-4.33	-	-	<5	-	-	<1	-	10	-	8	-	52		<0.1	<2	-	-	-	74
AECOM	BH26	10	2/11/10	Area C	333666	6251372	-7.41	-	-	<5	20	<1	<1	-	6	2	<5	-	24	86	<0.1	3	-	-	9	21
AECOM	BH26	11.4	2/11/10	Area C	333666	6251372	-8.81	-	-	18	240	<1	2	-	35	3	150	-	430	60	3.4	10	-	-	47	558
AECOM	BH26	16	2/11/10	Area C	333666	6251372	-13.41	-	-	<5	10	<1	<1	-	3	<2	<5	-	<5	<5	<0.1	<2	-	-	9	7
AECOM	BH26	4	2/11/10	Area B	333666	6251372	-1.41	-	-	<5	240	<1	<1	-	5	<2	7	-	559	88	<0.1	<2	-	-	11	398
AECOM	BH27	0.2	15/2/10	Area B	333630	6251405	2.21	-	-	<5	10	<1	<1	-	2	11	219	-	6	608	<0.1	8	-	-	88	41
AECOM	BH27	10	15/2/10	Area C	333630	6251405	-7.59	-	-	<5	10	<1	<1	-	5	<2	<5	-	10	8	<0.1	<2	-	-	9	6
AECOM	BH27	14.5	15/2/10	Area C	333630	6251405	-12.09	-	-	<5	10	<1	<1	-	6	<2	<5	-	14	<5	<0.1	<2	-	-	7	<5
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	-	-	<5	10	<1	<1	-	9	<2	8	-	45	53	<0.1	2	-	-	16	30
AECOM	BH28	0.5	15/2/10	Area B	333683	6251424	1.65	-	-	<5	40	<1	<1	-	8	8	33	-	80	214	0.1	17	-	-	23	97
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	-	-	12	260	<1	<1	-	15	2	80	-	672	50	3.5	7	-	-	24	492
AECOM	BH28	13	15/2/10	Area C	333683	6251424	-10.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH28	16	15/2/10	Area C	333683	6251424	-13.85	-	-	<5	10	<1	<1	-	3	<2	<5	-	<5	<5	<0.1	<2	-	-	<5	<5
AECOM	BH28	13	15/2/10	Area C	333683	6251424	-10.85	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-
AECOM	BH29	2.5	16/2/10	Area B	333662	6251448	0.12	-	-	<5	20	<1	<1	-	18	<2	9	-	69	58	<0.1	2	-	-	36	58
AECOM	BH29	7	16/2/10	Area B	333662	6251448	-4.38	-	-	<5	20	<1	<1	-	7	<2	8	-	32	26	<0.1	4	-	-	12	29
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	-	-	<5	40	<1	<1	-	8	2	24	-	102	168	<0.1	5	-	-	19	63
AECOM	BH30	7	16/2/10	Area B	333639	6251452	-4.58	-	-	50	50	<1	<1	-	20	14	420	-	50	146	0.2	34	-	-	18	342
AECOM	BH30	13	16/2/10	Area C	333639	6251452	-10.58	-	-	26	<10	<1	<1	-	23	<2	<5	-	10	<5	<0.1	<2	-	-	44	<5
AECOM	BH30	19	16/2/10	Area C	333639	6251452	-16.58	-	-	<5	10	<1	<1	-	7	<2	<5	-	<5	<5	<0.1	2	-	-	<5	<5
AECOM	BH300	0.14	8/11/10	Area B	333743	6251537	2.26	-	-	<5	-	-	<1	-	<2	-	7	-	<5	-	<0.1	<2	-	-	-	8
AECOM	BH300	1	8/11/10	Area B	333743	6251537	1.4	-	-	6	-	-	<1	-	14	-	40	-	459	-	0.3	12	-	-	-	192
AECOM	BH300	2	8/11/10	Area B	333743	6251537	0.4	-	-	8	-	-	<1	-	16	-	48	-	723	-	0.4	12	-	-	-	276
AECOM	BH300	3	8/11/10	Area B	333743	6251537	-0.6	-	-	<5	-	-	<1	-	8	-	8	-	10	-	<0.1	<2	-	-	-	14
AECOM	BH300	4	8/11/10	Area B	333743	6251537	-1.6	-	-	<5	-	-	<1	-	12	-	<5	-	7	-	<0.1	2	-	-	-	10
AECOM	BH300	5.4	8/11/10	Area B	333743	6251537	-3	-	-	8	-	-	<1	-	7	-	<5	-	6	-	<0.1	<2	-	-	-	7
AECOM	BH300	5	8/11/10	Area B	333743	6251537	-2.6	-	-	16	-	-	<1	-	13	-	<5	-	6	-	<0.1	4	-	-	-	8
AECOM	BH300	6.2	8/11/10	Area B	333743	6251537	-3.8	-	-	<5	-	-	<1	-	<2	-	<5	-	6	-	<0.1	<2	-	-	-	<5
AECOM	BH301	1.3	10/1/10	Area B	333746	6251509	1.1	-	-	<5	-	-	<1	-	2	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH302	0.1	8/4/10	Area B	333746	6251493	2.3	-	-	<5	-	-	<1	-	3	-	266	-	7	-	<0.1	9	-	-	-	62
AECOM	BH302	1.2	8/4/10	Area B	333746	6251493	1.2	-	-	<5	-	-	<1	-	8	-	34	-	88	-	0.1	10	-	-	-	57
AECOM	BH302	2	8/4/10	Area B	333746	6251493	0.4	-	-	<5	-	-	<1	-	10	-	206	-	244	-	0.2	5	-	-	-	201
AECOM	BH302	3	8/4/10	Area B	333746	6251493	-0.6	-	-	<5	-	-	<1	-	12	-	<5	-	8	-	<0.1	<2	-	-	-	19
AECOM	BH302	4	8/4/10	Area B	333746	6251493	-1.6	-	-	<5	-	-	<1	-	8	-	<5	-	9	-	<0.1	<2	-	-	-	21
AECOM	BH302	5	8/4/10	Area B	333746	6251493	-2.6	-	-	<5	-	-	<1	-	6	-	<5	-	8	-	<0.1	<2	-	-	-	<5
AECOM	BH302	6	8/4/10	Area B	333746	6251493	-3.6	-	-	13	-	-	<1	-	11	-	<5	-	<5	-	<0.1	4	-	-	-	7
AECOM	BH303	0.08	8/5/10	Area B	333753	6251477	2.32	-	-	<5	-	-	<1	-	2	-	262	-	7	-	<0.1	7	-	-	-	54
AECOM	BH303	1	8/11/10	Area B	333753	6251477	1.4	-	-	10	-	-	<1	-	16	-	56	-	520	-	0.5	9	-	-	-	327
AECOM	BH303	2.2	8/11/10	Area B	333753	6251477	0.2	-	-	<5	-	-	<1	-	10	-	14	-	50	-	0.1	4	-	-	-	36
AECOM	BH303	3.9	8/11/10	Area B	333753	6251477	-1.5	-	-	<5	-	-	<1	-	9	-	10	-	16	-	<0.1	<2	-	-	-	12
AECOM	BH303	4.9	8/11/10	Area B	333753	6251477	-2.5	-	-	20	-	-	<1	-	10	-	<5	-	5	-	<0.1	3	-	-	-	8
AECOM	BH303	5.8	8/11/10	Area B	333753	6251477	-3.4	-	-	8	-	-	<1	-	9	-	<5	-	7	-	<0.1	2	-	-	-	7

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH303	6.9	8/11/10	Area B	333753	6251477	-4.5	-	-	<5	-	-	<1	-	10	-	<5	-	<5	-	<0.1	4	-	-	-	<5
AECOM	BH304	0.1	8/4/10	Area B	333755	6251420	2.3	-	-	<5	-	-	<1	-	3	-	221	-	8	-	<0.1	10	-	-	-	56
AECOM	BH304	10	8/5/10	Area B	333755	6251420	-7.6	-	-	<5	-	-	<1	-	17	-	<5	-	<5	-	<0.1	<2	-	-	-	7
AECOM	BH304	1	8/4/10	Area B	333755	6251420	1.4	-	-	<5	-	-	<1	-	7	-	312	-	317	-	0.2	10	-	-	-	31
AECOM	BH304	2	8/4/10	Area B	333755	6251420	0.4	-	-	6	-	-	<1	-	11	-	61	-	232	-	0.3	6	-	-	-	39
AECOM	BH304	3	8/4/10	Area B	333755	6251420	-0.6	-	-	<5	-	-	<1	-	10	-	76	-	86	-	0.2	7	-	-	-	24
AECOM	BH304	4	8/4/10	Area B	333755	6251420	-1.6	-	-	<5	-	-	<1	-	7	-	5	-	33	-	<0.1	<2	-	-	-	19
AECOM	BH304	5	8/5/10	Area B	333755	6251420	-2.6	-	-	12	-	-	<1	-	9	-	15	-	28	-	<0.1	3	-	-	-	10
AECOM	BH304	6	8/5/10	Area B	333755	6251420	-3.6	-	-	10	-	-	<1	-	6	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH304	7	8/5/10	Area B	333755	6251420	-4.6	-	-	18	-	-	<1	-	13	-	<5	-	8	-	<0.1	3	-	-	-	6
AECOM	BH304	8	8/5/10	Area B	333755	6251420	-5.6	-	-	<5	-	-	<1	-	16	-	<5	-	9	-	<0.1	2	-	-	-	<5
AECOM	BH304	9	8/5/10	Area B	333755	6251420	-6.6	-	-	<5	-	-	<1	-	12	-	<5	-	<5	-	<0.1	<2	-	-	-	7
AECOM	BH305	0.1	8/4/10	Area B	333753	6251398	2.3	-	-	<5	-	-	<1	-	3	-	240	-	8	-	<0.1	11	-	-	-	57
AECOM	BH305	1.2	8/4/10	Area B	333753	6251398	1.2	-	-	5	-	-	<1	-	8	-	472	-	1210	-	<0.1	12	-	-	-	46
AECOM	BH305	10	8/10/10	Area B	333753	6251398	-7.6	-	-	<5	-	-	<1	-	13	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH305	11	8/11/10	Area B	333753	6251398	-8.6	-	-	<5	-	-	<1	-	19	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH305	2	8/4/10	Area B	333753	6251398	0.4	-	-	<5	-	-	<1	-	8	-	69	-	947	-	<0.1	13	-	-	-	47
AECOM	BH305	3	8/4/10	Area B	333753	6251398	-0.6	-	-	<5	-	-	<1	-	10	-	18	-	107	-	0.2	4	-	-	-	54
AECOM	BH305	1	8/4/10	Area B	333753	6251398	1.4	-	-	<5	-	-	<1	-	8	-	10	-	31	-	<0.1	3	-	-	-	10
AECOM	BH305	5	8/4/10	Area B	333753	6251398	-2.6	-	-	19	-	-	<1	-	18	-	6	-	14	-	<0.1	6	-	-	-	14
AECOM	BH305	6	8/4/10	Area B	333753	6251398	-3.6	-	-	30	-	-	<1	-	38	-	7	-	14	-	<0.1	12	-	-	-	30
AECOM	BH305	7	8/4/10	Area B	333753	6251398	-4.6	-	-	21	-	-	<1	-	38	-	6	-	14	-	<0.1	12	-	-	-	30
AECOM	BH305	8	8/10/10	Area B	333753	6251398	-5.6	-	-	6	-	-	<1	-	19	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH305	9	8/10/10	Area B	333753	6251398	-6.6	-	-	6	-	-	<1	-	31	-	<5	-	10	-	<0.1	3	-	-	-	5
AECOM	BH306	0.1	8/4/10	Area B	333752	6251362	2.3	-	-	<5	-	-	<1	-	9	-	190	-	5	-	<0.1	45	-	-	-	50
AECOM	BH306	0.5	8/4/10	Area B	333752	6251362	1.9	-	-	14	-	-	1	-	16	-	160	-	606	-	0.9	14	-	-	-	1340
AECOM	BH306	10	8/4/10	Area B	333752	6251362	-7.6	-	-	<5	-	-	<1	-	20	-	<5	-	5	-	<0.1	<2	-	-	-	<5
AECOM	BH306	11	8/4/10	Area B	333752	6251362	-8.6	-	-	<5	-	-	<1	-	9	-	<5	-	13	-	<0.1	<2	-	-	-	12
AECOM	BH306	12	8/4/10	Area B	333752	6251362	-9.6	-	-	5	-	-	<1	-	10	-	<5	-	5	-	<0.1	<2	-	-	-	<5
AECOM	BH306	13.4	8/4/10	Area B	333752	6251362	-11	-	-	<5	-	-	<1	-	20	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH306	2	8/4/10	Area B	333752	6251362	0.4	-	-	<5	-	-	<1	-	10	-	5	-	110	-	<0.1	<2	-	-	-	19
AECOM	BH306	3	8/4/10	Area B	333752	6251362	-0.6	-	-	<5	-	-	<1	-	10	-	14	-	110	-	0.2	3	-	-	-	73
AECOM	BH306	4	8/4/10	Area B	333752	6251362	-1.6	-	-	<5	-	-	<1	-	11	-	23	-	122	-	0.3	4	-	-	-	91
AECOM	BH306	5	8/4/10	Area B	333752	6251362	-2.6	-	-	<5	-	-	<1	-	11	-	11	-	46	-	0.1	<2	-	-	-	37
AECOM	BH306	6	8/4/10	Area B	333752	6251362	-3.6	-	-	<5	-	-	<1	-	6	-	5	-	23	-	<0.1	<2	-	-	-	19
AECOM	BH306	7	8/4/10	Area B	333752	6251362	-4.6	-	-	8	-	-	<1	-	12	-	<5	-	<5	-	<0.1	3	-	-	-	8
AECOM	BH306	8	8/4/10	Area B	333752	6251362	-5.6	-	-	9	-	-	<1	-	8	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH307	0.1	8/4/10	Area B	333715	6251529	2.3	-	-	<5	-	-	<1	-	3	-	239	-	8	-	<0.1	9	-	-	-	64
AECOM	BH307	1.5	8/4/10	Area B	333715	6251529	0.9	-	-	<5	-	-	<1	-	20	-	12	-	28	-	<0.1	4	-	-	-	82
AECOM	BH307	10	13/8/10	Area B	333715	6251529	-7.6	-	-	11	-	-	<1	-	20	-	<5	-	<5	-	<0.1	2	-	-	-	5
AECOM	BH307	11	13/8/10	Area B	333715	6251529	-8.6	-	-	<5	-	-	<1	-	4	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH307	12	13/8/10	Area B	333715	6251529	-9.6	-	-	<5	-	-	<1	-	20	-	<5	-	6	-	<0.1	<2	-	-	-	<5
AECOM	BH307	13	13/8/10	Area B	333715	6251529	-10.6	-	-	<5	-	-	<1	-	14	-	<5	-	11	-	<0.1	3	-	-	-	8
AECOM	BH307	2	8/9/10	Area B	333715	6251529	0.4	-	-	<5	-	-	<1	-	14	-	8	-	19	-	<0.1	7	-	-	-	43
AECOM	BH307	3	8/9/10	Area B	333715	6251529	-0.6	-	-	<5	-	-	<1	-	7	-	<5	-	8	-	<0.1	4	-	-	-	74

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH307	4	8/9/10	Area B	333715	6251529	-1.6	-	-	<5	-	-	<1	-	9	-	<5	-	18	-	<0.1	<2	-	-	-	11
AECOM	BH307	5	8/9/10	Area B	333715	6251529	-2.6	-	-	<5	-	-	<1	-	5	-	<5	-	<5	-	<0.1	<2	-	-	-	6
AECOM	BH307	6	8/9/10	Area B	333715	6251529	-3.6	-	-	<5	-	-	<1	-	8	-	<5	-	<5	-	<0.1	3	-	-	-	20
AECOM	BH307	7	13/8/10	Area B	333715	6251529	-4.6	-	-	8	-	-	<1	-	15	-	180	-	228	-	0.5	10	-	-	-	168
AECOM	BH307	9	13/8/10	Area B	333715	6251529	-6.6	-	-	10	-	-	<1	-	33	-	<5	-	9	-	<0.1	3	-	-	-	7
AECOM	BH308	0.1	8/6/10	Area B	333735	6251438	2.3	-	-	<5	-	-	<1	-	4	-	215	-	6	-	<0.1	19	-	-	-	51
AECOM	BH308	10	13/8/10	Area B	333735	6251438	-7.6	-	-	<5	-	-	<1	-	22	-	<5	-	10	-	<0.1	3	-	-	-	<5
AECOM	BH308	1	8/12/10	Area B	333735	6251438	1.4	-	-	<5	-	-	1	-	24	-	53	-	122	-	<0.1	16	-	-	-	113
AECOM	BH308	11	13/8/10	Area B	333735	6251438	-8.6	-	-	<5	-	-	<1	-	7	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH308	12	13/8/10	Area B	333735	6251438	-9.6	-	-	<5	-	-	<1	-	16	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH308	13	13/8/10	Area B	333735	6251438	-10.6	-	-	<5	-	-	<1	-	19	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH308	14	13/8/10	Area B	333735	6251438	-11.6	-	-	<5	-	-	<1	-	12	-	<5	-	9	-	<0.1	4	-	-	-	16
AECOM	BH308	2	8/12/10	Area B	333735	6251438	0.4	-	-	<5	-	-	<1	-	23	-	58	-	160	-	0.2	12	-	-	-	83
AECOM	BH308	3	8/12/10	Area B	333735	6251438	-0.6	-	-	9	-	-	<1	-	9	-	40	-	86	-	0.3	8	-	-	-	105
AECOM	BH308	4	8/12/10	Area B	333735	6251438	-1.6	-	-	18	-	-	1	-	47	-	188	-	934	-	3.2	46	-	-	-	920
AECOM	BH308	5	13/8/10	Area B	333735	6251438	-2.6	-	-	13	-	-	<1	-	29	-	138	-	934	-	4.3	23	-	-	-	690
AECOM	BH308	6	13/8/10	Area B	333735	6251438	-3.6	-	-	22	-	-	<1	-	31	-	30	-	152	-	0.2	11	-	-	-	64
AECOM	BH308	7	13/8/10	Area B	333735	6251438	-4.6	-	-	16	-	-	<1	-	18	-	<5	-	9	-	<0.1	5	-	-	-	13
AECOM	BH308	8	13/8/10	Area B	333735	6251438	-5.6	-	-	20	-	-	<1	-	11	-	<5	-	<5	-	<0.1	3	-	-	-	5
AECOM	BH308	9	13/8/10	Area B	333735	6251438	-6.6	-	-	<5	-	-	<1	-	12	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH309	0.1	30/7/10	Area B	333736	6251400	2.3	-	-	<5	-	-	<1	-	3	-	287	-	8	-	<0.1	9	-	-	-	64
AECOM	BH309	1.5	8/4/10	Area B	333736	6251400	0.9	-	-	<5	-	-	<1	-	9	-	54	-	60	-	0.2	6	-	-	-	82
AECOM	BH309	10.5	8/4/10	Area B	333736	6251400	-8.1	-	-	6	-	-	<1	-	8	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH309	11.5	8/4/10	Area B	333736	6251400	-9.1	-	-	<5	-	-	<1	-	7	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH309	12.5	8/4/10	Area B	333736	6251400	-10.1	-	-	<5	-	-	<1	-	13	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH309	2.5	8/4/10	Area B	333736	6251400	-0.1	-	-	<5	-	-	<1	-	8	-	14	-	68	-	<0.1	5	-	-	-	67
AECOM	BH309	4.5	8/4/10	Area B	333736	6251400	-2.1	-	-	<5	-	-	<1	-	12	-	10	-	39	-	0.3	2	-	-	-	13
AECOM	BH309	5.5	8/4/10	Area B	333736	6251400	-3.1	-	-	7	-	-	<1	-	15	-	105	-	808	-	3.1	10	-	-	-	308
AECOM	BH309	6.5	8/4/10	Area B	333736	6251400	-4.1	-	-	19	-	-	<1	-	27	-	218	-	909	-	0.6	10	-	-	-	43
AECOM	BH309	7.5	8/4/10	Area B	333736	6251400	-5.1	-	-	24	-	-	<1	-	11	-	<5	-	23	-	<0.1	3	-	-	-	7
AECOM	BH309	8.5	8/4/10	Area B	333736	6251400	-6.1	-	-	10	-	-	<1	-	7	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH309	9.5	8/4/10	Area B	333736	6251400	-7.1	-	-	16	-	-	<1	-	16	-	<5	-	9	-	<0.1	<2	-	-	-	<5
AECOM	BH31	0.2	16/2/10	Area B	333646	6251473	2.25	-	-	<5	20	<1	<1	-	2	10	221	-	5	729	<0.1	6	-	-	88	42
AECOM	BH31	2.5	16/2/10	Area B	333646	6251473	-0.05	-	-	<5	70	<1	<1	-	6	3	<5	-	14	126	<0.1	5	-	-	11	21
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	-	-	<5	30	<1	<1	-	2	<2	12	-	12	6	<0.1	<2	-	-	5	19
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	-	-	<5	20	<1	<1	-	22	<2	8	-	15	8	<0.1	<2	-	-	58	<5
AECOM	BH31	16	17/2/10	Area C	333646	6251473	-13.55	-	-	6	20	<1	<1	-	32	<2	<5	-	8	<5	<0.1	<2	-	-	51	<5
AECOM	BH31	23.5	17/2/10	Area C	333646	6251473	-21.05	-	-	<5	<10	<1	<1	-	4	<2	<5	-	<5	<5	<0.1	<2	-	-	24	<5
AECOM	BH310	0.1	30/7/10	Area B	333732	6251355	2.3	-	-	<5	-	-	<1	-	4	-	289	-	8	-	<0.1	11	-	-	-	59
AECOM	BH310	10	8/12/10	Area B	333732	6251355	-7.6	-	-	<5	-	-	<1	-	<2	-	<5	-	6	-	<0.1	<2	-	-	-	<5
AECOM	BH310	1	8/12/10	Area B	333732	6251355	1.4	-	-	<5	-	-	<1	-	14	-	40	-	191	-	0.3	5	-	-	-	135
AECOM	BH310	11	8/12/10	Area B	333732	6251355	-8.6	-	-	<5	-	-	<1	-	6	-	8	-	341	-	<0.1	<2	-	-	-	72
AECOM	BH310	12	8/12/10	Area B	333732	6251355	-9.6	-	-	<5	-	-	<1	-	8	-	30	-	400	-	0.3	4	-	-	-	238
AECOM	BH310	13	8/12/10	Area B	333732	6251355	-10.6	-	-	<5	-	-	<1	-	10	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH310	14	8/12/10	Area B	333732	6251355	-11.6	-	-	<5	-	-	<1	-	3	-	<5	-	<5	-	<0.1	<2	-	-	-	<5

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH310	15	8/12/10	Area B	333732	6251355	-12.6	-	-	<5	-	-	<1	-	7	-	<5	-	<5	-	<0.1	2	-	-	-	<5
AECOM	BH310	16	8/12/10	Area B	333732	6251355	-13.6	-	-	<5	-	-	<1	-	16	-	<5	-	20	-	<0.1	6	-	-	-	18
AECOM	BH310	2	8/12/10	Area B	333732	6251355	0.4	-	-	<5	-	-	<1	-	11	-	<5	-	12	-	<0.1	14	-	-	-	23
AECOM	BH310	3	8/12/10	Area B	333732	6251355	-0.6	-	-	<5	-	-	<1	-	12	-	16	-	15	-	0.1	4	-	-	-	16
AECOM	BH310	5	8/12/10	Area B	333732	6251355	-2.6	-	-	<5	-	-	<1	-	7	-	11	-	54	-	0.2	2	-	-	-	31
AECOM	BH310	6	8/12/10	Area B	333732	6251355	-3.6	-	-	<5	-	-	<1	-	7	-	38	-	163	-	<0.1	3	-	-	-	50
AECOM	BH310	9	8/12/10	Area B	333732	6251355	-6.6	-	-	<5	-	-	<1	-	5	-	8	-	24	-	<0.1	3	-	-	-	24
AECOM	BH311	0.1	30/7/10	Area B	333742	6251341	2.3	-	-	<5	-	-	<1	-	29	-	101	-	<5	-	<0.1	104	-	-	-	69
AECOM	BH311	0.9	8/2/10	Area B	333742	6251341	1.5	-	-	<5	-	-	<1	-	14	-	9	-	46	-	0.1	2	-	-	-	30
AECOM	BH311	10	8/2/10	Area B	333742	6251341	-7.6	-	-	9	-	-	<1	-	17	-	100	-	250	-	0.5	6	-	-	-	202
AECOM	BH311	11	8/2/10	Area B	333742	6251341	-8.6	-	-	<5	-	-	<1	-	12	-	8	-	22	-	0.2	<2	-	-	-	9
AECOM	BH311	12	8/2/10	Area B	333742	6251341	-9.6	-	-	<5	-	-	<1	-	6	-	46	-	103	-	<0.1	2	-	-	-	32
AECOM	BH311	13	8/2/10	Area B	333742	6251341	-10.6	-	-	12	-	-	<1	-	13	-	23	-	102	-	<0.1	<2	-	-	-	26
AECOM	BH311	14	8/2/10	Area B	333742	6251341	-11.6	-	-	<5	-	-	<1	-	4	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH311	15	8/2/10	Area B	333742	6251341	-12.6	-	-	<5	-	-	<1	-	8	-	6	-	20	-	<0.1	<2	-	-	-	9
AECOM	BH311	2	8/2/10	Area B	333742	6251341	0.4	-	-	<5	-	-	<1	-	6	-	13	-	62	-	0.1	3	-	-	-	35
AECOM	BH311	3	8/2/10	Area B	333742	6251341	-0.6	-	-	18	-	-	<1	-	17	-	35	-	474	-	0.2	11	-	-	-	132
AECOM	BH311	4	8/2/10	Area B	333742	6251341	-1.6	-	-	15	-	-	<1	-	8	-	8	-	82	-	0.1	5	-	-	-	58
AECOM	BH311	5.8	8/2/10	Area B	333742	6251341	-3.4	-	-	<5	-	-	<1	-	5	-	12	-	108	-	<0.1	2	-	-	-	44
AECOM	BH311	5	8/2/10	Area B	333742	6251341	-2.6	-	-	<5	-	-	<1	-	5	-	<5	-	26	-	<0.1	<2	-	-	-	17
AECOM	BH311	7	8/2/10	Area B	333742	6251341	-4.6	-	-	<5	-	-	<1	-	4	-	<5	-	19	-	<0.1	<2	-	-	-	11
AECOM	BH311	8	8/2/10	Area B	333742	6251341	-5.6	-	-	<5	-	-	<1	-	9	-	<5	-	33	-	<0.1	<2	-	-	-	29
AECOM	BH311	9	8/2/10	Area B	333742	6251341	-6.6	-	-	<5	-	-	<1	-	5	-	<5	-	38	-	<0.1	<2	-	-	-	19
AECOM	BH312	0.1	30/7/10	Area B	333741	6251326	2.3	-	-	<5	-	-	<1	-	13	-	93	-	<5	-	<0.1	72	-	-	-	66
AECOM	BH312	10	8/11/10	Area B	333741	6251326	-7.6	-	-	<5	-	-	<1	-	9	-	<5	-	34	-	<0.1	<2	-	-	-	<5
AECOM	BH312	1	8/2/10	Area B	333741	6251326	1.4	-	-	<5	-	-	<1	-	10	-	30	-	225	-	0.2	4	-	-	-	158
AECOM	BH312	11	8/11/10	Area B	333741	6251326	-8.6	-	-	14	-	-	<1	-	14	-	<5	-	10	-	<0.1	<2	-	-	-	<5
AECOM	BH312	12	8/11/10	Area B	333741	6251326	-9.6	-	-	<5	-	-	<1	-	6	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH312	13	8/11/10	Area B	333741	6251326	-10.6	-	-	<5	-	-	<1	-	6	-	<5	-	6	-	<0.1	<2	-	-	-	<5
AECOM	BH312	14	8/11/10	Area B	333741	6251326	-11.6	-	-	<5	-	-	<1	-	3	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH312	15	8/11/10	Area B	333741	6251326	-12.6	-	-	<5	-	-	<1	-	<2	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH312	16	8/11/10	Area B	333741	6251326	-13.6	-	-	<5	-	-	<1	-	8	-	<5	-	6	-	<0.1	7	-	-	-	22
AECOM	BH312	2.8	8/2/10	Area B	333741	6251326	-0.4	-	-	<5	-	-	<1	-	16	-	52	-	256	-	0.5	5	-	-	-	121
AECOM	BH312	2	8/2/10	Area B	333741	6251326	0.4	-	-	<5	-	-	<1	-	14	-	80	-	324	-	0.6	5	-	-	-	304
AECOM	BH312	4	8/11/10	Area B	333741	6251326	-1.6	-	-	<5	-	-	<1	-	9	-	48	-	115	-	0.1	6	-	-	-	82
AECOM	BH312	5	8/11/10	Area B	333741	6251326	-2.6	-	-	8	-	-	<1	-	14	-	51	-	243	-	0.4	8	-	-	-	78
AECOM	BH312	6	8/11/10	Area B	333741	6251326	-3.6	-	-	<5	-	-	<1	-	7	-	<5	-	<5	-	0.1	2	-	-	-	<5
AECOM	BH312	8	8/11/10	Area B	333741	6251326	-5.6	-	-	7	-	-	<1	-	9	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH312	9	8/11/10	Area B	333741	6251326	-6.6	-	-	<5	-	-	<1	-	11	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH313	0.1	8/4/10	Area B	333699	6251512	2.3	-	-	<5	-	-	<1	-	2	-	239	-	6	-	<0.1	7	-	-	-	58
AECOM	BH313	1	8/9/10	Area B	333699	6251512	1.4	-	-	7	-	-	<1	-	12	-	23	-	56	-	<0.1	10	-	-	-	140
AECOM	BH313	11	8/9/10	Area C	333699	6251512	-8.6	-	-	8	-	-	<1	-	16	-	11	-	43	-	<0.1	15	-	-	-	144
AECOM	BH313	12.5	8/9/10	Area C	333699	6251512	-10.1	-	-	5	-		<1	-	10	-	6	-	16	-	<0.1	10	-	-	-	58
AECOM	BH313	14	8/9/10	Area C	333699	6251512	-11.6	-	-	9	-	-	<1	-	17	-	24	-	51	-	0.2	13	-	-	-	119
AECOM	BH313	2	8/9/10	Area B	333699	6251512	0.4	-	-	6	-	-	<1	-	8	-	11	-	22	-	<0.1	6	-	-	-	59

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH313	3	8/9/10	Area B	333699	6251512	-0.6	-	-	8	-	-	<1	-	12	-	41	-	117	-	0.1	10	-	-	-	414
AECOM	BH313	4	8/9/10	Area B	333699	6251512	-1.6	-	-	8	-	-	<1	-	18	-	17	-	46	-	0.3	5	-	-	-	106
AECOM	BH313	5	8/9/10	Area B	333699	6251512	-2.6	-	-	<5	-	-	<1	-	10	-	<5	-	11	-	<0.1	6	-	-	-	28
AECOM	BH313	6	8/9/10	Area B	333699	6251512	-3.6	-	-	<5	-	-	<1	-	8	-	<5	-	11	-	<0.1	5	-	-	-	31
AECOM	BH313	7	8/9/10	Area B	333699	6251512	-4.6	-	-	<5	-	-	<1	-	9	-	<5	-	15	-	<0.1	7	-	-	-	40
AECOM	BH313	8	8/9/10	Area B	333699	6251512	-5.6	-	-	<5	-	-	<1	-	11	-	<5	-	9	-	<0.1	8	-	-	-	36
AECOM	BH313	9.5	8/9/10	Area C	333699	6251512	-7.1	-	-	<5	-	-	<1	-	10	-	<5	-	16	-	<0.1	9	-	-	-	49
AECOM	BH314	0.1	30/9/10	Area B	333711	6251398	2.3	-	-	<5	-	-	<1	-	7	-	12	-	238	-	<0.1	2	-	-	-	43
AECOM	BH314	10	30/9/10	Area C	333711	6251398	-7.6	-	-	<5	-	-	<1	-	7	-	<5	-	30	-	<0.1	4	-	-	-	36
AECOM	BH314	1	30/9/10	Area B	333711	6251398	1.4	-	-	<5	-	-	<1	-	7	-	<5	-	12	-	<0.1	<2	-	-	-	8
AECOM	BH314	11	30/9/10	Area C	333711	6251398	-8.6	-	-	<5	-	-	<1	-	13	-	<5	-	18	-	<0.1	<2	-	-	-	<5
AECOM	BH314	12	30/9/10	Area C	333711	6251398	-9.6	-	-	<5	-	-	<1	-	5	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH314	2	30/9/10	Area B	333711	6251398	0.4	-	-	<5	-	-	<1	-	7	-	45	-	34	-	<0.1	8	-	-	-	21
AECOM	BH314	3	30/9/10	Area B	333711	6251398	-0.6	-	-	<5	-	-	<1	-	9	-	13	-	30	-	<0.1	3	-	-	-	22
AECOM	BH314	4	30/9/10	Area B	333711	6251398	-1.6	-	-	<5	-	-	<1	-	7	-	<5	-	16	-	<0.1	3	-	-	-	21
AECOM	BH314	5	30/9/10	Area B	333711	6251398	-2.6	-	-	<5	-	-	<1	-	4	-	<5	-	29	-	<0.1	2	-	-	-	23
AECOM	BH314	7	30/9/10	Area B	333711	6251398	-4.6	-	-	<5	-	-	<1	-	11	-	11	-	29	-	<0.1	18	-	-	-	56
AECOM	BH314	8	30/9/10	Area B	333711	6251398	-5.6	-	-	<5	-	-	<1	-	8	-	8	-	22	-	<0.1	9	-	-	-	46
AECOM	BH315	0.1	30/9/10	Area B	333709	6251379	2.3	-	-	<5	-	-	<1	-	145	-	38	-	8	-	<0.1	122	-	-	-	60
AECOM	BH315	1	30/9/10	Area B	333709	6251379	1.4	-	-	<5	-	-	<1	-	141	-	42	-	8	-	<0.1	113	-	-	-	65
AECOM	BH315	2	30/9/10	Area B	333709	6251379	0.4	-	-	6	-	-	<1	-	11	-	28	-	41	-	<0.1	4	-	-	-	71
AECOM	BH315	3	30/9/10	Area B	333709	6251379	-0.6	-	-	<5	-	-	<1	-	14	-	21	-	79	-	<0.1	6	-	-	-	50
AECOM	BH315	4	30/9/10	Area B	333709	6251379	-1.6	-	-	<5	-	-	<1	-	10	-	27	-	143	-	0.2	6	-	-	-	82
AECOM	BH315	5	30/9/10	Area B	333709	6251379	-2.6	-	-	<5	-	-	<1	-	6	-	50	-	113	-	0.3	3	-	-	-	81
AECOM	BH315	6	30/9/10	Area B	333709	6251379	-3.6	-	-	<5	-	-	<1	-	7	-	31	-	35	-	0.1	4	-	-	-	33
AECOM	BH315	8	30/9/10	Area B	333709	6251379	-5.6	-	-	<5	-	-	<1	-	5	-	<5	-	35	-	<0.1	<2	-	-	-	41
AECOM	BH316	0.1	8/4/10	Area B	333721	6251335	2.3	-	-	<5	-	-	<1	-	9	-	120	-	<5	-	<0.1	46	-	-	-	50
AECOM	BH316	10	8/4/10	Area C	333721	6251335	-7.6	-	-	<5	-	-	<1	-	9	-	6	-	16	-	<0.1	3	-	-	-	31
AECOM	BH316	1	8/4/10	Area B	333721	6251335	1.4	-	-	<5	-	-	<1	-	5	-	11	-	27	-	<0.1	2	-	-	-	20
AECOM	BH316	2	8/4/10	Area B	333721	6251335	0.4	-	-	<5	-	-	<1	-	5	-	8	-	22	-	<0.1	<2	-	-	-	19
AECOM	BH316	3	8/4/10	Area B	333721	6251335	-0.6	-	-	<5	-	-	<1	-	3	-	<5	-	8	-	<0.1	<2	-	-	-	15
AECOM	BH316	4	8/4/10	Area B	333721	6251335	-1.6	-	-	<5	-	-	<1	-	6	-	48	-	32	-	<0.1	4	-	-	-	38
AECOM	BH316	6	8/4/10	Area B	333721	6251335	-3.6	-	-	<5	-	-	<1	-	7	-	16	-	23	-	<0.1	2	-	-	-	19
AECOM	BH316	7	8/4/10	Area B	333721	6251335	-4.6	-	-	<5	-	-	<1	-	5	-	8	-	25	-	<0.1	3	-	-	-	35
AECOM	BH317	0.1	8/4/10	Area B	333681	6251474	2.3	-	-	<5	-	-	<1	-	4	-	213	-	9	-	<0.1	16	-	-	-	52
AECOM	BH317	1	8/6/10	Area B	333681	6251474	1.4	-	-	<5	-	-	<1	-	7	-	17	-	92	-	0.1	4	-	-	-	60
AECOM	BH317	2	8/6/10	Area B	333681	6251474	0.4	-	-	<5	-	-	<1	-	6	-	9	-	59	-	<0.1	3	-	-	-	70
AECOM	BH317	4	8/6/10	Area B	333681	6251474	-1.6	-	-	<5	-	-	<1	-	11	-	12	-	71	-	<0.1	4	-	-	-	31
AECOM	BH317	5	8/6/10	Area B	333681	6251474	-2.6	-	-	<5	-	-	<1	-	6	-	<5	-	98	-	0.4	<2	-	-	-	58
AECOM	BH317	6	8/6/10	Area B	333681	6251474	-3.6	-	-	<5	-	-	<1	-	5	-	<5	-	31	-	0.1	2	-	-	-	32
AECOM	BH317	7	8/6/10	Area B	333681	6251474	-4.6	-	-	<5	-	-	<1	-	4	-	<5	-	20	-	<0.1	<2	-	-	-	8
AECOM	BH317	8	8/6/10	Area B	333681	6251474	-5.6	-	-	<5	-	-	<1	-	9	-	13	-	<5	-	<0.1	<2	-	-	-	9
AECOM	BH317	9	8/6/10	Area C	333681	6251474	-6.6	-	-	<5	-	-	<1	-	5	-	5	-	302	-	<0.1	<2	-	-	-	80
AECOM	BH318	0.1	29/9/10	Area B	333686	6251415	2.3	-	-	<5	-	-	<1	-	11	-	44	-	164	-	<0.1	17	-	-	-	102
AECOM	BH318	1	29/9/10	Area B	333686	6251415	1.4	-	-	24	-	-	<1	-	14	-	64	-	302	-	0.2	9	-	-	-	118

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH318	12	29/9/10	Area C	333686	6251415	-9.6	-	-	12	-	-	<1	-	18	-	6	-	31	-	<0.1	2	-	-	-	17
AECOM	BH318	13	29/9/10	Area C	333686	6251415	-10.6	-	-	<5	-	-	<1	-	7	-	<5	-	39	-	<0.1	<2	-	-	-	<5
AECOM	BH318	2	29/9/10	Area B	333686	6251415	0.4	-	-	<5	-	-	<1	-	25	-	12	-	901	-	0.3	3	-	-	-	329
AECOM	BH318	3	29/9/10	Area B	333686	6251415	-0.6	-	-	<5	-	-	<1	-	9	-	19	-	32	-	<0.1	3	-	-	-	48
AECOM	BH318	4	29/9/10	Area B	333686	6251415	-1.6	-	-	<5	-	-	<1	-	7	-	7	-	11	-	<0.1	<2	-	-	-	6
AECOM	BH318	5	29/9/10	Area B	333686	6251415	-2.6	-	-	<5	-	-	<1	-	6	-	75	-	103	-	0.2	6	-	-	-	55
AECOM	BH318	7	29/9/10	Area B	333686	6251415	-4.6	-	-	<5	-	-	<1	-	4	-	<5	-	6	-	<0.1	<2	-	-	-	8
AECOM	BH318	8	29/9/10	Area B	333686	6251415	-5.6	-	-	<5	-	-	<1	-	6	-	6	-	10	-	<0.1	2	-	-	-	11
AECOM	BH318	9	29/9/10	Area C	333686	6251415	-6.6	-	-	<5	-	-	<1	-	4	-	<5	-	7	-	<0.1	<2	-	-	-	9
AECOM	BH319	0.1	29/9/10	Area B	333690	6251396	2.3	-	-	5	-	-	<1	-	35	-	61	-	78	-	<0.1	35	-	-	-	101
AECOM	BH319	1	29/9/10	Area B	333690	6251396	1.4	-	-	<5	-	-	<1	-	9	-	24	-	230	-	0.2	4	-	-	-	60
AECOM	BH319	2	29/9/10	Area B	333690	6251396	0.4	-	-	<5	-	-	3	-	8	-	6	-	17	-	4.3	2	-	-	-	23
AECOM	BH319	3	29/9/10	Area B	333690	6251396	-0.6	-	-	<5	-	-	<1	-	9	-	26	-	42	-	0.1	6	-	-	-	46
AECOM	BH319	4	29/9/10	Area B	333690	6251396	-1.6	-	-	<5	-	-	<1	-	11	-	13	-	140	-	<0.1	5	-	-	-	106
AECOM	BH319	5	29/9/10	Area B	333690	6251396	-2.6	-	-	<5	-	-	<1	-	5	-	7	-	166	-	<0.1	<2	-	-	-	42
AECOM	BH319	6	29/9/10	Area B	333690	6251396	-3.6	-	-	<5	-	-	<1	-	9	-	13	-	40	-	<0.1	4	-	-	-	28
AECOM	BH319	7	29/9/10	Area B	333690	6251396	-4.6	-	-	5	-	-	<1	-	8	-	41	-	41	-	<0.1	6	-	-	-	46
AECOM	BH319	8	29/9/10	Area B	333690	6251396	-5.6	-	-	<5	-	-	<1	-	7	-	81	-	54	-	0.1	6	-	-	-	51
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	-	-	18	280	<1	<1	-	20	3	126	-	716	69	4.9	9	-	-	33	460
AECOM	BH32	14.5	2/12/10	Area C	333692	6251462	-11.68	-	-	19	410	<1	1	-	23	3	124	-	826	70	5.2	10	-	-	30	483
AECOM	BH32	16	2/12/10	Area C	333692	6251462	-13.18	-	-	<5	10	<1	<1	-	11	<2	<5	-	<5	<5	<0.1	<2	-	-	24	<5
AECOM	BH32	7	2/12/10	Area B	333692	6251462	-4.18	-	-	<5	40	<1	<1	-	11	<2	10	-	63	25	<0.1	<2	-	-	21	49
AECOM	BH320	0.1	28/9/10	Area B	333692	6251377	2.3	-	-	7	-	-	<1	-	20	-	56	-	268	-	<0.1	14	-	-	-	400
AECOM	BH320	10	28/9/10	Area C	333692	6251377	-7.6	-	-	5	-	-	<1	-	10	-	14	-	120	-	<0.1	3	-	-	-	43
AECOM	BH320	1	28/9/10	Area B	333692	6251377	1.4	-	-	<5	-	-	<1	-	23	-	<5	-	17	-	<0.1	<2	-	-	-	10
AECOM	BH320	11	28/9/10	Area C	333692	6251377	-8.6	-	-	<5	-	-	<1	-	20	-	17	-	71	-	<0.1	4	-	-	-	65
AECOM	BH320	12.4	28/9/10	Area C	333692	6251377	-10	-	-	43	-	-	3	-	42	-	269	-	1090	-	5.5	16	-	-	-	1550
AECOM	BH320	13	28/9/10	Area C	333692	6251377	-10.6	-	-	<5	-	-	<1	-	3	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH320	2	28/9/10	Area B	333692	6251377	0.4	-	-	6	-	-	<1	-	20	-	48	-	32	-	<0.1	18	-	-	-	19
AECOM	BH320	3	28/9/10	Area B	333692	6251377	-0.6	-	-	<5	-	-	<1	-	17	-	18	-	54	-	<0.1	4	-	-	-	62
AECOM	BH320	5	28/9/10	Area B	333692	6251377	-2.6	-	-	<5	-	-	<1	-	13	-	18	-	698	-	<0.1	7	-	-	-	115
AECOM	BH320	6	28/9/10	Area B	333692	6251377	-3.6	-	-	<5	-	-	<1	-	4	-	121	-	65	-	0.2	6	-	-	-	56
AECOM	BH320	7	28/9/10	Area B	333692	6251377	-4.6	-	-	<5	-	-	<1	-	14	-	<5	-	30	-	<0.1	7	-	-	-	33
AECOM	BH320	8	28/9/10	Area B	333692	6251377	-5.6	-	-	<5	-	-	<1	-	5	-	5	-	26	-	<0.1	<2	-	-	-	12
AECOM	BH320	9	28/9/10	Area C	333692	6251377	-6.6	-	-	<5	-	-	<1	-	11	-	54	-	56	-	<0.1	6	-	-	-	38
AECOM	BH321	0.23	8/4/10	Area B	333698	6251336	2.17	-	-	<5	-	-	<1	-	2	-	257	-	7	-	<0.1	7	-	-	-	54
AECOM	BH321	1	8/4/10	Area B	333698	6251336	1.4	-	-	<5	-	-	<1	-	7	-	44	-	38	-	<0.1	4	-	-	-	26
AECOM	BH321	11	8/4/10	Area C	333698	6251336	-8.6	-	-	<5	-	-	<1	-	10	-	14	-	128	-	<0.1	4	-	-	-	51
AECOM	BH321	12.5	8/4/10	Area C	333698	6251336	-10.1	-	-	15	-	-	<1	-	22	-	143	-	513	-	2.1	9	-	-	-	423
AECOM	BH321	2	8/4/10	Area B	333698	6251336	0.4	-	-	<5	-	-	<1	-	7	-	8	-	40	-	<0.1	<2	-	-	-	29
AECOM	BH321	3	8/4/10	Area B	333698	6251336	-0.6	-	-	<5	-	-	<1	-	7	-	<5	-	8	-	<0.1	<2	-	-	-	<5
AECOM	BH321	4	8/4/10	Area B	333698	6251336	-1.6	-	-	<5	-	-	<1	-	16	-	6	-	32	-	<0.1	3	-	-	-	26
AECOM	BH321	5	8/4/10	Area B	333698	6251336	-2.6	-	-	<5	-	-	<1	-	8	-	<5	-	98	-	<0.1	<2	-	-	-	30
AECOM	BH321	6	8/4/10	Area B	333698	6251336	-3.6	-	-	<5	-	-	<1	-	9	-	6	-	40	-	<0.1	5	-	-	-	18
AECOM	BH321	7	8/4/10	Area B	333698	6251336	-4.6	-	-	<5	-	-	<1	-	13	-	<5	-	15	-	<0.1	<2	-	-	-	12

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH321	8	8/4/10	Area B	333698	6251336	-5.6	-	-	<5	-	-	<1	-	7	-	9	-	54	-	<0.1	3	-	-	-	33
AECOM	BH321	9.5	8/4/10	Area C	333698	6251336	-7.1	-	-	<5	-	-	<1	-	7	-	6	-	22	-	<0.1	4	-	-	-	60
AECOM	BH322	0.1	23/7/10	Area B	333700	6251301	2.3	-	-	<5	-	-	<1	-	8	-	155	-	25	-	<0.1	28	-	-	-	74
AECOM	BH322	1	8/2/10	Area B	333700	6251301	1.4	-	-	<5	-	-	<1	-	8	-	11	-	35	-	0.2	2	-	-	-	50
AECOM	BH322	2	8/2/10	Area B	333700	6251301	0.4	-	-	<5	-	-	<1	-	4	-	6	-	47	-	<0.1	3	-	-	-	50
AECOM	BH322	3	8/2/10	Area B	333700	6251301	-0.6	-	-	<5	-	-	<1	-	3	-	<5	-	206	-	<0.1	<2	-	-	-	67
AECOM	BH322	4	8/2/10	Area B	333700	6251301	-1.6	-	-	<5	-	-	<1	-	4	-	<5	-	32	-	<0.1	2	-	-	-	11
AECOM	BH322	5.8	8/2/10	Area B	333700	6251301	-3.4	-	-	<5	-	-	<1	-	3	-	7	-	9	-	<0.1	<2	-	-	-	<5
AECOM	BH322	5	8/2/10	Area B	333700	6251301	-2.6	-	-	<5	-	-	<1	-	7	-	<5	-	24	-	<0.1	<2	-	-	-	12
AECOM	BH322	7	8/2/10	Area B	333700	6251301	-4.6	-	-	22	-	-	1	-	43	-	202	-	459	-	3.2	14	-	-	-	626
AECOM	BH322	8.5	8/2/10	Area C	333700	6251301	-6.1	-	-	6	-	-	<1	-	7	-	17	-	61	-	0.4	<2	-	-	-	166
AECOM	BH323	16.8	8/5/10	Area C	333657	6251510	-14.4	-	-	<5	-	-	<1	-	2	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH323	0.1	8/4/10	Area B	333657	6251510	2.3	-	-	<5	-	-	<1	-	4	-	318	-	7	-	<0.1	7	-	-	-	60
AECOM	BH323	1.5	8/4/10	Area B	333657	6251510	0.9	-	-	<5	-	-	<1	-	10	-	<5	-	11	-	<0.1	5	-	-	-	23
AECOM	BH323	10.5	8/4/10	Area C	333657	6251510	-8.1	-	-	<5	-	-	<1	-	6	-	<5	-	10	-	<0.1	5	-	-	-	24
AECOM	BH323	11.5	8/4/10	Area C	333657	6251510	-9.1	-	-	<5	-	-	<1	-	12	-	16	-	24	-	<0.1	14	-	-	-	59
AECOM	BH323	12.5	8/4/10	Area C	333657	6251510	-10.1	-	-	<5	-	-	<1	-	9	-	6	-	15	-	<0.1	8	-	-	-	19
AECOM	BH323	13.5	8/5/10	Area C	333657	6251510	-11.1	-	-	<5	-	-	<1	-	10	-	7	-	10	-	<0.1	11	-	-	-	48
AECOM	BH323	14.5	8/5/10	Area C	333657	6251510	-12.1	-	-	5	-	-	<1	-	10	-	9	-	14	-	<0.1	13	-	-	-	66
AECOM	BH323	15.5	8/5/10	Area C	333657	6251510	-13.1	-	-	16	-	-	<1	-	14	-	<5	-	13	-	<0.1	<2	-	-	-	14
AECOM	BH323	2.5	8/4/10	Area B	333657	6251510	-0.1	-	-	<5	-	-	<1	-	18	-	<5	-	11	-	<0.1	5	-	-	-	21
AECOM	BH323	3.5	8/4/10	Area B	333657	6251510	-1.1	-	-	<5	-	-	<1	-	8	-	<5	-	14	-	<0.1	8	-	-	-	32
AECOM	BH323	4.5	8/4/10	Area B	333657	6251510	-2.1	-	-	<5	-	-	<1	-	7	-	8	-	9	-	<0.1	5	-	-	-	20
AECOM	BH323	5.5	8/4/10	Area B	333657	6251510	-3.1	-	-	<5	-	-	<1	-	8	-	6	-	14	-	<0.1	7	-	-	-	41
AECOM	BH323	6.5	8/4/10	Area B	333657	6251510	-4.1	-	-	<5	-	-	<1	-	7	-	<5	-	11	-	<0.1	7	-	-	-	38
AECOM	BH323	7.5	8/4/10	Area B	333657	6251510	-5.1	-	-	<5	-	-	<1	-	9	-	6	-	12	-	<0.1	7	-	-	-	26
AECOM	BH323	8.5	8/4/10	Area C	333657	6251510	-6.1	-	-	<5	-	-	<1	-	9	-	11	-	17	-	<0.1	9	-	-	-	50
AECOM	BH323	9.5	8/4/10	Area C	333657	6251510	-7.1	-	-	6	-	-	<1	-	10	-	48	-	16	-	<0.1	15	-	-	-	70
AECOM	BH324	10.5	8/9/10	Area C	333657	6251489	-8.1	-	-	<5	-	-	<1	-	8	-	<5	-	137	-	<0.1	<2	-	-	-	71
AECOM	BH324	2	8/5/10	Area B	333657	6251489	0.4	-	-	7	-	-	2	-	16	-	24	-	200	-	0.1	25	-	-	-	178
AECOM	BH324	3	8/5/10	Area B	333657	6251489	-0.6	-	-	7	-	-	<1	-	16	-	26	-	67	-	<0.1	7	-	-	-	66
AECOM	BH324	4	8/5/10	Area B	333657	6251489	-1.6	-	-	<5	-	-	<1	-	12	-	17	-	96	-	<0.1	<2	-	-	-	20
AECOM	BH324	5	8/5/10	Area B	333657	6251489	-2.6	-	-	<5	-	-	<1	-	8	-	21	-	275	-	0.2	4	-	-	-	99
AECOM	BH324	6	8/5/10	Area B	333657	6251489	-3.6	-	-	<5	-	-	<1	-	5	-	14	-	118	-	<0.1	2	-	-	-	92
AECOM	BH324	7	8/5/10	Area B	333657	6251489	-4.6	-	-	<5	-	-	<1	-	10	-	14	-	92	-	<0.1	<2	-	-	-	45
AECOM	BH324	8	8/5/10	Area B	333657	6251489	-5.6	-	-	<5	-	-	<1	-	7	-	32	-	82	-	<0.1	3	-	-	-	43
AECOM	BH324	9	8/6/10	Area C	333657	6251489	-6.6	-	-	<5	-	-	<1	-	4	-	18	-	192	-	<0.1	<2	-	-	-	65
AECOM	BH325	0.1	8/5/10	Area B	333660	6251433	2.3	-	-	<5	-	-	<1	-	3	-	264	-	6	-	<0.1	10	-	-	-	54
AECOM	BH325	1.5	8/5/10	Area B	333660	6251433	0.9	-	-	<5	-	-	<1	-	8	-	8	-	62	-	<0.1	2	-	-	-	48
AECOM	BH325	10.5	8/6/10	Area C	333660	6251433	-8.1	-	-	<5	-	-	<1	-	8	-	16	-	<5	-	<0.1	4	-	-	-	8
AECOM	BH325	11.5	8/6/10	Area C	333660	6251433	-9.1	-	-	<5	-	-	<1	-	9	-	10	-	60	-	0.2	3	-	-	-	46
AECOM	BH325	12.5	8/6/10	Area C	333660	6251433	-10.1	-	-	87	-	-	<1	-	54	-	<5	-	20	-	<0.1	<2	-	-	-	<5
AECOM	BH325	2.5	8/5/10	Area B	333660	6251433	-0.1	-	-	<5	-	-	<1	-	8	-	7	-	50	-	<0.1	<2	-	-	-	41
AECOM	BH325	3.5	8/5/10	Area B	333660	6251433	-1.1	-	-	<5	-	-	<1	-	4	-	<5	-	32	-	<0.1	<2	-	-	-	23
AECOM	BH325	4.5	8/5/10	Area B	333660	6251433	-2.1	-	-	<5	-	-	<1	-	8	-	17	-	58	-	<0.1	3	-	-	-	48

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH325	5.5	8/5/10	Area B	333660	6251433	-3.1	-	-	<5	-	-	<1	-	6	-	<5	-	8	-	<0.1	<2	-	-	-	<5
AECOM	BH325	6.5	8/5/10	Area B	333660	6251433	-4.1	-	-	<5	-	-	<1	-	9	-	7	-	12	-	<0.1	4	-	-	-	21
AECOM	BH325	7.5	8/5/10	Area B	333660	6251433	-5.1	-	-	<5	-	-	<1	-	6	-	45	-	31	-	<0.1	<2	-	-	-	7
AECOM	BH325	8.5	8/5/10	Area C	333660	6251433	-6.1	-	-	13	-	-	<1	-	17	-	6	-	22	-	0.2	6	-	-	-	33
AECOM	BH325	9.5	8/6/10	Area C	333660	6251433	-7.1	-	-	<5	-	-	<1	-	4	-	7	-	9	-	<0.1	<2	-	-	-	5
AECOM	BH326	0.1	8/5/10	Area B	333659	6251418	2.3	-	-	<5	-	-	<1	-	3	-	202	-	7	-	<0.1	12	-	-	-	46
AECOM	BH326	1	8/6/10	Area B	333659	6251418	1.4	-	-	<5	-	-	<1	-	6	-	13	-	35	-	<0.1	2	-	-	-	23
AECOM	BH326	2	8/6/10	Area B	333659	6251418	0.4	-	-	<5	-	-	<1	-	3	-	9	-	11	-	<0.1	<2	-	-	-	10
AECOM	BH326	3	8/6/10	Area B	333659	6251418	-0.6	-	-	<5	-	-	<1	-	4	-	<5	-	5	-	<0.1	<2	-	-	-	9
AECOM	BH326	4	8/6/10	Area B	333659	6251418	-1.6	-	-	<5	-	-	<1	-	10	-	12	-	43	-	0.2	5	-	-	-	22
AECOM	BH326	5	8/6/10	Area B	333659	6251418	-2.6	-	-	<5	-	-	<1	-	10	-	<5	-	26	-	<0.1	3	-	-	-	34
AECOM	BH326	6	8/9/10	Area B	333659	6251418	-3.6	-	-	<5	-	-	<1	-	15	-	<5	-	66	-	0.1	2	-	-	-	26
AECOM	BH326	7	8/9/10	Area B	333659	6251418	-4.6	-	-	<5	-	-	<1	-	8	-	<5	-	8	-	<0.1	<2	-	-	-	6
AECOM	BH326	8	8/9/10	Area B	333659	6251418	-5.6	-	-	<5	-	-	<1	-	8	-	6	-	24	-	<0.1	4	-	-	-	39
AECOM	BH327	0.1	8/5/10	Area B	333660	6251400	2.3	-	-	<5	-	-	<1	-	3	-	222	-	8	-	<0.1	18	-	-	-	47
AECOM	BH327	1	8/5/10	Area B	333660	6251400	1.4	-	-	<5	-	-	<1	-	4	-	381	-	177	-	<0.1	<2	-	-	-	664
AECOM	BH327	12	8/5/10	Area C	333660	6251400	-9.6	-	-	25	-	-	1	-	34	-	151	-	459	-	4.4	12	-	-	-	586
AECOM	BH327	13.5	8/5/10	Area C	333660	6251400	-11.1	-	-	<5	-	-	<1	-	27	-	<5	-	13	-	<0.1	2	-	-	-	<5
AECOM	BH327	2.	8/5/10	Area B	333660	6251400	0.4	-	-	<5	-	-	<1	-	6	-	8	-	222	-	<0.1	2	-	-	-	34
AECOM	BH327	3	8/5/10	Area B	333660	6251400	-0.6	-	-	<5	-	-	<1	-	7	-	13	-	292	-	0.2	5	-	-	-	183
AECOM	BH327	1	8/5/10	Area B	333660	6251400	1.4	-	-	<5	-	-	<1	-	5	-	6	-	7	-	<0.1	<2	-	-	-	18
AECOM	BH327	5	8/5/10	Area B	333660	6251400	-2.6	-	-	<5	-	-	<1	-	5	-	19	-	26	-	<0.1	<2	-	-	-	32
AECOM	BH327	7	8/5/10	Area B	333660	6251400	-4.6	-	-	<5	-	-	<1	-	8	-	28	-	126	-	0.3	4	-	-	-	68
AECOM	BH327	9	8/5/10	Area C	333660	6251400	-6.6	-	-	12	-	-	4	-	11	-	50	-	46	-	0.1	18	-	-	-	39
AECOM	BH328	0.1	28/9/10	Area B	333668	6251378	2.3	-	-	<5	-	-	<1	-	10	-	36	-	120	-	<0.1	19	-	-	-	82
AECOM	BH328	1	28/9/10	Area B	333668	6251378	1.4	-	-	<5	-	-	<1	-	13	-	90	-	45	-	<0.1	58	-	-	-	86
AECOM	BH328	2	28/9/10	Area B	333668	6251378	0.4	-	-	<5	-	-	<1	-	8	-	66	-	80	-	0.1	10	-	-	-	46
AECOM	BH328	3	28/9/10	Area B	333668	6251378	-0.6	-	-	<5	-	-	<1	-	13	-	45	-	65	-	0.1	6	-	-	-	36
AECOM	BH328	4	28/9/10	Area B	333668	6251378	-1.6	-	-	<5	-	-	<1	-	7	-	18	-	302	-	0.1	2	-	-	-	81
AECOM	BH328	5	28/9/10	Area B	333668	6251378	-2.6	-	-	<5	-	-	<1	-	6	-	11	-	417	-	<0.1	<2	-	-	-	140
AECOM	BH328	6	28/9/10	Area B	333668	6251378	-3.6	-	-	<5	-	-	<1	-	16	-	11	-	69	-	<0.1	9	-	-	-	70
AECOM	BH328	7	28/9/10	Area B	333668	6251378	-4.6	-	-	<5	-	-	<1	-	7	-	34	-	30	-	<0.1	6	-	-	-	48
AECOM	BH328	8	28/9/10	Area B	333668	6251378	-5.6	-	-	<5	-	-	<1	-	4	-	<5	-	<5	-	<0.1	2	-	-	-	<5
AECOM	BH329	0.1	27/7/10	Area B	333670	6251356	2.3	-	-	<5	-	-	<1	-	3	-	276	-	9	-	<0.1	10	-	-	-	59
AECOM	BH329	10	27/9/10	Area C	333670	6251356	-7.6	-	-	6	-	-	<1	-	8	-	17	-	78	-	<0.1	11	-	-	-	97
AECOM	BH329	1	27/9/10	Area B	333670	6251356	1.4	-	-	12	-	-	<1	-	24	-	54	-	20	-	<0.1	56	-	-	-	48
AECOM	BH329	12	27/9/10	Area C	333670	6251356	-9.6	-	-	<5	-	-	<1	-	9	-	105	-	<5	-	<0.1	47	-	-	-	34
AECOM	BH329	13	27/9/10	Area C	333670	6251356	-10.6	-	-	<5	-	-	<1	-	6	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
AECOM	BH329	2	27/9/10	Area B	333670	6251356	0.4	-	-	<5	-	-	<1	-	6	-	8	-	43	-	<0.1	3	-	-	-	36
AECOM	BH329	3	27/9/10	Area B	333670	6251356	-0.6	-	-	<5	-	-	<1	-	11	-	21	-	1810	-	0.1	2	-	-	-	214
AECOM	BH329	4	27/9/10	Area B	333670	6251356	-1.6	-	-	<5	-	-	<1	-	7	-	34	-	90	-	<0.1	3	-	-	-	103
AECOM	BH329	5	27/9/10	Area B	333670	6251356	-2.6	-	-	<5	-	-	<1	-	6	-	39	-	87	-	<0.1	9	-	-	-	60
AECOM	BH329	6	27/9/10	Area B	333670	6251356	-3.6	-	-	<5	-	-	<1	-	5	-	6	-	521	-	<0.1	<2	-	-	-	45
AECOM	BH329	7	27/9/10	Area B	333670	6251356	-4.6	-	-	8	-	-	<1	-	19	-	35	-	811	-	0.2	<2	-	-	-	99
AECOM	BH329	8	27/9/10	Area B	333670	6251356	-5.6	-	-	<5	-	-	<1	-	3	-	<5	-	20	-	<0.1	<2	-	-	-	8

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH33	0.75	12/2/10	Block 3	333699	6251546	1.55	-	-	<5	-	-	<1	-	8	-	264	-	6	-	<0.1	10	-	-	-	50
AECOM	BH33	5	12/2/10	Block 3	333699	6251546	-2.7	-	-	6	-	-	<1	-	10	-	12	-	36	-	<0.1	12	-	-	-	77
AECOM	BH33	8	12/2/10	Block 3	333699	6251546	-5.7	-	-	<5	-	-	<1	-	9	-	10	-	37	-	<0.1	7	-	-	-	40
AECOM	BH33	0.75	2/12/10	Area B	333699	6251546	1.55	-	-	<5	-	-	<1	-	8	-	264	-	6	-	<0.1	10	-	-	-	50
AECOM	BH33	5	2/12/10	Area B	333699	6251546	-2.7	-	-	6	-	-	<1	-	10	-	12	-	36	-	<0.1	12	-	-	-	77
AECOM	BH33	8	2/12/10	Area B	333699	6251546	-5.7	-	-	<5	-	-	<1	-	9	-	10	-	37	-	<0.1	7	-	-	-	40
AECOM	BH330	0.1	23/7/10	Area B	333674	6251337	2.3	-	-	<5	-	-	<1	-	4	-	208	-	54	-	<0.1	9	-	-	-	62
AECOM	BH330	1	8/4/10	Area B	333674	6251337	1.4	-	-	<5	-	-	<1	-	7	-	61	-	43	-	<0.1	30	-	-	-	52
AECOM	BH330	2	8/4/10	Area B	333674	6251337	0.4	-	-	<5	-	-	<1	-	7	-	23	-	84	-	<0.1	15	-	-	-	48
AECOM	BH330	3	8/4/10	Area B	333674	6251337	-0.6	-	-	<5	-	-	<1	-	10	-	27	-	187	-	<0.1	12	-	-	-	114
AECOM	BH330	4	8/4/10	Area B	333674	6251337	-1.6	-	-	<5	-	-	<1	-	13	-	6	-	45	-	<0.1	<2	-	-	-	16
AECOM	BH330	5	8/4/10	Area B	333674	6251337	-2.6	-	-	<5	-	-	<1	-	19	-	<5	-	18	-	<0.1	<2	-	-	-	10
AECOM	BH330	6	8/4/10	Area B	333674	6251337	-3.6	-	-	<5	-	-	<1	-	7	-	<5	-	6	-	<0.1	<2	-	-	-	8
AECOM	BH330	7	8/4/10	Area B	333674	6251337	-4.6	-	-	<5	-	-	<1	-	8	-	<5	-	16	-	<0.1	4	-	-	-	48
AECOM	BH331	0.1	23/7/10	Area B	333676	6251315	2.3	-	-	<5	-	-	<1	-	3	-	220	-	6	-	<0.1	11	-	-	-	55
AECOM	BH331	10	8/4/10	Area C	333676	6251315	-7.6	-	-	<5	-	-	<1	-	6	-	8	-	86	-	0.2	3	-	-	-	36
AECOM	BH331	1	8/2/10	Area B	333676	6251315	1.4	-	-	<5	-	-	<1	-	14	-	40	-	64	-	<0.1	22	-	-	-	64
AECOM	BH331	11	8/4/10	Area C	333676	6251315	-8.6	-	-	<5	-	-	<1	-	6	-	38	-	134	-	0.4	5	-	-	-	127
AECOM	BH331	12	8/4/10	Area C	333676	6251315	-9.6	-	-	<5	-	-	<1	-	10	-	19	-	49	-	0.6	<2	-	-	-	84
AECOM	BH331	2	8/2/10	Area B	333676	6251315	0.4	-	-	<5	-	-	<1	-	8	-	110	-	30	-	<0.1	19	-	-	-	101
AECOM	BH331	3	8/2/10	Area B	333676	6251315	-0.6	-	-	6	-	-	<1	-	10	-	10	-	23	-	0.2	<2	-	-	-	9
AECOM	BH331	4	8/2/10	Area B	333676	6251315	-1.6	-	-	6	-	-	<1	-	10	-	28	-	24	-	<0.1	8	-	-	-	26
AECOM	BH331	5	8/2/10	Area B	333676	6251315	-2.6	-	-	<5	-	-	<1	-	9	-	7	-	24	-	<0.1	3	-	-	-	18
AECOM	BH331	6	8/4/10	Area B	333676	6251315	-3.6	-	-	<5	-	-	<1	-	8	-	8	-	45	-	0.1	4	-	-	-	28
AECOM	BH331	7	8/4/10	Area B	333676	6251315	-4.6	-	-	8	-	-	<1	-	12	-	11	-	21	-	<0.1	<2	-	-	-	35
AECOM	BH331	8	8/4/10	Area B	333676	6251315	-5.6	-	-	<5	-	-	<1	-	6	-	<5	-	34	-	0.2	<2	-	-	-	18
AECOM	BH331	9	8/4/10	Area C	333676	6251315	-6.6	-	-	<5	-	-	<1	-	6	-	12	-	2100	-	0.5	4	-	-	-	54
AECOM	BH332	0.1	8/5/10	Area B	333642	6251451	2.3	-	-	<5	-	-	<1	-	3	-	286	-	6	-	<0.1	7	-	-	-	48
AECOM	BH332	1	8/5/10	Area B	333642	6251451	1.4	-	-	<5	-	-	<1	-	8	-	10	-	167	-	<0.1	2	-	-	-	56
AECOM	BH332	11	8/6/10	Area C	333642	6251451	-8.6	-	-	<5	-	-	<1	-	9	-	10	-	36	-	0.2	<2	-	-	-	24
AECOM	BH332	12.6	8/6/10	Area C	333642	6251451	-10.2	-	-	30	-	-	1	-	41	-	184	-	788	-	4.6	16	-	-	-	896
AECOM	BH332	2	8/5/10	Area B	333642	6251451	0.4	-	-	<5	-	-	<1	-	7	-	12	-	59	-	<0.1	5	-	-	-	41
AECOM	BH332	3	8/5/10	Area B	333642	6251451	-0.6	-	-	<5	-	-	<1	-	4	-	<5	-	8	-	<0.1	<2	-	-	-	6
AECOM	BH332	5	8/5/10	Area B	333642	6251451	-2.6	-	-	<5	-	-	<1	-	7	-	<5	-	13	-	<0.1	3	-	-	-	23
AECOM	BH332	6	8/5/10	Area B	333642	6251451	-3.6	-	-	<5	-	-	<1	-	6	-	6	-	18	-	<0.1	6	-	-	-	62
AECOM	BH332	7	8/5/10	Area B	333642	6251451	-4.6	-	-	<5	-	-	<1	-	7	-	<5	-	45	-	<0.1	3	-	-	-	33
AECOM	BH332	9.5	8/6/10	Area C	333642	6251451	-7.1	-	-	<5	-	-	<1	-	7	-	10	-	85	-	<0.1	4	-	-	-	41
AECOM	BH333	0.1	27/7/10	Area B	333644	6251433	2.3	-	-	<5	-	-	<1	-	2	-	316	-	8	-	<0.1	8	-	-	-	57
AECOM	BH333	1	8/2/10	Area B	333644	6251433	1.4	-	-	<5	-	-	<1	-	10	-	12	-	67	-	0.2	3	-	-	-	28
AECOM	BH333	2	8/2/10	Area B	333644	6251433	0.4	-	-	<5	-	-	<1	-	8	-	20	-	466	-	0.3	4	-	-	-	133
AECOM	BH333	3	8/2/10	Area B	333644	6251433	-0.6	-	-	<5	-	-	<1	-	7	-	22	-	352	-	0.2	4	-	-	-	84
AECOM	BH333	4	8/2/10	Area B	333644	6251433	-1.6	-	-	<5	-	-	<1	-	7	-	20	-	77	-	<0.1	3	-	-	-	386
AECOM	BH333	5	8/2/10	Area B	333644	6251433	-2.6	-	-	6	-	-	<1	-	10	-	25	-	104	-	0.2	4	-	-	-	85
AECOM	BH333	6	8/2/10	Area B	333644	6251433	-3.6	-	-	<5	-	-	<1	-	7	-	<5	-	18	-	<0.1	<2	-	-	-	30
AECOM	BH333	7	8/2/10	Area B	333644	6251433	-4.6	-	-	<5	-	-	<1	-	8	-	10	-	35	-	0.1	<2	-	-	-	44

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH333	8	8/2/10	Area B	333644	6251433	-5.6	-	-	<5	-	-	<1	-	5	-	<5	-	6	-	<0.1	<2	-	-	-	<5
AECOM	BH334	0.1	27/7/10	Area B	333645	6251412	2.3	-	-	<5	-	-	<1	-	4	-	246	-	6	-	<0.1	8	-	-	-	56
AECOM	BH334	10	8/2/10	Area C	333645	6251412	-7.6	-	-	<5	-	-	<1	-	3	-	<5	-	<5	-	<0.1	<2	-	-	-	8
AECOM	BH334	1	8/2/10	Area B	333645	6251412	1.4	-	-	<5	-	-	<1	-	8	-	39	-	58	-	0.6	17	-	-	-	38
AECOM	BH334	11	8/2/10	Area C	333645	6251412	-8.6	-	-	<5	-	-	<1	-	7	-	12	-	17	-	<0.1	<2	-	-	-	11
AECOM	BH334	12	8/2/10	Area C	333645	6251412	-9.6	-	-	<5	-	-	<1	-	2	-	<5	-	50	-	<0.1	<2	-	-	-	<5
AECOM	BH334	13	8/2/10	Area C	333645	6251412	-10.6	-	-	123	-	-	<1	-	52	-	<5	-	18	-	<0.1	5	-	-	-	38
AECOM	BH334	2	8/2/10	Area B	333645	6251412	0.4	-	-	<5	-	-	<1	-	9	-	18	-	388	-	0.3	3	-	-	-	282
AECOM	BH334	4	8/2/10	Area B	333645	6251412	-1.6	-	-	6	-	-	<1	-	6	-	21	-	121	-	0.1	4	-	-	-	248
AECOM	BH334	6	8/2/10	Area B	333645	6251412	-3.6	-	-	6	-	-	<1	-	9	-	100	-	798	-	0.6	5	-	-	-	176
AECOM	BH334	7	8/2/10	Area B	333645	6251412	-4.6	-	-	<5	-	-	<1	-	10	-	25	-	72	-	0.1	4	-	-	-	87
AECOM	BH334	8	8/2/10	Area B	333645	6251412	-5.6	-	-	<5	-	-	<1	-	6	-	<5	-	26	-	<0.1	<2	-	-	-	32
AECOM	BH334	9	8/2/10	Area C	333645	6251412	-6.6	-	-	<5	-	-	<1	-	8	-	<5	-	13	-	<0.1	2	-	-	-	19
AECOM	BH335	0.1	27/7/10	Area B	333649	6251395	2.3	-	-	<5	-	-	<1	-	3	-	226	-	8	-	<0.1	12	-	-	-	48
AECOM	BH335	1	8/5/10	Area B	333649	6251395	1.4	-	-	<5	-	-	<1	-	9	-	30	-	206	-	0.2	4	-	-	-	105
AECOM	BH335	3	8/5/10	Area B	333649	6251395	-0.6	-	-	<5	-	-	<1	-	4	-	<5	-	28	-	<0.1	<2	-	-	-	18
AECOM	BH335	5	8/5/10	Area B	333649	6251395	-2.6	-	-	<5	-	-	<1	-	10	-	7	-	21	-	<0.1	2	-	-	-	28
AECOM	BH335	6	8/5/10	Area B	333649	6251395	-3.6	-	-	<5	-	-	<1	-	9	-	5	-	56	-	<0.1	4	-	-	-	37
AECOM	BH335	7	8/5/10	Area B	333649	6251395	-4.6	-	-	<5	-	-	<1	-	5	-	<5	-	44	-	<0.1	2	-	-	-	26
AECOM	BH335	8	8/5/10	Area B	333649	6251395	-5.6	-	-	<5	-	-	<1	-	10	-	11	-	77	-	<0.1	5	-	-	-	57
AECOM	BH336	0.1	22/7/10	Area B	333652	6251355	2.3	-	-	<5	-	-	<1	-	3	-	239	-	7	-	<0.1	9	-	-	-	55
AECOM	BH336	1	30/7/10	Area B	333652	6251355	1.4	-	-	<5	-	-	<1	-	10	-	25	-	144	-	0.2	5	-	-	-	96
AECOM	BH336	2	30/7/10	Area B	333652	6251355	0.4	-	-	<5	-	-	<1	-	16	-	36	-	48	-	<0.1	2	-	-	-	39
AECOM	BH336	3	30/7/10	Area B	333652	6251355	-0.6	-	-	<5	-	-	<1	-	10	-	7	-	262	-	0.1	4	-	-	-	104
AECOM	BH336	4	30/7/10	Area B	333652	6251355	-1.6	-	-	<5	-	-	<1	-	8	-	6	-	7	-	<0.1	3	-	-	-	13
AECOM	BH336	5	30/7/10	Area B	333652	6251355	-2.6	-	-	<5	-	-	<1	-	15	-	48	-	135	-	<0.1	11	-	-	-	232
AECOM	BH336	6	30/7/10	Area B	333652	6251355	-3.6	-	-	<5	-	-	<1	-	6	-	5	-	48	-	<0.1	<2	-	-	-	109
AECOM	BH336	7	30/7/10	Area B	333652	6251355	-4.6	-	-	<5	-	-	<1	-	10	-	14	-	560	-	<0.1	4	-	-	-	170
AECOM	BH336	8	30/7/10	Area B	333652	6251355	-5.6	-	-	7	-	-	<1	-	18	-	11	-	46	-	<0.1	<2	-	-	-	24
AECOM	BH337	0.1	8/4/10	Area B	333661	6251315	2.3	-	-	<5	-	-	<1	-	2	-	217	-	5	-	<0.1	8	-	-	-	50
AECOM	BH337	1	8/4/10	Area B	333661	6251315	1.4	-	-	6	-	-	<1	-	20	-	16	-	43	-	<0.1	13	-	-	-	45
AECOM	BH337	2	8/4/10	Area B	333661	6251315	0.4	-	-	6	-	-	2	-	18	-	32	-	148	-	<0.1	12	-	-	-	268
AECOM	BH337	3	8/4/10	Area B	333661	6251315	-0.6	-	-	<5	-	-	<1	-	7	-	<5	-	10	-	<0.1	<2	-	-	-	<5
AECOM	BH337	4	8/4/10	Area B	333661	6251315	-1.6	-	-	<5	-	-	<1	-	4	-	7	-	11	-	<0.1	<2	-	-	-	<5
AECOM	BH337	5	8/5/10	Area B	333661	6251315	-2.6	-	-	6	-	-	<1	-	6	-	12	-	23	-	<0.1	<2	-	-	-	<5
AECOM	BH337	6	8/5/10	Area B	333661	6251315	-3.6	-	-	<5	-	-	<1	-	8	-	10	-	11	-	<0.1	<2	-	-	-	<5
AECOM	BH337	7	8/5/10	Area B	333661	6251315	-4.6	-	-	<5	-	-	<1	-	7	-	<5	-	120	-	<0.1	<2	-	-	-	36
AECOM	BH337	8	8/5/10	Area B	333661	6251315	-5.6	-	-	<5	-	-	<1	-	3	-	<5	-	12	-	<0.1	<2	-	-	-	7
AECOM	BH338	0	27/7/10	Area B	333659	6251299	2.4	-	-	<5	-	-	<1	-	16	-	21	-	24	-	0.1	8	-	-	-	53
AECOM	BH338	1	8/2/10	Area B	333659	6251299	1.4	-	-	<5	-	-	<1	-	8	-	16	-	105	-	<0.1	6	-	-	-	63
AECOM	BH338	3	8/2/10	Area B	333659	6251299	-0.6	-	-	<5	-	-	<1	-	8	-	<5	-	12	-	<0.1	3	-	-	-	<5
AECOM	BH338	4	8/2/10	Area B	333659	6251299	-1.6	-	-	<5	-	-	<1	-	9	-	<5	-	12	-	<0.1	<2	-	-	-	6
AECOM	BH338	5	8/2/10	Area B	333659	6251299	-2.6	-	-	<5	-	-	<1	-	8	-	10	-	21	-	<0.1	<2	-	-	-	12
AECOM	BH338	6	8/2/10	Area B	333659	6251299	-3.6	-	-	6	-	-	<1	-	26	-	6	-	16	-	<0.1	<2	-	-	-	<5
AECOM	BH338	7	8/2/10	Area B	333659	6251299	-4.6	-	-	<5	-	-	<1	-	5	-	<5	-	14	-	<0.1	<2	-	-	-	<5

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH338	8	8/2/10	Area B	333659	6251299	-5.6	-	-	11	-	-	<1	-	23	-	64	-	330	-	1.1	6	-	-	-	278
AECOM	BH338	9	8/2/10	Area C	333659	6251299	-6.6	-	-	15	-	-	1	-	38	-	113	-	681	-	2.3	16	-	-	-	976
AECOM	BH339	0.1	22/7/10	Area B	333615	6251469	2.3	-	-	<5	-	-	<1	-	3	-	298	-	10	-	<0.1	8	-	-	-	62
AECOM	BH339	10	8/2/10	Area C	333615	6251469	-7.6	-	-	<5	-	-	<1	-	8	-	8	-	12	-	<0.1	4	-	-	-	19
AECOM	BH339	1	30/7/10	Area B	333615	6251469	1.4	-	-	<5	-	-	<1	-	11	-	28	-	115	-	<0.1	5	-	-	-	66
AECOM	BH339	11	8/2/10	Area C	333615	6251469	-8.6	-	-	<5	-	-	<1	-	4	-	<5	-	10	-	<0.1	7	-	-	-	16
AECOM	BH339	12	8/2/10	Area C	333615	6251469	-9.6	-	-	<5	-	-	<1	-	12	-	9	-	24	-	<0.1	10	-	-	-	28
AECOM	BH339	13	8/2/10	Area C	333615	6251469	-10.6	-	-	5	-	-	<1	-	12	-	7	-	76	-	<0.1	<2	-	-	-	55
AECOM	BH339	14	8/2/10	Area C	333615	6251469	-11.6	-	-	25	-	-	<1	-	44	-	<5	-	21	-	<0.1	3	-	-	-	8
AECOM	BH339	2	30/7/10	Area B	333615	6251469	0.4	-	-	<5	-	-	<1	-	11	-	13	-	341	-	0.4	4	-	-	-	49
AECOM	BH339	3	8/2/10	Area B	333615	6251469	-0.6	-	-	<5	-	-	<1	-	7	-	6	-	23	-	<0.1	<2	-	-	-	<5
AECOM	BH339	4	8/2/10	Area B	333615	6251469	-1.6	-	-	<5	-	-	<1	-	12	-	14	-	55	-	<0.1	6	-	-	-	109
AECOM	BH339	5	8/2/10	Area B	333615	6251469	-2.6	-	-	<5	-	-	<1	-	10	-	9	-	22	-	<0.1	8	-	-	-	30
AECOM	BH339	6	8/2/10	Area B	333615	6251469	-3.6	-	-	<5	-	-	<1	-	23	-	12	-	30	-	<0.1	14	-	-	-	166
AECOM	BH339	7	8/2/10	Area B	333615	6251469	-4.6	-	-	<5	-	-	<1	-	3	-	<5	-	11	-	<0.1	4	-	-	-	15
AECOM	BH339	8	8/2/10	Area B	333615	6251469	-5.6	-	-	<5	-	-	<1	-	9	-	15	-	14	-	<0.1	7	-	-	-	18
AECOM	BH339	9	8/2/10	Area C	333615	6251469	-6.6	-	-	<5	-	-	<1	-	10	-	<5	-	11	-	<0.1	9	-	-	-	20
AECOM	BH34	1.8	25/2/10	Block 4	333689	6251576	0.24	-	-	<5	80	<1	<1	<0.5	16	5	6	-	15	252	<0.1	6	-	-	18	33
AECOM	BH34	11	25/2/10	Block 4	333689	6251576	-8.96	-	-	<5	30	<1	<1	-	9	4	<5	-	11	219	<0.1	5	-	-	13	27
AECOM	BH34	3.8	25/2/10	Block 4	333689	6251576	-1.76	-	-	<5	40	<1	<1	-	9	4	<5	-	9	160	<0.1	4	-	-	14	17
AECOM	BH34	6	25/2/10	Block 4	333689	6251576	-3.96	-	-	<5	40	<1	<1	-	11	6	6	-	11	285	<0.1	8	-	-	17	40
AECOM	BH340	0.1	21/7/10	Area B	333625	6251392	2.3	-	-	<5	-	-	<1	-	3	-	293	-	10	-	<0.1	10	-	-	-	67
AECOM	BH340	10	30/7/10	Area C	333625	6251392	-7.6	-	-	<5	-	-	<1	-	10	-	32	-	58	-	<0.1	7	-	-	-	68
AECOM	BH340	1	30/7/10	Area B	333625	6251392	1.4	-	-	12	-	-	<1	-	8	-	18	-	195	-	0.1	16	-	-	-	214
AECOM	BH340	11	30/7/10	Area C	333625	6251392	-8.6	-	-	<5	-	-	<1	-	7	-	32	-	41	-	<0.1	5	-	-	-	44
AECOM	BH340	12	30/7/10	Area C	333625	6251392	-9.6	-	-	26	-	-	<1	-	26	-	509	-	1350	-	4.4	12	-	-	-	376
AECOM	BH340	13	30/7/10	Area C	333625	6251392	-10.6	-	-	126	-	-	<1	-	79	-	<5	-	18	-	<0.1	2	-	-	-	7
AECOM	BH340	3	30/7/10	Area B	333625	6251392	-0.6	-	-	27	-	-	<1	-	19	-	44	-	824	-	0.2	13	-	-	-	331
AECOM	BH340	4	30/7/10	Area B	333625	6251392	-1.6	-	-	<5	-	-	<1	-	10	-	55	-	174	-	<0.1	8	-	-	-	127
AECOM	BH340	6	30/7/10	Area B	333625	6251392	-3.6	-	-	<5	-	-	<1	-	5	-	10	-	183	-	<0.1	4	-	-	-	124
AECOM	BH340	7	30/7/10	Area B	333625	6251392	-4.6	-	-	6	-	-	<1	-	6	-	12	-	62	-	<0.1	4	-	-	-	72
AECOM	BH340	8	30/7/10	Area B	333625	6251392	-5.6	-	-	<5	-	-	<1	-	7	-	17	-	38	-	<0.1	3	-	-	-	74
AECOM	BH340	9	30/7/10	Area C	333625	6251392	-6.6	-	-	<5	-	-	<1	-	7	-	42	-	33	-	<0.1	5	-	-	-	53
AECOM	BH341	0.1	22/7/10	Area B	333627	6251372	2.3	-	-	<5	-	-	<1	-	3	-	334	-	10	-	<0.1	8	-	-	-	63
AECOM	BH341	1.5	29/7/10	Area B	333627	6251372	0.9	-	-	<5	-	-	<1	-	6	-	<5	-	30	-	<0.1	<2	-	-	-	14
AECOM	BH341	2.5	29/7/10	Area B	333627	6251372	-0.1	-	-	<5	-	-	<1	-	8	-	10	-	92	-	0.3	2	-	-	-	60
AECOM	BH341	3.5	29/7/10	Area B	333627	6251372	-1.1	-	-	<5	-	-	<1	-	11	-	9	-	101	-	0.1	4	-	-	-	47
AECOM	BH341	4.5	29/7/10	Area B	333627	6251372	-2.1	-	-	<5	-	-	<1	-	8	-	15	-	57	-	<0.1	2	-	-	-	32
AECOM	BH341	5.5	29/7/10	Area B	333627	6251372	-3.1	-	-	<5	-	-	<1	-	7	-	9	-	16	-	<0.1	2	-	-	-	5
AECOM	BH341	6.5	29/7/10	Area B	333627	6251372	-4.1	-	-	5	-	-	<1	-	10	-	12	-	237	-	<0.1	10	-	-	-	116
AECOM	BH341	7.5	29/7/10	Area B	333627	6251372	-5.1	-	-	<5	-	-	<1	-	8	-	5	-	47	-	<0.1	2	-	-	-	26
AECOM	BH341	8.5	29/7/10	Area C	333627	6251372	-6.1	-	-	<5	-	-	<1	-	6	-	11	-	121	-	<0.1	2	-	-	-	42
AECOM	BH342	0.1	22/7/10	Area B	333633	6251335	2.3	-	-	<5	-	-	<1	-	4	-	280	-	9	-	<0.1	12	-	-	-	63
AECOM	BH342	1.0	30/7/10	Area B	333633	6251335	1.4	-	-	<5	-	-	<1	-	8	-	27	-	188	-	0.1	5	-	-	-	130
AECOM	BH342	2	30/7/10	Area B	333633	6251335	0.4	-	-	<5	-	-	<1	-	10	-	27	-	89	-	<0.1	6	-	-	-	78

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH342	3	30/7/10	Area B	333633	6251335	-0.6	-	-	<5	-	-	<1	-	8	-	<5	-	9	-	<0.1	<2	-	-	-	6
AECOM	BH342	5	30/7/10	Area B	333633	6251335	-2.6	-	-	<5	-	-	<1	-	7	-	<5	-	7	-	<0.1	2	-	-	-	8
AECOM	BH342	6	30/7/10	Area B	333633	6251335	-3.6	-	-	6	-	-	<1	-	7	-	6	-	28	-	<0.1	<2	-	-	-	34
AECOM	BH342	7	30/7/10	Area B	333633	6251335	-4.6	-	-	<5	-	-	<1	-	5	-	<5	-	21	-	<0.1	<2	-	-	-	6
AECOM	BH342	8	30/7/10	Area B	333633	6251335	-5.6	-	-	<5	-	-	<1	-	14	-	5	-	39	-	<0.1	<2	-	-	-	15
AECOM	BH343	0.1	22/7/10	Area B	333632	6251315	2.3	-	-	<5	-	-	<1	-	6	-	256	-	7	-	<0.1	10	-	-	-	61
AECOM	BH343	10.5	8/4/10	Area C	333632	6251315	-8.1	-	-	<5	-	-	<1	-	8	-	9	-	11	-	<0.1	2	-	-	-	14
AECOM	BH343	1	8/4/10	Area B	333632	6251315	1.4	-	-	<5	-	-	<1	-	10	-	15	-	67	-	0.3	3	-	-	-	66
AECOM	BH343	12	8/4/10	Area C	333632	6251315	-9.6	-	-	11	-	-	<1	-	12	-	32	-	55	-	0.7	3	-	-	-	64
AECOM	BH343	13	8/4/10	Area C	333632	6251315	-10.6	-	-	<5	-	-	<1	-	7	-	<5	-	6	-	<0.1	<2	-	-	-	5
AECOM	BH343	2	8/4/10	Area B	333632	6251315	0.4	-	-	<5	-	-	<1	-	11	-	30	-	72	-	0.3	7	-	-	-	72
AECOM	BH343	3	8/4/10	Area B	333632	6251315	-0.6	-	-	<5	-	-	<1	-	18	-	34	-	53	-	0.1	9	-	-	-	261
AECOM	BH343	4	8/4/10	Area B	333632	6251315	-1.6	-	-	<5	-	-	<1	-	6	-	16	-	101	-	0.2	7	-	-	-	88
AECOM	BH343	5	8/4/10	Area B	333632	6251315	-2.6	-	-	<5	-	-	<1	-	22	-	9	-	81	-	<0.1	21	-	-	-	57
AECOM	BH343	6	8/4/10	Area B	333632	6251315	-3.6	-	-	<5	-	-	<1	-	4	-	6	-	20	-	<0.1	4	-	-	-	39
AECOM	BH343	7	8/4/10	Area B	333632	6251315	-4.6	-	-	35	-	-	<1	-	15	-	91	-	199	-	0.1	13	-	-	-	259
AECOM	BH343	8	8/4/10	Area B	333632	6251315	-5.6	-	-	<5	-	-	<1	-	8	-	6	-	46	-	<0.1	2	-	-	-	49
AECOM	BH344	0.1	22/7/10	Area B	333639	6251280	2.3	-	-	<5	-	-	<1	-	5	-	261	-	9	-	<0.1	10	-	-	-	64
AECOM	BH344	0.8	8/2/10	Area B	333639	6251280	1.6	-	-	6	-	-	<1	-	28	-	16	-	115	-	0.2	4	-	-	-	73
AECOM	BH344	1.8	8/2/10	Area B	333639	6251280	0.6	-	-	19	-	-	<1	-	10	-	100	-	104	-	0.2	4	-	-	-	78
AECOM	BH344	3	8/2/10	Area B	333639	6251280	-0.6	-	-	<5	-	-	<1	-	8	-	16	-	605	-	1.7	3	-	-	-	259
AECOM	BH344	4	8/2/10	Area B	333639	6251280	-1.6	-	-	<5	-	-	<1	-	9	-	26	-	130	-	0.2	6	-	-	-	111
AECOM	BH344	5.8	8/2/10	Area B	333639	6251280	-3.4	-	-	<5	-	-	<1	-	6	-	5	-	157	-	<0.1	<2	-	-	-	43
AECOM	BH344	5	8/2/10	Area B	333639	6251280	-2.6	-	-	<5	-	-	<1	-	5	-	25	-	501	-	0.1	<2	-	-	-	54
AECOM	BH344	7	8/2/10	Area B	333639	6251280	-4.6	-	-	<5	-	-	<1	-	9	-	16	-	220	-	0.1	6	-	-	-	238
AECOM	BH344	8	8/2/10	Area B	333639	6251280	-5.6	-	-	<5	-	-	<1	-	8	-	10	-	67	-	<0.1	4	-	-	-	34
AECOM	BH344	9	8/2/10	Area C	333639	6251280	-6.6	-	-	<5	-	-	<1	-	8	-	7	-	29	-	<0.1	<2	-	-	-	15
AECOM	BH345	0.1	21/7/10	Area A	333595	6251485	2.3	-	-	<5	-	-	<1	-	2	-	288	-	8	-	<0.1	8	-	-	-	55
AECOM	BH345	1.5	21/7/10	Area A	333595	6251485	0.9	-	-	<5	-	-	<1	-	7	-	11	-	101	-	0.2	3	-	-	-	84
AECOM	BH345	10.5	21/7/10	Area A	333595	6251485	-8.1	-	-	<5	-	-	<1	-	8	-	8	-	35	-	<0.1	4	-	-	-	55
AECOM	BH345	12	22/7/10	Area A	333595	6251485	-9.6	-	-	<5	-	-	<1	-	11	-	<5	-	8	-	<0.1	7	-	-	-	9
AECOM	BH345	13.5	22/7/10	Area A	333595	6251485	-11.1	-	-	<5	-	-	<1	-	5	-	7	-	12	-	<0.1	3	-	-	-	9
AECOM	BH345	15	22/7/10	Area A	333595	6251485	-12.6	-	-	<5	-	-	<1	-	6	-	31	-	134	-	0.1	2	-	-	-	59
AECOM	BH345	16.5	22/7/10	Area A	333595	6251485	-14.1	-	-	<5	-	-	<1	-	25	-	8	-	21	-	<0.1	4	-	-	-	7
AECOM	BH345	18	22/7/10	Area A	333595	6251485	-15.6	-	-	168	-	-	<1	-	67	-	<5	-	20	-	<0.1	6	-	-	-	15
AECOM	BH345	3	21/7/10	Area A	333595	6251485	-0.6	-	-	<5	-	-	<1	-	6	-	<5	-	17	-	<0.1	2	-	-	-	22
AECOM	BH345	4.5	21/7/10	Area A	333595	6251485	-2.1	-	-	<5	-	-	<1	-	11	-	16	-	820	-	0.3	12	-	-	-	132
AECOM	BH345	6	21/7/10	Area A	333595	6251485	-3.6	-	-	<5	-	-	<1	-	8	-	7	-	62	-	0.1	4	-	-	-	36
AECOM	BH345	7.5	21/7/10	Area A	333595	6251485	-5.1	-	-	<5	-	-	<1	-	6	-	<5	-	32	-	<0.1	4	-	-	-	25
AECOM	BH345	9	21/7/10	Area A	333595	6251485	-6.6	-	-	<5	-	-	<1	-	4	-	<5	-	12	-	<0.1	2	-	-	-	13
AECOM	BH346	0.1	21/7/10	Area A	333597	6251467	2.3	-	-	<5	-	-	<1	-	3	-	355	-	7	-	<0.1	11	-	-	-	71
AECOM	BH346	1.5	21/7/10	Area A	333597	6251467	0.9	-	-	<5	-	-	<1	-	9	-	15	-	120	-	0.2	7	-	-	-	177
AECOM	BH346	10.5	22/7/10	Area A	333597	6251467	-8.1	-	-	<5	-	-	<1	-	12	-	27	-	28	-	<0.1	8	-	-	-	49
AECOM	BH346	12	22/7/10	Area A	333597	6251467	-9.6	-	-	<5	-	-	<1	-	5	-	<5	-	23	-	<0.1	2	-	-	-	18
AECOM	BH346	13.5	22/7/10	Area A	333597	6251467	-11.1	-	-	<5	-	-	<1	-	13	-	20	-	48	-	<0.1	6	-	-	-	50

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH346	15	22/7/10	Area A	333597	6251467	-12.6	-	-	<5	-	-	<1	-	5	-	5	-	48	-	<0.1	5	-	-	-	14
AECOM	BH346	16.5	22/7/10	Area A	333597	6251467	-14.1	-	-	10	-	-	<1	-	15	-	45	-	176	-	0.4	4	-	-	-	144
AECOM	BH346	17	22/7/10	Area A	333597	6251467	-14.6	-	-	22	-	-	<1	-	33	-	128	-	254	-	3.4	11	-	-	-	312
AECOM	BH346	3	21/7/10	Area A	333597	6251467	-0.6	-	-	<5	-	-	<1	-	12	-	257	-	66	-	<0.1	7	-	-	-	87
AECOM	BH346	6	21/7/10	Area A	333597	6251467	-3.6	-	-	<5	-	-	<1	-	9	-	<5	-	18	-	<0.1	4	-	-	-	30
AECOM	BH346	7.5	21/7/10	Area A	333597	6251467	-5.1	-	-	<5	-	-	<1	-	7	-	10	-	53	-	<0.1	5	-	-	-	39
AECOM	BH346	9	21/7/10	Area A	333597	6251467	-6.6	-	-	<5	-	-	<1	-	10	-	<5	-	16	-	<0.1	4	-	-	-	25
AECOM	BH347	0.1	21/7/10	Area A	333603	6251446	2.3	-	-	<5	-	-	<1	-	3	-	284	-	8	-	<0.1	7	-	-	-	59
AECOM	BH347	1.5	22/7/10	Area A	333603	6251446	0.9	-	-	<5	-	-	<1	-	6	-	92	-	34	-	<0.1	10	-	-	-	52
AECOM	BH347	10.5	23/7/10	Area A	333603	6251446	-8.1	-	-	<5	-	-	<1	-	4	-	8	-	148	-	<0.1	<2	-	-	-	72
AECOM	BH347	12	23/7/10	Area A	333603	6251446	-9.6	-	-	6	-	-	<1	-	8	-	22	-	170	-	<0.1	10	-	-	-	173
AECOM	BH347	13.5	23/7/10	Area A	333603	6251446	-11.1	-	-	<5	-	-	<1	-	9	-	24	-	154	-	0.3	4	-	-	-	105
AECOM	BH347	15.1	23/7/10	Area A	333603	6251446	-12.7	-	-	19	-	-	<1	-	28	-	77	-	212	-	2.5	10	-	-	-	261
AECOM	BH347	15	23/7/10	Area A	333603	6251446	-12.6	-	-	11	-	-	<1	-	14	-	15	-	67	-	0.9	3	-	-	-	67
AECOM	BH347	3	22/7/10	Area A	333603	6251446	-0.6	-	-	<5	-	-	<1	-	4	-	5	-	176	-	<0.1	<2	-	-	-	100
AECOM	BH347	4.5	22/7/10	Area A	333603	6251446	-2.1	-	-	<5	-	-	<1	-	4	-	<5	-	15	-	<0.1	<2	-	-	-	7
AECOM	BH347	6	22/7/10	Area A	333603	6251446	-3.6	-	-	<5	-	-	<1	-	6	-	59	-	19	-	<0.1	3	-	-	-	10
AECOM	BH347	7.5	22/7/10	Area A	333603	6251446	-5.1	-	-	<5	-	-	<1	-	7	-	12	-	104	-	<0.1	<2	-	-	-	97
AECOM	BH347	9	22/7/10	Area A	333603	6251446	-6.6	-	-	6	-	-	1	-	10	-	16	-	80	-	<0.1	5	-	-	-	242
AECOM	BH348	0.1	21/7/10	Area A	333602	6251429	2.3	-	-	<5	-	-	<1	-	2	-	274	-	8	-	<0.1	9	-	-	-	62
AECOM	BH348	1.5	23/7/10	Area A	333602	6251429	0.9	-	-	<5	-	-	<1	-	12	-	22	-	266	-	0.2	7	-	-	-	120
AECOM	BH348	10.5	23/7/10	Area A	333602	6251429	-8.1	-	-	6	-	-	<1	-	11	-	12	-	56	-	<0.1	7	-	-	-	52
AECOM	BH348	12	26/7/10	Area A	333602	6251429	-9.6	-	-	<5	-	-	<1	-	5	-	6	-	591	-	<0.1	2	-	-	-	202
AECOM	BH348	14.5	26/7/10	Area A	333602	6251429	-12.1	-	-	<5	-	-	<1	-	34	-	<5	-	27	-	<0.1	3	-	-	-	13
AECOM	BH348	3	23/7/10	Area A	333602	6251429	-0.6	-	-	<5	-	-	<1	-	7	-	9	-	301	-	0.1	3	-	-	-	131
AECOM	BH348	4.5	23/7/10	Area A	333602	6251429	-2.1	-	-	<5	-	-	<1	-	3	-	12	-	400	-	<0.1	2	-	-	-	48
AECOM	BH348	6	23/7/10	Area A	333602	6251429	-3.6	-	-	<5	-	-	<1	-	5	-	5	-	185	-	<0.1	2	-	-	-	220
AECOM	BH348	7.5	23/7/10	Area A	333602	6251429	-5.1	-	-	<5	-	-	<1	-	8	-	7	-	142	-	<0.1	2	-	-	-	36
AECOM	BH348	9	23/7/10	Area A	333602	6251429	-6.6	-	-	<5	-	-	<1	-	8	-	6	-	98	-	<0.1	<2	-	-	-	26
AECOM	BH349	0.1	21/7/10	Area A	333605	6251410	2.3	-	-	<5	-	-	<1	-	5	-	283	-	9	-	<0.1	9	-	-	-	68
AECOM	BH349	1.5	22/7/10	Area A	333605	6251410	0.9	-	-	8	-	-	<1	-	26	-	24	-	48	-	0.1	15	-	-	-	131
AECOM	BH349	10.5	23/7/10	Area A	333605	6251410	-8.1	-	-	<5	-	-	<1	-	16	-	20	-	114	-	<0.1	6	-	-	-	66
AECOM	BH349	12	26/7/10	Area A	333605	6251410	-9.6	-	-	<5	-	-	<1	-	12	-	35	-	22	-	<0.1	6	-	-	-	163
AECOM	BH349	13.6	26/7/10	Area A	333605	6251410	-11.2	-	-	<5	-	-	<1	-	34	-	6	-	22	-	<0.1	4	-	-	-	23
AECOM	BH349	3	22/7/10	Area A	333605	6251410	-0.6	-	-	<5	-	-	<1	-	8	-	12	-	97	-	<0.1	3	-	-	-	103
AECOM	BH349	4.5	22/7/10	Area A	333605	6251410	-2.1	-	-	<5	-	-	<1	-	6	-	12	-	67	-	<0.1	<2	-	-	-	62
AECOM	BH349	6	22/7/10	Area A	333605	6251410	-3.6	-	-	<5	-	-	<1	-	5	-	<5	-	29	-	<0.1	5	-	-	-	47
AECOM	BH349	7.5	23/7/10	Area A	333605	6251410	-5.1	-	-	<5	-	-	<1	-	10	-	11	-	53	-	<0.1	3	-	-	-	31
AECOM	BH349	9	23/7/10	Area A	333605	6251410	-6.6	-	-	<5	-	-	<1	-	10	-	13	-	178	-	<0.1	4	-	-	-	67
AECOM	BH35	0.9	22/2/10	Block 4	333706	6251580	1.29	-	-	7	70	1	<1	-	9	10	9	-	40	457	<0.1	13	-	-	19	89
AECOM	BH35	4	22/2/10	Block 4	333706	6251580	-1.81	-	-	<5	110	<1	<1	-	10	5	<5	-	13	268	<0.1	6	-	-	17	27
AECOM	BH35	6.4	22/2/10	Block 4	333706	6251580	-4.21	-	-	<5	90	<1	<1	-	10	5	<5	-	12	308	<0.1	7	-	-	18	28
AECOM	BH35	9.9	22/2/10	Block 4	333706	6251580	-7.71	-	-	<5	20	<1	<1	<0.5	9	4	<5	13200	12	154	<0.1	6	-	-	19	37
AECOM	BH350	0.1	21/7/10	Area A	333608	6251395	2.3	-	-	<5	-	-	<1	-	3	-	302	-	9	-	<0.1	8	-	-	-	64
AECOM	BH350	1.5	30/7/10	Area A	333608	6251395	0.9	-	-	14	-	-	<1	-	35	-	9	-	98	-	<0.1	<2	-	-	-	46

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH350	10	30/7/10	Area A	333608	6251395	-7.6	-	-	<5	-	-	<1	-	6	-	20	-	77	-	<0.1	3	-	-	-	75
AECOM	BH350	11.5	30/7/10	Area A	333608	6251395	-9.1	-	-	<5	-	-	<1	-	9	-	5	-	28	-	<0.1	4	-	-	-	65
AECOM	BH350	14.5	30/7/10	Area A	333608	6251395	-12.1	-	-	<5	-	-	<1	-	10	-	20	-	64	-	0.4	2	-	-	-	79
AECOM	BH350	16	30/7/10	Area A	333608	6251395	-13.6	-	-	<5	-	-	<1	-	4	-	<5	-	<5	-	<0.1	<2	-	-	-	6
AECOM	BH350	2.5	30/7/10	Area A	333608	6251395	-0.1	-	-	<5	-	-	<1	-	8	-	137	-	205	-	<0.1	4	-	-	-	93
AECOM	BH350	4	30/7/10	Area A	333608	6251395	-1.6	-	-	<5	-	-	<1	-	11	-	24	-	114	-	<0.1	10	-	-	-	69
AECOM	BH350	5.5	30/7/10	Area A	333608	6251395	-3.1	-	-	<5	-	-	<1	-	10	-	38	-	21	-	<0.1	2	-	-	-	31
AECOM	BH350	8.5	30/7/10	Area A	333608	6251395	-6.1	-	-	<5	-	-	<1	-	5	-	13	-	36	-	<0.1	4	-	-	-	26
AECOM	BH351	0.1	23/7/10	Area A	333610	6251371	2.3	-	-	<5	-	-	<1	-	4	-	345	-	11	-	<0.1	8	-	-	-	62
AECOM	BH351	1.5	27/7/10	Area A	333610	6251371	0.9	-	-	5	-	-	<1	-	10	-	54	-	193	-	0.4	9	-	-	-	143
AECOM	BH351	10	27/7/10	Area A	333610	6251371	-7.6	-	-	<5	-	-	<1	-	6	-	10	-	98	-	<0.1	<2	-	-	-	58
AECOM	BH351	11.5	27/7/10	Area A	333610	6251371	-9.1	-	-	6	-	-	<1	-	16	-	36	-	61	-	<0.1	5	-	-	-	171
AECOM	BH351	14.5	27/7/10	Area A	333610	6251371	-12.1	-	-	9	-	-	<1	-	16	-	43	-	299	-	0.6	6	-	-	-	225
AECOM	BH351	2.5	27/7/10	Area A	333610	6251371	-0.1	-	-	<5	-	-	<1	-	11	-	54	-	157	-	0.2	12	-	-	-	136
AECOM	BH351	4	27/7/10	Area A	333610	6251371	-1.6	-	-	<5	-	-	<1	-	7	-	48	-	109	-	0.1	5	-	-	-	108
AECOM	BH351	7	27/7/10	Area A	333610	6251371	-4.6	-	-	<5	-	-	<1	-	8	-	11	-	90	-	<0.1	4	-	-	-	60
AECOM	BH351	8.5	27/7/10	Area A	333610	6251371	-6.1	-	-	<5	-	-	<1	-	5	-	11	-	265	-	<0.1	2	-	-	-	121
AECOM	BH352	9.5	27/7/10	Area A	333611	6251353	-7.1	-	-	<5	-	-	<1	-	8	-	13	-	20	-	<0.1	6	-	-	-	74
AECOM	BH352	0.1	23/7/10	Area A	333611	6251353	2.3	-	-	<5	-	-	<1	-	3	-	296	-	10	-	<0.1	11	-	-	-	67
AECOM	BH352	1.5	27/7/10	Area A	333611	6251353	0.9	-	-	<5	-	-	<1	-	9	-	13	-	87	-	<0.1	5	-	-	-	54
AECOM	BH352	10.5	27/7/10	Area A	333611	6251353	-8.1	-	-	18	-	-	<1	-	29	-	61	-	33	-	<0.1	10	-	-	-	53
AECOM	BH352	12	27/7/10	Area A	333611	6251353	-9.6	-	-	<5	-	-	<1	-	9	-	18	-	88	-	<0.1	8	-	-	-	65
AECOM	BH352	13.5	27/7/10	Area A	333611	6251353	-11.1	-	-	7	-	-	<1	-	15	-	40	-	290	-	0.4	6	-	-	-	238
AECOM	BH352	3	27/7/10	Area A	333611	6251353	-0.6	-	-	6	-	-	<1	-	8	-	14	-	37	-	0.3	3	-	-	-	196
AECOM	BH352	4.5	27/7/10	Area A	333611	6251353	-2.1	-	-	<5	-	-	<1	-	5	-	24	-	56	-	0.1	7	-	-	-	29
AECOM	BH352	6	27/7/10	Area A	333611	6251353	-3.6	-	-	<5	-	-	<1	-	6	-	<5	-	13	-	<0.1	5	-	-	-	9
AECOM	BH352	7.5	27/7/10	Area A	333611	6251353	-5.1	-	-	<5	-	-	<1	-	13	-	59	-	98	-	<0.1	3	-	-	-	61
AECOM	BH353	0.1	23/7/10	Area A	333613	6251333	2.3	-	-	<5	-	-	<1	-	3	-	303	-	10	-	<0.1	8	-	-	-	66
AECOM	BH353	1.5	27/7/10	Area A	333613	6251333	0.9	-	-	<5	-	-	<1	-	6	-	78	-	88	-	0.2	6	-	-	-	51
AECOM	BH353	10.5	28/7/10	Area A	333613	6251333	-8.1	-	-	<5	-	-	<1	-	7	-	13	-	2450	-	<0.1	3	-	-	-	41
AECOM	BH353	11.7	29/7/10	Area A	333613	6251333	-9.3	-	-	<5	-	-	<1	-	4	-	43	-	43	-	<0.1	3	-	-	-	69
AECOM	BH353	13	29/7/10	Area A	333613	6251333	-10.6	-	-	<5	-	-	<1	-	22	-	<5	-	24	-	<0.1	3	-	-	-	5
AECOM	BH353	3	27/7/10	Area A	333613	6251333	-0.6	-	-	<5	-	-	<1	-	3	-	<5	-	86	-	<0.1	<2	-	-	-	37
AECOM	BH353	4	27/7/10	Area A	333613	6251333	-1.6	-	-	<5	-	-	<1	-	5	-	19	-	72	-	<0.1	5	-	-	-	53
AECOM	BH353	6	28/7/10	Area A	333613	6251333	-3.6	-	-	<5	-	-	<1	-	8	-	45	-	53	-	<0.1	9	-	-	-	229
AECOM	BH353	7.5	28/7/10	Area A	333613	6251333	-5.1	-	-	<5	-	-	<1	-	9	-	13	-	179	-	<0.1	6	-	-	-	204
AECOM	BH354	0.1	23/7/10	Area A	333615	6251314	2.3	-	-	<5	-	-	<1	-	2	-	327	-	8	-	<0.1	8	-	-	-	58
AECOM	BH354	1.5	29/7/10	Area A	333615	6251314	0.9	-	-	6	-	-	<1	-	9	-	35	-	114	-	1.7	15	-	-	-	119
AECOM	BH354	10.5	29/7/10	Area A	333615	6251314	-8.1	-	-	9	-	-	<1	-	9	-	38	-	106	-	0.2	9	-	-	-	398
AECOM	BH354	12	29/7/10	Area A	333615	6251314	-9.6	-	-	14	-	-	<1	-	11	-	14	-	238	-	0.1	2	-	-	-	125
AECOM	BH354	13.5	29/7/10	Area A	333615	6251314	-11.1	-	-	<5	-	-	<1	-	11	-	16	-	96	-	<0.1	4	-	-	-	85
AECOM	BH354	3	29/7/10	Area A	333615	6251314	-0.6	-	-	<5	-	-	<1	-	6	-	28	-	120	-	0.1	14	-	-	-	79
AECOM	BH354	4.5	29/7/10	Area A	333615	6251314	-2.1	-	-	<5	-	-	<1	-	8	-	72	-	82	-	0.1	11	-	-	-	118
AECOM	BH354	6	29/7/10	Area A	333615	6251314	-3.6	-	-	6	-	-	<1	-	15	-	61	-	31	-	0.1	8	-	-	-	43
AECOM	BH354	7.5	29/7/10	Area A	333615	6251314	-5.1	-	-	<5	-	-	<1	-	10	-	142	-	92	-	0.1	11	-	-	-	96

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH355	0	27/7/10	Area A	333617	6251295	2.4	-	-	<5	-	-	<1	-	3	-	315	-	7	-	<0.1	8	-	-	-	59
AECOM	BH355	1.5	29/7/10	Area A	333617	6251295	0.9	-	-	<5	-	-	<1	-	9	-	61	-	263	-	2.4	5	-	-	-	179
AECOM	BH355	11.5	29/7/10	Area A	333617	6251295	-9.1	-	-	6	-	-	<1	-	15	-	37	-	363	-	<0.1	13	-	-	-	174
AECOM	BH355	13	30/7/10	Area A	333617	6251295	-10.6	-	-	<5	-	-	<1	-	4	-	<5	-	26	-	<0.1	<2	-	-	-	<5
AECOM	BH355	2.5	29/7/10	Area A	333617	6251295	-0.1	-	-	<5	-	-	<1	-	6	-	83	-	215	-	0.3	5	-	-	-	92
AECOM	BH355	4	29/7/10	Area A	333617	6251295	-1.6	-	-	<5	-	-	<1	-	9	-	10	-	50	-	0.1	2	-	-	-	35
AECOM	BH355	5.5	29/7/10	Area A	333617	6251295	-3.1	-	-	<5	-	-	<1	-	9	-	16	-	41	-	0.1	3	-	-	-	56
AECOM	BH355	7	29/7/10	Area A	333617	6251295	-4.6	-	-	<5	-	-	<1	-	3	-	<5	-	217	-	<0.1	<2	-	-	-	70
AECOM	BH355	8.5	29/7/10	Area A	333617	6251295	-6.1	-	-	6	-	-	<1	-	5	-	14	-	33	-	<0.1	6	-	-	-	46
AECOM	BH356	0.1	27/7/10	Area A	333619	6251279	2.3	-	-	<5	-	-	<1	-	2	-	265	-	7	-	<0.1	8	-	-	-	62
AECOM	BH356	1.3	28/7/10	Area A	333619	6251279	1.1	-	-	<5	-	-	<1	-	6	-	35	-	102	-	<0.1	4	-	-	-	41
AECOM	BH356	10.5	29/7/10	Area A	333619	6251279	-8.1	-	-	<5	-	-	<1	-	8	-	42	-	30	-	<0.1	4	-	-	-	40
AECOM	BH356	12	29/7/10	Area A	333619	6251279	-9.6	-	-	<5	-	-	<1	-	8	-	6	-	29	-	<0.1	<2	-	-	-	15
AECOM	BH356	13.5	29/7/10	Area A	333619	6251279	-11.1	-	-	<5	-	-	<1	-	19	-	11	-	22	-	<0.1	15	-	-	-	117
AECOM	BH356	3	28/7/10	Area A	333619	6251279	-0.6	-	-	5	-	-	<1	-	10	-	15	-	273	-	<0.1	3	-	-	-	117
AECOM	BH356	4	28/7/10	Area A	333619	6251279	-1.6	-	-	<5	-	-	<1	-	5	-	6	-	291	-	1.4	18	-	-	-	264
AECOM	BH356	6	29/7/10	Area A	333619	6251279	-3.6	-	-	12	-	-	<1	-	16	-	17	-	49	-	<0.1	8	-	-	-	37
AECOM	BH356	7.5	29/7/10	Area A	333619	6251279	-5.1	-	-	6	-	-	<1	-	10	-	16	-	83	-	<0.1	3	-	-	-	26
AECOM	BH356	9	29/7/10	Area A	333619	6251279	-6.6	-	-	<5	-	-	<1	-	9	-	11	-	142	-	<0.1	4	-	-	-	186
AECOM	BH36	0.7	19/2/10	Block 3	333684	6251545	1.55	-	-	<5	20	<1	<1	-	2	12	256	-	6	753	<0.1	7	-	-	119	51
AECOM	BH36	1	3/3/10	Block 3	333684	6251545	1.25	-	-	<5	10	<1	<1	-	8	<2	<5	-	17	43	<0.1	<2	-	-	12	14
AECOM	BH36	13	3/3/10	Block 3	333684	6251545	-10.75	-	-	<5	50	<1	<1	-	8	4	6	-	13	254	<0.1	5	-	-	14	40
AECOM	BH36	15	3/3/10	Block 3	333684	6251545	-12.75	-	-	<5	40	<1	<1	<0.5	12	<2	<5	12800	12	43	<0.1	5	-	-	20	11
AECOM	BH36	4	3/3/10	Block 3	333684	6251545	-1.75	-	-	<5	30	<1	<1	-	7	<2	<5	-	9	73	<0.1	2	-	-	12	17
AECOM	BH36	8.5	3/3/10	Block 3	333684	6251545	-6.25	-	-	<5	50	<1	<1	-	9	6	7	-	13	308	<0.1	10	-	-	14	46
AECOM	BH36	0.7	19/2/10	Area B	333684	6251545	1.55	-	-	<5	20	<1	<1	-	2	12	256	-	6	753	<0.1	7	-	-	119	51
AECOM	BH36	1	3/3/10	Area B	333684	6251545	1.25	-	-	<5	10	<1	<1	-	8	<2	<5	-	17	43	<0.1	<2	-	-	12	14
AECOM	BH36	13	3/3/10	Area C	333684	6251545	-10.75	-	-	<5	50	<1	<1	-	8	4	6	-	13	254	<0.1	5	-	-	14	40
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	-	-	<5	40	<1	<1	<0.5	12	<2	<5	12,800	12	43	<0.1	5	-	-	20	11
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	-	-	<5	30	<1	<1	-	7	<2	<5	-	9	73	<0.1	2	-	-	12	17
AECOM	BH36	8.5	3/3/10	Area C	333684	6251545	-6.25	-	-	<5	50	<1	<1	-	9	6	7	-	13	308	<0.1	10	-	-	14	46
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	-	-	<5	20	<1	<1	<0.5	7	<2	<5	9810	10	11	<0.1	<2	-	-	15	6
AECOM	BH37	0.06	17/2/10	Area B	333655	6251543	2.17	-	-	<5	20	<1	<1	-	2	12	225	-	6	768	<0.1	7	-	-	125	47
AECOM	BH37	15.8	18/2/10	Area C	333655	6251543	-13.57	-	-	<5	20	<1	<1	<0.5	11	<2	<5	1030	10	<5	<0.1	2	-	-	9	<5
AECOM	BH37	2.5	17/2/10	Area B	333655	6251543	-0.27	-	-	<5	<10	<1	<1	-	5	<2	23	-	9	9	<0.1	<2	-	-	8	11
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	-	-	<5	<10	<1	<1	<0.5	2	<2	<5	620	6	<5	<0.1	2	-	-	10	<5
AECOM	BH37	5.5	18/2/10	Area B	333655	6251543	-3.27	-	-	<5	30	<1	<1	<0.5	8	3	<5	8730	20	125	<0.1	5	-	-	15	28
AECOM	BH37	8.3	18/2/10	Area B	333655	6251543	-6.07	-	-	<5	80	<1	<1	-	10	6	<5	-	11	329	<0.1	9	-	-	16	46
AECOM	BH38	0.15	18/2/10	Southern Cove	333620	6251544	2.22	-	-	<5	30	<1	<1	-	4	13	231	-	11	864	<0.1	7	-	-	128	50
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	-	-	<5	40	<1	<1	<0.5	15	5	5	-	14	345	<0.1	7	-	-	22	31
AECOM	BH38	14.5	19/2/10	Southern Cove	333620	6251544	-12.13	-	-	<5	30	<1	<1	<0.5	7	2	7	-	9	183	<0.1	3	-	-	10	26
AECOM	BH38	2.5	19/2/10	Southern Cove	333620	6251544	-0.13	-	-	<5	30	<1	<1	-	6	<2	15	-	31	185	<0.1	3	-	-	14	57
AECOM	BH38	20.5	19/2/10	Southern Cove	333620	6251544	-18.13	-	-	<5	20	<1	<1	<0.5	17	<2	<5	-	9	<5	<0.1	<2	-	-	34	<5
AECOM	BH38	8.5	19/2/10	Southern Cove	333620	6251544	-6.13	-	-	<5	70	<1	<1	<0.5	6	<2	8	8210	42	167	<0.1	4	-	-	11	53
AECOM	BH39	0.15	18/2/10	Southern Cove	333609	6251568	2.33	-	-	<5	20	<1	<1	-	2	13	247	-	6	819	<0.1	7	-	-	139	52

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH39	11.5	24/2/10	Southern Cove	333609	6251568	-9.02	-	-	<5	20	<1	<1	-	7	<2	<5	-	<5	134	<0.1	<2	-	-	7	8
AECOM	BH39	16	24/2/10	Southern Cove	333609	6251568	-13.52	-	-	<5	20	<1	<1	-	7	<2	<5	-	5	<5	<0.1	<2	-	-	14	<5
AECOM	BH39	2.5	23/2/10	Southern Cove	333609	6251568	-0.02	-	-	<5	110	<1	<1	-	8	3	<5	-	6	156	<0.1	3	-	-	10	18
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	-	-	<5	10	<1	<1	-	4	<2	<5	-	<5	<5	<0.1	<2	-	-	<5	<5
AECOM	BH39	4	24/2/10	Southern Cove	333609	6251568	-1.52	-	-	<5	110	<1	<1	-	10	3	<5	-	7	206	<0.1	3	-	-	11	16
AECOM	BH39	7	24/2/10	Southern Cove	333609	6251568	-4.52	-	-	<5	30	<1	<1	-	12	2	<5	-	6	200	<0.1	3	-	-	12	23
AECOM	BH40	1	18/2/10	Southern Cove	333642	6251571	1.12	-	-	<5	20	<1	<1	-	9	3	<5	-	10	181	<0.1	4	-	-	13	20
AECOM	BH40	13	18/2/10	Proposed Southern Cove	333642	6251571	-10.88	-	-	<5	<10	<1	<1	-	4	<2	<5	-	-	77	<0.1	<2	-	-	8	36
AECOM	BH40	14.5	19/2/10	Southern Cove	333642	6251571	-12.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	-	-	20	<10	<1	<1	<0.5	22	<2	<5	17800	-	<5	<0.1	<2	-	-	86	<5
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	-	-	<5	10	<1	<1	<0.5	5	<2	<5	890	-	<5	<0.1	<2	-	-	6	<5
AECOM	BH40	19	18/2/10	Southern Cove	333642	6251571	-16.88	-	-	38	20	<1	<1	<0.5	28	<2	<5	24500	8	9	<0.1	2	-	-	116	8
AECOM	BH40	7	18/2/10	Southern Cove	333642	6251571	-4.88	-	-	<5	20	<1	<1	-	7	4	<5	-	7	180	<0.1	5	-	-	9	30
AECOM	BH41	0.07	19/2/10	Southern Cove	333661	6251582	2.152	-	-	<5	20	<1	<1	-	2	13	356	-	7	852	<0.1	11	-	-	127	54
AECOM	BH41	1	4/3/10	Southern Cove	333661	6251582	1.222	-	-	7	510	1	<1	<0.5	11	13	11	38400	17	682	<0.1	21	-	-	22	94
AECOM	BH41	14.5	8/3/10	Southern Cove	333661	6251582	-12.278	-	-	<5	80	<1	<1	-	12	3	15	-	47	203	0.3	5	-	-	18	101
AECOM	BH41	16	8/3/10	Southern Cove	333661	6251582	-13.778	-	-	<5	10	<1	<1	-	8	<2	<5	2840	7	<5	0.1	2	-	-	10	<5
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	-	-	-	-	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	4	4/3/10	Southern Cove	333661	6251582	-1.778	-	-	<5	20	<1	<1	-	7	4	<5	-	8	215	<0.1	5	-	-	10	34
AECOM	BH41	8.5	4/3/10	Southern Cove	333661	6251582	-6.278	-	-	<5	10	<1	<1	<0.5	8	3	<5	9710	8	169	<0.1	3	-	-	12	16
AECOM	BH42	1	23/2/10	Block 4	333738	6251549	1.51	-	-	5	70	<1	<1	-	11	4	25	-	142	203	0.2	8	-	-	18	89
AECOM	BH42	20.5	19/2/10	Southern Cove	333738	6251549	-17.99	-	-	-	-	-	-	-	-								-	-	-	-
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	-	-	6	<10	<1	<1	<0.5	4	<2	<5	4550	8	6	<0.1	<2	-	-	8	<5
AECOM	BH42	3.5	23/2/10	Block 4	333738	6251549	-0.99	-	-	10	<10	<1	<1	-	5	<2	<5	-	<5	9	<0.1	<2	-	-	10	<5
AECOM	BH43	8.5	19/2/10	Southern Cove	333761	6251581	-5.92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH44	1.4	23/2/10	Block 4	333733	6251591	0.95	-	-	<5	100	<1	<1	-	18	18	50	-	127	406	0.1	66	-	-	31	89
AECOM	BH44	1.9	23/2/10	Block 4	333733	6251591	0.45	-	-	5	130	<1	<1	<0.5	8	<2	9	11300	17	<5	<0.1	<2	-	-	32	<5
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	-	-	<5	50	<1	<1	<0.5	11	<2	<5	8600	<5	<5	<0.1	<2	-	-	10	<5
AECOM	BH45	0.8	23/2/10	Proposed Southern Cove	333698	6251587	1.36	-	-	<5	70	<1	<1	-	12	5	<5	-	18	283	<0.1	6	-	-	17	28
AECOM	BH45	13.2	23/2/10	Proposed Southern Cove	333698	6251587	-11.04	-	-	<5	40	<1	<1	-	12	5	<5	-	13	297	<0.1	6	-	-	18	32
AECOM	BH45	3.2	23/2/10	Proposed Southern Cove	333698	6251587	-1.04	-	-	<5	60	<1	<1	-	16	5	<5	-	13	318	<0.1	7	-	-	19	29
AECOM	BH45	7.2	23/2/10	Proposed Southern Cove	333698	6251587	-5.04	-	-	<5	50	1	<1	<0.5	9	5	5	21800	16	193	<0.1	6	-	-	15	51
AECOM	BH46	1	23/2/10	Southern Cove	333627	6251582	1.22	-	-	<5	270	<1	<1	-	20	5	7	-	11	285	<0.1	6	-	-	13	29
AECOM	BH46	14.5	23/2/10	Southern Cove	333627	6251582	-12.28	-	-	<5	<10	<1	<1	<0.5	8	<2	<5	5210	6	<5	<0.1	<2	-	-	13	<5
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	-	-	<5	10	<1	<1	<0.5	5	<2	<5	480	6	<5	<0.1	<2	-	-	<5	<5
AECOM	BH46	20.5	23/2/10	Southern Cove	333627	6251582	-18.28	-	-	<5	<10	<1	<1	<0.5	7	<2	<5	12800	<5	5	<0.1	<2	-	-	18	<5
AECOM	BH46	23.5	23/2/10	Southern Cove	333627	6251582	-21.28	-	-	<5	120	<1	<1	-	12	<2	<5	-	11	9	<0.1	<2	-	-	17	<5
AECOM	BH46	4	23/2/10	Southern Cove	333627	6251582	-1.78	-	-	<5	50	<1	<1	-	8	5	8	-	6	130	<0.1	6	-	-	11	24
AECOM	BH46	7	23/2/10	Southern Cove	333627	6251582	-4.78	-	-	<5	50	<1	<1	-	7	3	6	-	12	154	<0.1	4	-	-	12	27
AECOM	BH47	10	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-7.62	-	-	<5	140	<1	<1	-	12	5	24	-	282	179	<0.1	11	-	-	22	166
AECOM	BH47	1	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	1.38	-	-	<5	120	<1	<1	-	8	3	19	-	164	137	<0.1	4	-	-	21	177
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	-	-	<5	60	<1	<1	<0.5	18	4	29	14500	70	171	<0.1	18	-	-	20	55
AECOM	BH47	18.6	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-16.22	-	-	7	20	<1	<1	-	14	<2	7	-	11	51	<0.1	4	-	-	23	49
AECOM	BH47	4	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-1.62	-	-	<5	210	<1	<1	-	10	2	17	-	764	131	0.2	4	-	-	15	1020
AECOM	BH47	8.5	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-6.12	-	-	<5	100	<1	<1	-	7	<2	26	-	226	150	<0.1	6	-	-	14	148

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH48	0.15	19/2/10	Block 4	333652	6251615	2.31	-	-	<5	70	<1	<1	-	12	29	77	-	<5	599	<0.1	83	-	-	32	41
AECOM	BH48	1	22/2/10	Block 4	333652	6251615	1.46	-	-	<5	130	<1	<1	-	8	<2	13	-	259	90	0.3	3	-	-	14	201
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	-	-	<5	30	<1	<1	<0.8	4	<2	23	4420	12	33	0.3	<2	-	-	8	27
AECOM	BH48	17	23/2/10	Block 4	333652	6251615	-14.54	-	-	<5	10	<1	<1	-	3	<2	<5	-	5	<5	<0.1	<2	-	-	5	<5
AECOM	BH48	8.5	23/2/10	Block 4	333652	6251615	-6.04	-	-	<5	90	<1	<1	-	8	2	15	-	88	111	0.3	6	-	-	18	906
AECOM	BH48	14.5	23/2/10		333652	6251615	-12.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH49	1.5	22/2/10	Block 4	333699	6251517	1.04	-	-	<5	70	<1	<1	-	14	6	56	-	141	251	0.2	11	-	-	18	110
AECOM	BH49	10.2	22/2/10	Block 4	333699	6251517	-7.66	-	-	<5	30	<1	<1	-	35	<2	<5	-	8	<5	<0.1	<2	-	-	54	<5
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	-	-	<5	<10	<1	<1	<0.5	19	<2	<5	12200	26	<5	<0.1	<2	-	-	9	<5
AECOM	BH49	4.2	22/2/10	Block 4	333699	6251517	-1.66	-	-	<5	50	<1	<1	-	3	<2	15	-	30	110	0.7	3	-	-	6	6
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	-	-	14	<10	<1	<1	<0.5	23	<2	<5	24400	7	20	<0.1	2	-	-	49	<5
AECOM	BH49	8.2	22/2/10	Block 4	333699	6251517	-5.66	-	-	6	<10	<1	<1	-	30	<2	<5	-	14	33	<0.1	<2	-	-	44	<5
AECOM	BH50	0.15	24/2/10	Block 4	333741	6251608	2.36	-	-	<5	30	<1	<1	-	10	28	80	-	<5	507	<0.1	91	-	-	22	36
AECOM	BH50	1.3	26/2/10	Block 4	333741	6251608	1.21	-	-	<5	<10	<1	<1	-	3	<2	<5	2310	<5	<5	<0.1	<2	-	-	6	<5
AECOM	BH52	0.15	17/2/10	Block 4	333710	6251631	2.32	-	-	<5	60	<1	<1	<0.5	25	39	72	60700	<5	677	<0.1	160	-	-	34	48
AECOM	BH52	1	22/2/10	Block 4	333710	6251631	1.47	-	-	<5	50	<1	<1	-	8	<2	57	-	132	69	0.2	4	-	-	11	114
AECOM	BH52	2.2	22/2/10	Block 4	333710	6251631	0.27	-	-	<5	20	<1	<1	<0.5	18	3	14	12400	35	150	<0.1	8	-	-	19	61
AECOM	BH52	4.2	22/2/10	Block 4	333710	6251631	-1.73	-	-	<5	60	<1	<1	-	19	<2	190	-	93	35	0.2	6	-	-	24	38
AECOM	BH54	0.6	18/2/10	Block 4	333737	6251636	1.53	-	-	<5	100	<1	<1	<0.5	10	5	30	55000	630	246	0.2	16	-	-	18	231
AECOM	BH54	1	23/2/10	Block 4	333737	6251636	1.13	-	-	<5	40	<1	<1	<0.5	12	3	28	118000	206	652	<0.1	3	-	-	22	20
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	-	-	<5	10	<1	<1	-	12	<2	<5	-	9	8	<0.1	<2	-	-	17	<5
AECOM	BH55	1	25/2/10	Block 4	333725	6251640	1.23	-	-	<5	40	<1	<1	-	5	<2	<5	-	20	15	0.4	<2	-	-	10	<5
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	1430	<5	<5	10	<1	<1	-	5	<2	<5	6640	9	<5	<0.1	<2	<5	<2	8	<5
AECOM	BH55	2.7	25/2/10	Block 4	333725	6251640	-0.47	-	-	<5	20	<1	<1	-	10	<2	11	-	30	6	0.1	<2	-	-	6	<5
AECOM	BH56	11.5	4/3/10	Public Domain Blocks 4&5	333616	6251645	-8.89	-	-	<5	30	<1	<1	-	5	<2	8	-	65	71	<0.1	2	-	-	11	134
AECOM	BH56	13	5/3/10	Public Domain Blocks 4&5	333616	6251645	-10.39	-	-	<5	20	<1	<1	-	5	4	38	-	59	84	<0.1	2	-	-	11	49
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	-	-	<5	40	<1	<1	<0.5	6	<2	12	7550	105	27	<0.1	<2	-	-	18	41
AECOM	BH56	17.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-14.89	-	-	<5	10	<1	<1	-	7	<2	<5	-	7	<5	<0.1	<2	-	-	9	7
AECOM	BH56	2.5	4/3/10	Public Domain Blocks 4&5	333616	6251645	0.11	-	-	<5	80	<1	<1	-	11	3	25	-	290	214	<0.1	5	-	-	13	118
AECOM	BH56	20.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-17.89	-	-	<5	10	<1	<1	-	4	<2	<5	-	<5	<5	<0.1	<2	-	-	<5	<5
AECOM	BH56	21.4	5/3/10	Public Domain Blocks 4&5	333616	6251645	-18.79	-	-	<5	<10	<1	<1	-	<2	<2	<5	-	8	<5	<0.1	<2	-	-	<5	<5
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	-	-	<5	40	<1	<1	<0.5	6	2	11	7270	66	52	<0.1	<2	-	-	14	33
AECOM	BH57	11.5	25/2/10	Block 4	333648	6251649	-8.99	-	-	<5	40	<1	<1	-	6	5	96	-	83	179	0.2	8	-	-	36	62
AECOM	BH57	16.5	25/2/10	Block 4	333648	6251649	-13.99	-	-	5	10	<1	<1	-	210	<2	7	-	10	188	<0.1	5	-	-	21	7
AECOM	BH57	4	25/2/10	Block 4	333648	6251649	-1.49	-	-	<5	50	<1	<1	-	6	<2	12	-	280	46	0.3	2	-	-	14	99
AECOM	BH57	7	25/2/10	Block 4	333648	6251649	-4.49	-	-	8	290	<1	<1	-	18	<2	25	13300	318	87	0.3	4	-	-	36	379
AECOM	BH58	0.15	17/2/10	Block 4	333697	6251651	2.3	-	-	<5	60	<1	<1	<0.5	21	34	65	55000	<5	618	<0.1	137	-	-	30	46
AECOM	BH58	10.2	22/2/10	Block 4	333697	6251651	-7.75	-	-	<5	60	<1	<1	-	9	<2	41	-	131	59	0.5	4	-	-	10	159
AECOM	BH58	10.8	22/2/10	Block 4	333697	6251651	-8.35	-	-	<5	50	<1	<1	<0.5	8	3	28	10100	66	133	0.1	5	-	-	17	74
AECOM	BH58	1	22/2/10	Block 4	333697	6251651	1.45	-	-	8	60	<1	<1	-	11	4	30	-	54	186	0.6	8	-	-	25	49
AECOM	BH58	3.2	22/2/10	Block 4	333697	6251651	-0.75	-	-	<5	50	<1	<1	-	9	6	70	-	118	160	0.1	12	-	-	28	120
AECOM	BH58	5.2	22/2/10	Block 4	333697	6251651	-2.75	-	-	<5	120	<1	<1	-	13	4	55	-	386	127	0.2	10	-	-	21	261
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	-	-	7	160	<1	<1	<0.5	12	3	145	13600	585	122	0.7	8	-	-	16	380
AECOM	BH59	0.15	17/2/10	Block 4	333730	6251655	2.22	-	-	<5	20	<1	<1	<0.5	7	26	111	43200	<5	502	<0.1	70	-	-	28	37
AECOM	BH59	1.9	22/2/10	Block 4	333730	6251655	0.47	-	-	<5	10	<1	<1	-	21	<2	<5	-	10	<5	<0.1	23	-	-	12	27

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH59	1	22/2/10	Block 4	333730	6251655	1.37	-	-	6	50	<1	<1	-	30	3	27	-	112	83	1.2	11	-	-	11	96
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	-	-	14	<10	<1	<1	<0.5	5	<2	<5	15000	<5	106	<0.1	<2	-	-	9	<5
AECOM	BH59	4.2	22/2/10	Block 4	333730	6251655	-1.83	-	-	<5	<10	<1	<1	-	6	<2	<5	-	<5	<5	<0.1	<2	-	-	10	<5
AECOM	BH60	0.17	24/2/10	Public Domain Blocks 4&5	333586	6251687	2.52	-	-	<5	30	<1	<1	-	16	39	106	-	<5	649	<0.1	149	-	-	28	41
AECOM	BH60	13	1/3/10	Public Domain Blocks 4&5	333586	6251687	-10.31	-	-	<5	80	<1	<1	<0.5	10	<2	11	6240	110	105	<0.1	3	-	-	13	75
AECOM	BH60	16	1/3/10	Public Domain Blocks 4&5	333586	6251687	-13.31	-	-	<5	<10	<1	<1	1.4	3	<2	<5	1060	<5	<5	<0.1	<2	-	-	<5	<5
AECOM	BH60	17.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-14.81	-	-	36	20	<1	<1	-	25	<2	<5	-	13	<5	<0.1	2	-	-	72	5
AECOM	BH60	2.5	1/3/10	Public Domain Blocks 4&5	333586	6251687	0.19	-	-	<5	70	<1	<1	-	14	5	50	-	55	177	<0.1	9	-	-	41	59
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	-	-	<5	<10	<1	<1	<0.5	3	<2	<5	940	<5	<5	<0.1	<2	-	-	<5	<5
AECOM	BH60	7	1/3/10	Public Domain Blocks 4&5	333586	6251687	-4.31	-	-	<5	90	<1	<1	-	13	3	34	-	37	145	<0.1	6	-	-	28	63
AECOM	BH62	1	26/2/10	Block 5	333682	6251687	1.23	-	-	<5	30	<1	<1	-	7	<2	16	-	102	25	0.2	<2	-	-	16	68
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	-	-	<5	50	<1	<1	-	7	<2	6	3300	120	9	<0.1	<2	-	-	13	174
AECOM	BH62	3.4	26/2/10	Block 5	333682	6251687	-1.17	-	-	<5	130	<1	<1	-	11	2	10	-	1300	146	<0.1	6	-	-	19	97
AECOM	BH62	5.4	26/2/10	Block 5	333682	6251687	-3.17	-	-	6	150	<1	<1	-	13	3	37	-	364	92	<0.1	9	-	-	28	244
AECOM	BH62	8	26/2/10	Block 5	333682	6251687	-5.77	-	-	<5	60	<1	<1	-	8	2	22	-	78	112	<0.1	6	-	-	22	56
AECOM	BH63	11.5	1/3/10	Public Domain Blocks 4&5	333642	6251713	-9.15	-	-	19	<10	<1	<1	-	23	<2	<5	-	9	<5	<0.1	<2	-	-	79	<5
AECOM	BH63	13	1/3/10	Public Domain Blocks 4&5	333642	6251713	-10.65	-	-	36	20	<1	<1	<0.5	42	<2	<5	31600	14	<5	<0.1	<2	-	-	85	5
AECOM	BH63	17.7	1/3/10	Public Domain Blocks 4&5	333642	6251713	-15.35	-	-	94	<10	<1	<1	-	76	<2	<5	-	16	<5	<0.1	<2	-	-	248	5
AECOM	BH63	2.5	26/2/10	Public Domain Blocks 4&5	333642	6251713	-0.15	-	-	5	100	<1	<1	<0.5	53	<2	14	7440	324	108	<0.1	3	-	-	15	264
AECOM	BH63	20.5	2/3/10	Public Domain Blocks 4&5	333642	6251713	-18.15	-	-	<5	10	<1	<1	-	3	<2	<5	-	11	<5	<0.1	<2	-	-	<5	<5
AECOM	BH63	6.5	26/2/10	Public Domain Blocks 4&5	333642	6251713	-4.15	-	-	<5	60	<1	<1	-	8	2	20	-	228	111	<0.1	4	-	-	24	140
AECOM	BH64	0.15	1/3/10	Block 5	333717	6251694	2.22	-	-	<5	60	<1	<1	-	18	32	63	-	<5	550	<0.1	119	-	-	32	45
AECOM	BH64	10	1/3/10	Block 5	333717	6251694	-7.63	-	-	6	<10	<1	<1	-	34	<2	9	-	12	7	<0.1	<2	-	-	83	12
AECOM	BH64	1	1/3/10	Block 5	333717	6251694	1.37	-	-	<5	70	<1	<1	-	9	3	28	-	52	101	0.5	6	-	-	17	37
AECOM	BH64	2.5	1/3/10	Block 5	333717	6251694	-0.13	-	-	7	540	<1	<1	-	176	3	150	19900	163	54	0.2	19	-	-	43	53
AECOM	BH64	5.5	1/3/10	Block 5	333717	6251694	-3.13	-	-	<5	<10	<1	<1	-	11	<2	<5	-	<5	7	<0.1	<2	-	-	20	<5
AECOM	BH65	0.15	23/2/10	Block 5	333709	6251701	2.26	-	-	<5	80	<1	<1	-	19	32	76	-	<5	636	<0.1	118	-	-	32	41
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	-	-	11	<10	<1	<1	<0.5	31	<2	6	43100	7	<5	<0.1	<2	-	-	67	8
AECOM	BH65	13.4	24/2/10	Block 5	333709	6251701	-10.99	-	-	<5	30	<1	<1	-	5	<2	<5	-	42	<5	<0.1	<2	-	-	6	<5
AECOM	BH65	3.4	24/2/10	Block 5	333709	6251701	-0.99	-	-	7	690	<1	5	-	309	6	161	-	2110	96	0.3	45	-	-	19	1150
AECOM	BH65	8.2	24/2/10	Block 5	333709	6251701	-5.79	-	-	<5	220	<1	<1	-	32	4	47	-	869	120	0.1	27	-	-	19	325
AECOM	BH66	2.3	24/2/10	Block 5	333731	6251712	-0.02	-	-	<5	120	<1	<1	<0.5	20	6	33	15500	35	218	<0.1	22	-	-	26	96
AECOM	BH66	3.2	24/2/10	Block 5	333731	6251712	-0.92	-	-	14	10	<1	<1	-	8	<2	15	-	13	15	<0.1	3	-	-	19	7
AECOM	BH66	7	24/2/10	Block 5	333731	6251712	-4.72	-	-	<5	<10	<1	<1	-	3	<2	<5	-	<5	<5	<0.1	<2	-	-	5	<5
AECOM	BH68	2.5	2/3/10	Block 5	333758	6251752	0.06	-	-	10	100	<1	<1	-	27	7	129	-	120	261	<0.1	26	-	-	30	190
AECOM	BH68	4	2/3/10	Block 5	333758	6251752	-1.44	-	-	<5	30	<1	<1	-	10	8	20	-	16	260	<0.1	10	-	-	15	56
AECOM	BH68	7	2/3/10	Block 5	333758	6251752	-4.44	-	-	<5	30	<1	<1	-	8	<2	<5	-	6	22	<0.1	2	-	-	15	8
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	-	-	<5	<10	<1	<1	-	7	<2	<5	4590	6	6	<0.1	<2	-	-	8	8
AECOM	BH69	1	26/2/10	Block 5	333706	6251737	1.4	-	-	<5	50	<1	<1	-	10	3	24	-	104	71	0.1	8	-	-	14	79
AECOM	BH69	4	26/2/10	Block 5	333706	6251737	-1.6	-	-	<5	90	<1	<1	-	12	2	29	-	235	61	0.2	15	-	-	23	189
AECOM	BH70	0.1	3/3/10	Block 5	333712	6251766	2.19	-	-	<5	30	<1	<1	-	8	28	67	-	<5	524	<0.1	93	-	-	26	37
AECOM	BH70	11.5	8/3/10	Block 5	333712	6251766	-9.21	-	-	<5	20	<1	<1	-	3	<2	64	-	141	13	<0.1	2	-	-	5	52
AECOM	BH70	13	8/3/10	Block 5	333712	6251766	-10.71	-	-	8	90	<1	<1	-	17	<2	8	-	79	34	0.1	<2	-	-	42	68
AECOM	BH70	16	8/3/10	Block 5	333712	6251766	-13.71	-	-	7	20	<1	<1	<0.8	17	<2	<5	9290	12	6	0.1	<2	-	-	32	7
AECOM	BH70	2.5	8/3/10	Block 5	333712	6251766	-0.21	-	-	<5	40	<1	<1	<0.5	3	5	94	14500	74	212	<0.1	4	-	-	64	80

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
AECOM	BH70	4	8/3/10	Block 5	333712	6251766	-1.71	-	-	5	20	<1	<1	-	9	<2	6	-	158	17	<0.1	<2	-	-	15	8
AECOM	BH70	5.5	8/3/10	Block 5	333712	6251766	-3.21	-	-	7	80	<1	<1	<0.8	15	7	121	-	647	363	0.5	11	-	-	108	263
AECOM	BH70	8.5	8/3/10	Block 5	333712	6251766	-6.21	-	-	<5	60	<1	<1	-	6	<2	13	-	123	100	0.2	4	-	-	16	53
AECOM	BH71	0.08	3/3/10	Public Domain Blocks 4&5	333677	6251751	2.7	-	-	<5	20	<1	<1	<0.5	5	20	44	30300	<5	385	<0.1	72	-	-	13	25
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	-	-	<5	50	<1	<1	<0.5	7	<2	11	5360	63	37	0.1	<2	-	-	12	45
AECOM	BH71	13	4/3/10	Public Domain Blocks 4&5	333677	6251751	-10.22	-	-	<5	60	<1	<1	<0.5	7	<2	80	9060	223	53	0.4	4	-	-	16	171
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	-	-	<5	<10	<1	<1	<0.5	3	<2	<5	6870	<5	<5	<0.1	<2	-	-	10	<5
AECOM	BH71	19	4/3/10	Public Domain Blocks 4&5	333677	6251751	-16.22	-	-	<5	20	<1	<1	-	10	<2	<5	-	15	<5	<0.1	<2	-	-	8	<5
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	-	-	6	100	<1	<1	-	10	<2	23	15100	93	138	1.1	5	-	-	15	180
AECOM	BH71	23.5	5/3/10	Public Domain Blocks 4&5	333677	6251751	-20.72	-	-	<5	10	<1	<1	-	5	<2	<5	-	12	30	<0.1	<2	-	-	15	6
AECOM	BH71	7	4/3/10	Public Domain Blocks 4&5	333677	6251751	-4.22	-	-	<5	30	<1	<1	-	7	<2	7	-	50	83	0.1	<2	-	-	13	47
AECOM	BH72	0.15	25/2/10	Public Domain Blocks 4&5	333634	6251746	2.37	-	-	<5	70	<1	<1	-	19	36	77	-	<5	626	<0.1	117	-	-	47	50
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	-	-	<5	160	<1	<1	<0.5	9	4	14	10600	446	214	<0.1	6	-	-	18	165
AECOM	BH72	13	3/3/10	Public Domain Blocks 4&5	333634	6251746	-10.48	-	-	14	240	<1	<1	-	31	3	110	-	420	93	2.8	9	-	-	33	436
AECOM	BH72	16	4/3/10	Public Domain Blocks 4&5	333634	6251746	-13.48	-	-	11	20	<1	<1	-	19	<2	<5	-	11	<5	<0.1	<2	-	-	31	<5
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	-	-	<5	40	<1	<1	<0.5	6	<2	<5	790	6	<5	<0.1	<2	-	-	9	<5
AECOM	BH72	2.5	3/3/10	Public Domain Blocks 4&5	333634	6251746	0.02	-	-	<5	90	<1	<1	-	6	5	52	-	89	190	<0.1	8	-	-	22	61
AECOM	BH72	20.5	4/3/10	Public Domain Blocks 4&5	333634	6251746	-17.98	-	-	<5	<10	<1	<1	<0.5	3	<2	<5	790	<5	<5	<0.1	<2	-	-	<5	<5
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	-	-	<5	<10	<1	<1	<0.5	5	<2	7	2050	10	9	<0.1	<2	-	-	6	9
AECOM	BH73	11.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-8.87	-	-	<5	200	<1	<1	-	9	3	17	-	250	187	<0.1	4	-	-	24	332
AECOM	BH73	16	2/3/10	Public Domain Blocks 4&5	333582	6251695	-13.37	-	-	<5	<10	<1	<1	-	9	<2	<5	-	5	<5	<0.1	<2	-	-	15	<5
AECOM	BH73	17.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-14.87	-	-	33	10	<1	<1	-	39	<2	<5	60600	15	6	<0.1	<2	-	-	62	9
AECOM	BH73	19	2/3/10	Public Domain Blocks 4&5	333582	6251695	-16.37	-	-	<5	<10	<1	<1	-	3	<2	<5	-	6	<5	<0.1	<2	-	-	<5	<5
AECOM	BH73	2.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	0.13	-	-	<5	20	<1	<1	-	8	<2	<5	-	26	28	<0.1	2	-	-	8	18
AECOM	BH73	20.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-17.87	-	-	<5	<10	<1	<1	-	6	<2	<5	-	7	<5	<0.1	<2	-	-	8	<5
AECOM	BH73	7	2/3/10	Public Domain Blocks 4&5	333582	6251695	-4.37	-	-	7	150	<1	<1	<0.5	21	2	281	6780	367	148	5.2	5	-	-	14	198
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	-	-	<5	40	<1	<1	<0.5	6	<2	11	4980	58	59	<0.1	3	-	-	8	44
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	-	-	<5	50	<1	<1	<0.5	9	4	108	13200	49	146	0.2	5	-	-	14	86
AECOM	BH74	13	3/3/10	Public Domain Blocks 4&5	333626	6251702	-10.67	-	-	<5	10	<1	<1	-	2	<2	<5	-	39	18	<0.1	<2	-	-	<5	55
AECOM	BH74	16	3/3/10	Public Domain Blocks 4&5	333626	6251702	-13.67	-	-	<5	10	<1	<1	-	2	<2	<5	-	9	<5	<0.1	<2	-	-	<5	14
AECOM	BH74	5.5	3/3/10	Public Domain Blocks 4&5	333626	6251702	-3.17	-	-	<5	60	<1	<1	-	8	2	11	-	189	127	0.5	6	-	-	12	78
AECOM	BH74	8.5	3/3/10	Public Domain Blocks 4&5	333626	6251702	-6.17	-	-	<5	110	<1	<1	<0.5	10	2	22	-	78	96	0.1	4	-	-	13	69
AECOM	BH75	1	25/2/10	Public Domain Blocks 4&5	333617	6251749	1.34	-	-	<5	60	<1	<1	-	11	4	<5	-	16	138	<0.1	4	-	-	12	26
AECOM	BH75	16	26/2/10	Public Domain Blocks 4&5	333617	6251749	-13.66	-	-	<5	20	<1	<1	<0.5	8	<2	<5	760	11	<5	<0.1	<2	-	-	7	<5
AECOM	BH75	4	25/2/10	Public Domain Blocks 4&5	333617	6251749	-1.66	-	-	<5	30	<1	<1	-	11	6	<5	-	11	260	<0.1	7	-	-	19	42
AECOM	BH75	8.5	25/2/10	Public Domain Blocks 4&5	333617	6251749	-6.16	-	-	11	170	<1	<1	-	17	8	102	-	512	344	<0.1	26	-	-	35	195
AECOM	SV09	0.2	26/2/10	Block 5	333585	6251733	2.21	-	-	<5	60	<1	<1	-	28	2	17	-	144	26	0.2	15	-	-	8	14
AECOM	SV09	1.3	26/2/10	Block 5	333585	6251733	1.11	-	-	18	110	<1	2	-	139	<2	42	-	499	13	<0.1	<2	-	-	149	7
ERM	BH001	1	1/5/06	Block 5	333728	6251686	1.39	-	-	6	-	-	<1	-	44	-	40	-	49	-	0.3	23	-	-	-	67
ERM	BH001	4	2/5/06	Block 5	333728	6251686	-1.61	-	-	5	-	-	<1	-	28	-	16	-	65	-	<0.1	9	-	-	-	35
ERM	BH017	0.5	8/5/06	Southern Cove	333724	6251690	1.86	-	-	<5	-	-	<1	-	5	-	150	-	30	-	<0.1	6	-	-	-	71
ERM	BH017	1.5	8/5/06	Southern Cove	333724	6251690	0.86	-	-	<5	-	-	<1	-	35	-	49	-	21	-	<0.1	6	-	-	-	56
ERM	BH017	21.5	8/5/06	Southern Cove	333724	6251690	-19.14	-	-	<5	-	-	<1	-	41	-	8	-	22	-	0.1	4	-	-	-	25
ERM	BH017	3	8/5/06	Southern Cove	333724	6251690	-0.64	-	-	<5	-	-	<1	-	19	-	32	-	18	-	<0.1	5	-	-	-	40
ERM	BH018	0.3	5/8/06	Area B	333610	6251593	2.15	-	-	<5	-	-	<1	-	5	-	<5	-	<5	-	<0.1	<2	-	-	-	<5

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
ERM	BH018	0	5/8/06	Area B	333610	6251593	2.45	-	-	<5	-	-	<1	-	5	-	192	-	7	-	<0.1	7	-	-	-	50
ERM	BH018	3	5/8/06	Area B	333610	6251593	-0.55	-	-	5	-	-	<1	-	9	-	18	-	54	-	<0.1	6	-	-	-	102
ERM	BH019	0.3	8/5/06	Block 4	333689	6251510	1.88	-	-	<5	-	-	<1	-	11	-	23	-	42	-	<0.1	21	-	-	-	43
ERM	BH019	1.5	8/5/06	Block 4	333689	6251510	0.68	-	-	<5	-	-	<1	-	15	-	8	-	13	-	<0.1	<2	-	-	-	<5
ERM	BH019	2.5	8/5/06	Block 4	333689	6251510	-0.32	-	-	<5	-	-	<1	-	8	-	37	-	117	-	<0.1	<2	-	-	-	6
ERM	BH019	3	8/5/06	Block 4	333689	6251510	-0.82	-	-	<5	-	-	<1	-	8	-	21	-	51	-	<0.1	5	-	-	-	9
ERM	BH020	0.3	9/5/06	Block 4	333724	6251628	1.9	-	-	<5	-	-	<1	-	12	-	42	-	178	-	0.2	22	-	-	-	121
ERM	BH020	1.5	9/5/06	Block 4	333724	6251628	0.7	-	-	<5	-	-	<1	-	8	-	32	-	106	-	<0.1	10	-	-	-	98
ERM	BH020	3	9/5/06	Block 4	333724	6251628	-0.8	-	-	<5	-	-	<1	-	8	-	28	-	183	-	0.2	6	-	-	-	90
ERM	BH021	0.3	9/5/06	Block 4	333684	6251663	1.99	-	-	<5	-	-	<1	-	10	-	17	-	48	-	<0.1	12	-	-	-	40
ERM	BH021	1.5	9/5/06	Public Domain Blocks 4&5	333684	6251663	0.79	-	-	<5	-	-	<1	-	22	-	24	-	70	-	0.1	21	-	-	-	65
ERM	BH021	16	9/5/06	Public Domain Blocks 4&5	333684	6251663	-13.71	-	-	<5	-	-	<1	-	9	-	8	-	56	-	0.1	<2	-	-	-	39
ERM	BH026	0.3	12/5/06	Public Domain Blocks 4&5	333622	6251692	1.91	-	-	<5	-	-	<1	-	14	-	6	-	18	-	<0.1	6	-	-	-	37
ERM	BH026	1.5	12/5/06	Public Domain Blocks 4&5	333622	6251692	0.71	-	-	<5	-	-	<1	-	13	-	20	-	111	-	0.2	11	-	-	-	67
ERM	BH026	16.5	15/5/06	Public Domain Blocks 4&5	333622	6251692	-14.29	-	-	<5	-	-	<1	-	32	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH028	0.3	12/5/06	Block 5	333617	6251775	2.05	-	-	<5	-	-	<1	-	10	-	40	-	136	-	0.2	29	-	-	-	100
ERM	BH028	13	12/5/06	Block 5	333617	6251775	-10.65	-	-	<5	-	-	<1	-	6	-	<5	-	10	-	<0.1	<2	-	-	-	<5
ERM	BH028	3	12/5/06	Block 5	333617	6251775	-0.65	-	-	7	-	-	<1	-	10	-	45	-	-	-	<0.1	4	-	-	-	312
ERM	BH035	0.3	18/5/06	Area B	333694	6251749	2.26	-	-	<5	-	-	<1	-	2	-	212	-	7	-	<0.1	6	-	-	-	48
ERM	BH035	1.5	18/5/06	Area B	333694	6251749	1.06	-	-	<5	-	-	<1	-	11	-	9	-	20	-	<0.1	5	-	-	-	31
ERM	BH035	4	18/5/06	Area B	333694	6251749	-1.44	-	-	<5	-	-	<1	-	16	-	10	-	18	-	<0.1	33	-	-	-	38
ERM	BH042	0.3	23/5/06	Block 5	333654	6251541	1.91	-	-	<5	-	-	<1	-	11	-	41	-	91	-	0.2	23	-	-	-	80
ERM	BH042	1.5	23/5/06	Block 5	333654	6251541	0.71	-	-	<5	-	-	<1	-	12	-	198	-	642	-	0.9	2	-	-	-	30
ERM	BH042	6	23/5/06	Block 5	333654	6251541	-3.79	-	-	<5	-	-	<1	-	12	-	<5	-	6	-	<0.1	<2	-	-	-	<5
ERM	BH044	0.3	23/5/06	Block 5	333730	6251756	1.94	-	-	<5	-	-	<1	-	12	-	103	-	155	-	0.3	27	-	-	-	94
ERM	BH044	2.3	23/5/06	Block 5	333730	6251756	-0.06	-	-	7	-	-	<1	-	9	-	230	-	374	-	0.6	7	-	-	-	348
ERM	BH044	4	23/5/06	Block 5	333730	6251756	-1.76	-	-	<5	-	-	<1	-	10	-	7	-	14	-	<0.1	<2	-	-	-	27
ERM	BH045	0.3	24/5/06	Block 5	333728	6251774	1.99	-	-	<5	-	-	<1	-	12	-	43	-	22	-	<0.1	54	-	-	-	46
ERM	BH045	1.5	24/5/06	Block 5	333728	6251774	0.79	-	-	<5	-	-	<1	-	6	-	26	-	403	-	0.6	6	-	-	-	162
ERM	BH045	3	24/5/06	Block 5	333728	6251774	-0.71	-	-	8	-	-	<1	-	8	-	16	-	223	-	0.1	4	-	-	-	160
ERM	BH046	1.5	24/5/06	Public Domain Blocks 4&5	333656	6251723	0.89	-	-	6	-	-	<1	-	34	-	286	-	216	-	6.4	32	-	-	-	374
ERM	BH046	3	24/5/06	Public Domain Blocks 4&5	333656	6251723	-0.61	-	-	6	-	-	<1	-	29	-	200	-	456	-	3.5	18	-	-	-	337
ERM	BH047	0.3	24/5/06	Area B	333641	6251753	2.33	-	-	6	-	-	<1	-	7	-	127	-	15	-	<0.1	8	-	-		53
ERM	BH047	1.5	24/5/06	Area B	333641	6251753	1.13	-	-	<5	-	-	<1	-	10	-	15	-	23	-	<0.1	7	-	-		47
ERM	BH048	1.5	24/5/06	Area B	333635	6251526	0.67	-	-	7	-	-	<1	-	4	-	<5	-	18	-	<0.1	<2	-	-		36
ERM	BH048	3	24/5/06	Area B	333635	6251526	-0.83	-	-	<5	-	-	<1	-	3	-	<5	-	<5	-	<0.1	<2	-	-		26
ERM	BH049	0.3	25/5/06	Area A	333621	6251500	2.14	-	-	<5	-	-	<1	-	3	-	262	-	6	-	<0.1	6	-	-		54
ERM	BH049	3	25/5/06	Area A	333621	6251500	-0.56	-	-	<5	-	-	<1	-	3	-	<5	-	8	-	<0.1	2	-	-		10
ERM	BH052	1.5	26/5/06	Public Domain Blocks 4&5	333617	6251533	0.94	-	-	<5	-	-	<1	-	13	-	23	-	276	-	0.2	<2	-	-	-	145
ERM	BH052	3	26/5/06	Public Domain Blocks 4&5	333617	6251533	-0.56	-	-	<5	-	-	<1	-	16	-	37	-	197	-	0.2	8	-	-	-	194
ERM	BH053	0.3	29/5/06	Public Domain Blocks 4&5	333607	6251758	2.01	-	-	<5	-	-	<1	-	21	-	66	-	<5	-	<0.1	164	-	-	-	46
ERM	BH053	1.5	29/5/06	Public Domain Blocks 4&5	333607	6251758	0.81	-	-	<5	-	-	<1	-	6	-	9	-	630	-	0.1	<2	-	-	-	172
ERM	BH053	3	29/5/06	Public Domain Blocks 4&5	333607	6251758	-0.69	-	-	<5	-	-	<1	-	8	-	13	-	316	-	0.3	2	-	-	-	250
ERM	BH054	1.5	29/5/06	Public Domain Blocks 4&5	333603	6251640	1.26	-	-	<5	-	-	<1	-	8	-	6	-	24	-	<0.1	4	-	-	-	20
ERM	BH054	3	29/5/06	Public Domain Blocks 4&5	333603	6251640	-0.24	-	-	16	-	-	<1	-	23	-	7	-	42	-	<0.1	<2	-	-	-	33

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
ERM	BH055	0.8	30/5/06	Southern Cove	333663	6251601	1.51	-	-	<5	-	-	<1	-	7	-	<5	-	25	-	<0.1	<2	-	-	-	26
ERM	BH055	1.8	30/5/06	Southern Cove	333663	6251601	0.51	-	-	<5	-	-	<1	-	5	-	5	-	34	-	<0.1	2	-	-	-	18
ERM	BH055	3.3	30/5/06	Southern Cove	333663	6251601	-0.99	-	-	<5	-	-	<1	-	7	-	5	-	16	-	<0.1	9	-	-	-	15
ERM	BH058	1.5	31/5/06	Block 5	333731	6251736	0.76	-	-	7	-	-	<1	-	89	-	102	-	212	-	0.5	58	-	-	-	253
ERM	BH058	6	31/5/06	Block 5	333731	6251736	-3.74	-	-	<5	-	-	<1	-	11	-	<5	-	7	-	<0.1	<2	-	-	-	11
ERM	BH059	1.5	31/5/06	Block 5	333712	6251751	0.79	-	-	6	-	-	<1	-	13	-	61	-	53	-	<0.1	7	-	-	-	99
ERM	BH059	3	31/5/06	Block 5	333712	6251751	-0.71	-	-	<5	-	-	<1	-	8	-	47	-	102	-	0.2	4	-	-	-	48
ERM	BH059	8.5	31/5/06	Block 5	333712	6251751	-6.21	-	-	<5	-	-	<1	-	13	-	<5	-	9	-	<0.1	<2	-	-	-	8
ERM	BH060	1.7	31/5/06	Block 5	333722	6251703	0.73	-	-	8	-	-	<1	-	13	-	1050	-	502	-	<0.1	15	-	-	-	712
ERM	BH060	9.5	31/5/06	Block 5	333722	6251703	-7.07	-	-	<5	-	-	<1	-	17	-	<5	-	12	-	<0.1	<2	-	-	-	7
ERM	BH062	1.5	31/5/06	Block 5	333701	6251699	0.85	-	-	<5	-	-	<1	-	11	-	32	-	-	-	0.4	8	-	-	-	284
ERM	BH062	3	31/5/06	Block 5	333701	6251699	-0.65	-	-	<5	-	-	<1	-	15	-	130	-	236	-	2.3	24	-	-	-	187
ERM	BH063	1.5	1/6/06	Public Domain Blocks 4&5	333642	6251664	0.79	-	-	<5	-	-	<1	-	8	-	6	-	46	-	<0.1	3	-	-	-	30
ERM	BH063	2.8	1/6/06	Public Domain Blocks 4&5	333642	6251664	-0.51	-	-	<5	-	-	<1	-	5	-	13	-	149	-	<0.1	<2	-	-	-	64
ERM	BH064	1.5	1/6/06	Public Domain Blocks 4&5	333595	6251569	1.04	-	-	<5	-	-	<1	-	8	-	<5	-	118	-	<0.1	<2	-	-	-	39
ERM	BH064	3	1/6/06	Public Domain Blocks 4&5	333595	6251569	-0.46	-	-	<5	-	-	<1	-	18	-	36	-	114	-	0.4	17	-	-	-	115
ERM	BH065	0.3	1/6/06	Block 4	333692	6251676	2	-	-	<5	-	-	<1	-	16	-	39	-	144	-	0.1	24	-	-	-	110
ERM	BH065	1.5	1/6/06	Block 4	333692	6251676	0.8	-	-	<5	-	-	<1	-	12	-	32	-	144	-	0.2	11	-	-	-	103
ERM	BH065	3	1/6/06	Block 4	333692	6251676	-0.7	-	-	5	-	-	<1	-	12	-	61	-	210	-	0.3	9	-	-	-	169
ERM	BH066	0.3	1/6/06	Block 5	333655	6251689	1.94	-	-	<5	-	-	<1	-	14	-	17	-	80	-	0.2	17	-	-	-	65
ERM	BH066	1.5	1/6/06	Block 5	333655	6251689	0.74	-	-	<5	-	-	<1	-	13	-	19	-	223	-	0.1	6	-	-	-	150
ERM	BH067	1.5	1/6/06	Block 5	333681	6251695	0.8	-	-	14	-	-	2	-	35	-	84	-	-	-	0.2	28	-	-	-	4770
ERM	BH067	3	1/6/06	Block 5	333681	6251695	-0.7	-	-	14	-	-	<1	-	6	-	137	-	195	-	0.4	6	-	-	-	216
ERM	BH068	0.3	1/6/06	Block 4	333666	6251663	1.98	-	-	<5	-	-	<1	-	12	-	36	-	47	-	0.1	43	-	-	-	47
ERM	BH068	3	1/6/06	Block 4	333666	6251663	-0.72	-	-	<5	-	-	<1	-	8	-	38	-	217	-	0.6	5	-	-	-	138
ERM	BH068	9.5	1/6/06	Block 4	333666	6251663	-7.22	-	-	<5	-	-	<1	-	7	-	<5	-	116	-	<0.1	<2	-	-	-	29
ERM	BH070	0.3	2/5/06	Block 4	333683	6251681	1.9	-	-	<5	-	-	<1	-	7	-	16	-	87	-	<0.1	5	-	-	-	63
ERM	BH070	1.5	2/5/06	Block 4	333683	6251681	0.7	-	-	5	-	-	<1	-	11	-	26	-	320	-	0.5	3	-	-	-	169
ERM	BH071	1.5	2/5/06	Proposed Southern Cove	333666	6251589	0.84	-	-	<5	-	-	<1	-	10	-	18	-	55	-	<0.1	5	-	-	-	43
ERM	BH071	3	2/5/06	Proposed Southern Cove	333666	6251589	-0.66	-	-	<5	-	-	<1	-	10	-	21	-	20	-	<0.1	7	-	-	-	42
ERM	BH072	0.3	2/5/06	Proposed Southern Cove	333667	6251571	2.01	-	-	<5	-	-	<1	-	2	-	226	-	7	-	<0.1	5	-	-	-	50
ERM	BH072	3	2/5/06	Proposed Southern Cove	333667	6251571	-0.69	-	-	<5	-	-	<1	-	11	-	168	-	23	-	<0.1	7	-	-	-	54
ERM	BH072	9.5	2/5/06	Proposed Southern Cove	333667	6251571	-7.19	-	-	<5	-	-	<1	-	16	-	12	-	16	-	<0.1	7	-	-	-	34
ERM	BH073	1.5	2/5/06	Block 4	333735	6251645	0.73	-	-	<5	-	-	<1	-	13	-	29	-	130	-	0.1	25	-	-	-	38
ERM	BH073	3	2/5/06	Block 4	333735	6251645	-0.77	-	-	<5	-	-	<1	-	35	-	11	-	59	-	<0.1	<2	-	-	-	6
ERM	BH074	1.5	2/5/06	Block 5	333684	6251725	0.85	-	-	10	-	-	<1	-	7	-	1410	-	-	-	0.5	10	-	-	-	1380
ERM	BH074	3	2/5/06	Block 5	333684	6251725	-0.65	-	-	7	-	-	<1	-	12	-	363	-	-	-	1.3	7	-	-	-	418
ERM	BH074	9.5	2/5/06	Block 5	333684	6251725	-7.15	-	-	<5	-	-	<1	-	13	-	<5	-	11	-	<0.1	<2	-	-	-	<5
ERM	BH075	0.3	6/6/06	Block 4	333708	6251660	1.98	-	-	<5	-	-	<1	-	14	-	52	-	83	-	0.2	54	-	-	-	80
ERM	BH075	3	6/6/06	Block 4	333708	6251660	-0.72	-	-	<5	-	-	<1	-	36	-	11	-	31	-	<0.1	11	-	-	-	83
ERM	BH076	0.3	6/6/06	Public Domain Blocks 4&5	333586	6251646	2.32	-	-	<5	-	-	<1	-	15	-	44	-	12	-	<0.1	47	-	-	-	45
ERM	BH076	1.5	6/6/06	Public Domain Blocks 4&5	333586	6251646	1.12	-	-	<5	-	-	<1	-	14	-	10	-	57	-	0.2	16	-	-	-	65
ERM	BH077	0.3	6/6/06	Block 5	333670	6251771	2.53	-	-	<5	-	-	<1	-	9	-	25	-	79	-	<0.1	30	-	-	-	56
ERM	BH077	3	6/6/06	Block 5	333670	6251771	-0.17	-	-	<5	-	-	<1	-	9	-	93	-	51	-	<0.1	10	-	-	-	49
ERM	BH078	1.5	6/6/06	Block 5	333694	6251773	1.01	-	-	<5	-	-	<1	-	17	-	21	-	52	-	<0.1	26	-	-	-	56

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
ERM	BH078	3	6/6/06	Block 5	333694	6251773	-0.49	-	-	<5	-	-	<1	-	15	-	19	-	290	-	0.7	21	-	-	-	175
ERM	BH079	0.3	6/6/06	Block 5	333671	6251743	2.44	-	-	<5	-	-	<1	-	11	-	20	-	53	-	0.1	19	-	-	-	68
ERM	BH079	1.5	6/6/06	Block 5	333671	6251743	1.24	-	-	<5	-	-	<1	-	13	-	13	-	75	-	<0.1	13	-	-	-	68
ERM	BH087	1.5	8/6/06	Block 4	333732	6251613	0.79	-	-	<5	-	-	<1	-	9	-	<5	-	14	-	<0.1	<2	-	-	-	<5
ERM	BH087	3	8/6/06	Block 4	333732	6251613	-0.71	-	-	<5	-	-	<1	-	12	-	17	-	128	-	<0.1	<2	-	-	-	13
ERM	BH087	7	8/6/06	Block 4	333732	6251613	-4.71	-	-	<5	-	-	<1	-	15	-	<5	-	13	-	<0.1	<2	-	-	-	<5
ERM	BH089	0.3	9/6/06	Block 4	333678	6251627	2.38	-	-	<5	-	-	<1	-	12	-	29	-	19	-	<0.1	26	-	-	-	43
ERM	BH089	1.5	9/6/06	Block 4	333678	6251627	1.18	-	-	<5	-	-	<1	-	44	-	51	-	269	-	0.2	14	-	-	-	165
ERM	BH089	3	9/6/06	Block 4	333678	6251627	-0.32	-	-	<5	-	-	<1	-	28	-	16	-	198	-	0.3	5	-	-	-	100
ERM	BH090	1.5	9/6/06	Block 4	333682	6251647	1.02	-	-	<5	-	-	<1	-	13	-	14	-	602	-	0.2	5	-	-	-	281
ERM	BH090	3	9/6/06	Block 4	333682	6251647	-0.48	-	-	<5	-	-	<1	-	20	-	33	-	480	-	0.2	34	-	-	-	401
ERM	BH091	0.3	13/6/06	Area B	333761	6251440	2.13	-	-	<5	-	-	<1	-	2	-	16	-	14	-	<0.1	6	-	-	-	14
ERM	BH091	3	13/6/06	Area B	333761	6251440	-0.57	-	-	<5	-	-	<1	-	7	-	16	-	75	-	0.1	2	-	-	-	23
ERM	BH093	0.3	13/6/06	Area B	333679	6251281	1.73	-	-	<5	-	-	<1	-	5	-	57	-	10	-	<0.1	22	-	-	-	26
ERM	BH093	1.5	13/6/06	Area B	333679	6251281	0.53	-	-	<5	-	-	<1	-	8	-	14	-	29	-	<0.1	7	-	-	-	30
ERM	BH093	3	13/6/06	Area B	333679	6251281	-0.97	-	-	<5	-	-	<1	-	7	-	19	-	146	-	<0.1	3	-	-	-	66
ERM	BH094	1.5	13/6/06	Area D	333756	6251343	1.02	-	-	<5	-	-	<1	-	11	-	143	-	274	-	3.3	13	-	-	-	132
ERM	BH094	3	13/6/06	Area D	333756	6251343	-0.48	-	-	<5	-	-	<1	-	30	-	48	-	62	-	0.2	22	-	-	-	46
ERM	BH095	1.5	13/6/06	Area B	333663	6251334	0.93	-	-	<5	-	-	<1	-	2	-	5	-	20	-	<0.1	<2	-	-	-	12
ERM	BH095	3	13/6/06	Area B	333663	6251334	-0.57	-	-	<5	-	-	<1	-	10	-	7	-	32	-	<0.1	<2	-	-	-	16
ERM	BH096	1.5	13/6/06	Area B	333705	6251326	1.19	-	-	<5	-	-	<1	-	4	-	30	-	9	-	<0.1	<2	-	-	-	<5
ERM	BH096	3	13/6/06	Area B	333705	6251326	-0.31	-	-	<5	-	-	<1	-	4	-	<5	-	18	-	<0.1	<2	-	-	-	<5
ERM	BH097	0.3	13/6/06	Area B	333731	6251385	2.3	-	-	<5	-	-	<1	-	8	-	45	-	78	-	0.2	11	-	-	-	67
ERM	BH098	1.7	13/6/06	Area B	333668	6251367	0.94	-	-	<5	-	-	<1	-	4	-	9	-	593	-	<0.1	<2	-	-	-	37
ERM	BH098	3	13/6/06	Area B	333668	6251367	-0.36	-	-	5	-	-	<1	-	18	-	38	-	354	-	0.2	7	-	-	-	272
ERM	BH099	0.3	15/6/06	Area B	333649	6251404	2.07	-	-	<5	-	-	<1	-	8	-	64	-	112	-	<0.1	22	-	-	-	68
ERM	BH100	1.5	15/6/06	Area B	333663	6251466	1.13	-	-	<5	-	-	<1	-	12	-	5	-	34	-	0.2	<2	-	-	-	26
ERM	BH100	14	15/6/06	Area C	333663	6251466	-11.37	-	-	<5	-	-	<1	-	6	-	<5	-	12	-	<0.1	<2	-	-	-	6
ERM	BH100	3	15/6/06	Area B	333663	6251466	-0.37	-	-	<5	-	-	<1	-	<2	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH101	1.5	15/6/06	Area B	333722	6251441	1.17	-	-	<5	-	-	<1	-	9	-	<5	-	13	-	<0.1	<2	-	-	-	12
ERM	BH101	14	15/6/06	Area C	333722	6251441	-11.33	-	-	6	-	-	<1	-	12	-	<5	-	16	-	<0.1	<2	-	-	-	8
ERM	BH102	1.5	16/6/06	Area B	333621	6251480	1.03	-	-	6	-	-	<1	-	7	-	11	-	128	-	<0.1	3	-	-	-	78
ERM	BH102	17.8	16/6/06	Area C	333621	6251480	-15.27	-	-	<5	-	-	<1	-	15	-	<5	-	28	-	<0.1	<2	-	-	-	10
ERM	BH102	3	16/6/06	Area B	333621	6251480	-0.47	-	-	<5	-	-	<1	-	12	-	15	-	878	-	<0.1	4	-	-	-	749
ERM	BH103	1.5	19/6/06	Area B	333625	6251434	1.05	-	-	<5	-	-	<1	-	10	-	23	-	1320	-	0.3	4	-	-	-	402
ERM	BH103	3	19/6/06	Area B	333625	6251434	-0.45	-	-	7	-	-	<1	-	16	-	20	-	68	-	<0.1	3	-	-	-	46
ERM	BH104	0.3	19/6/06	Area B	333642	6251285	2.16	-	-	5	-	-	<1	-	10	-	47	-	93	-	0.1	3	-	-	-	35
ERM	BH104	3	19/6/06	Area B	333642	6251285	-0.54	-	-	<5	-	-	<1	-	8	-	52	-	162	-	0.2	5	-	-	-	124
ERM	BH108	1.5	26/6/06	Area B	333633	6251360	1.05	-	-	<5	-	-	<1	-	28	-	9	-	14	-	<0.1	6	-	-	-	31
ERM	BH108	3	27/6/06	Area B	333633	6251360	-0.45	-	-	<5	-	-	<1	-	81	-	50	-	132	-	<0.1	7	-	-	-	85
ERM	BH109	0.3	27/6/06	Block 4	333683	6251569	1.81	-	-	<5	-	-	<1	-	3	-	225	-	12	-	<0.1	6	-	-	-	53
ERM	BH109	3	27/6/06	Block 4	333683	6251569	-0.89	-	-	<5	-	-	<1	-	41	-	20	-	14	-	<0.1	8	-	-	-	34
ERM	BH109	9.5	27/6/06	Block 4	333683	6251569	-7.39	-	-	<5	-	-	<1	-	23	-	6	-	17	-	<0.1	7	-	-	-	40
ERM	BH110	0.3	27/6/06	Area B	333671	6251531	2.01	-	-	<5	-	-	<1	-	6	-	228	-	14	-	<0.1	6	-	-	-	50
ERM	BH110	1.5	27/6/06	Area B	333671	6251531	0.81	-	-	<5	-	-	<1	-	22	-	38	-	22	-	<0.1	6	-	-	-	60

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
ERM	BH110	23.3	27/6/06	Area C	333671	6251531	-20.99	-	-	<5	-	-	<1	-	27	-	<5	-	15	-	<0.1	4	-	-	-	32
ERM	BH110	3	27/6/06	Area B	333671	6251531	-0.69	-	-	<5	-	-	<1	-	10	-	8	-	17	-	<0.1	4	-	-	-	33
ERM	BH111	1.5	27/6/06	Area B	333691	6251530	0.61	-	-	<5	-	-	<1	-	12	-	6	-	15	-	<0.1	2	-	-	-	19
ERM	BH111	3	27/6/06	Area B	333691	6251530	-0.89	-	-	<5	-	-	<1	-	11	-	6	-	17	-	<0.1	9	-	-	-	52
ERM	BH111	9.5	27/6/06	Area C	333691	6251530	-7.39	-	-	<5	-	-	<1	-	14	-	<5	-	24	-	<0.1	<2	-	-	-	49
ERM	BH112	1.5	27/6/06	Area B	333709	6251539	0.7	-	-	<5	-	-	<1	-	10	-	<5	-	10	-	<0.1	5	-	-	-	26
ERM	BH112	3	27/6/06	Area B	333709	6251539	-0.8	-	-	<5	-	-	<1	-	19	-	10	-	12	-	<0.1	7	-	-	-	42
ERM	BH112	7	27/6/06	Area B	333709	6251539	-4.8	-	-	8	-	-	<1	-	24	-	10	-	28	-	<0.1	13	-	-	-	87
ERM	BH113	1.5	27/6/06	Block 4	333706	6251570	0.68	-	-	<5	-	-	<1	-	10	-	<5	-	9	-	<0.1	4	-	-	-	21
ERM	BH113	3	27/6/06	Block 4	333706	6251570	-0.82	-	-	5	-	-	<1	-	33	-	12	-	17	-	<0.1	8	-	-	-	52
ERM	BH114	0.3	28/6/06	Block 4	333718	6251554	1.98	-	-	<5	-	-	<1	-	4	-	198	-	15	-	<0.1	5	-	-	-	54
ERM	BH114	3	28/6/06	Block 4	333718	6251554	-0.72	-	-	6	-	-	<1	-	37	-	12	-	15	-	<0.1	7	-	-	-	47
ERM	BH115	0.8	28/6/06	Block 4	333689	6251605	1.48	-	-	<5	-	-	<1	-	14	-	28	-	358	-	5.2	8	-	-	-	236
ERM	BH115	1.5	28/6/06	Block 4	333689	6251605	0.78	-	-	<5	-	-	<1	-	11	-	26	-	330	-	1.2	4	-	-	-	279
ERM	BH115	3	28/6/06	Block 4	333689	6251605	-0.72	-	-	<5	-	-	<1	-	11	-	21	-	278	-	2.7	6	-	-	-	180
ERM	BH116	1.5	28/6/06	Southern Cove	333607	6251595	0.97	-	-	<5	-	-	<1	-	9	-	30	-	23	-	<0.1	4	-	-	-	38
ERM	BH116	3	28/6/06	Southern Cove	333607	6251595	-0.53	-	-	<5	-	-	<1	-	31	-	18	-	14	-	<0.1	4	-	-	-	28
ERM	BH117	1.5	29/6/06	Area B	333722	6251516	0.85	-	-	7	-	-	<1	-	17	-	17	-	20	-	0.1	15	-	-		42
ERM	BH117	10	29/6/06	Area B	333722	6251516	-7.65	-	-	<5	-	-	<1	-	14	-	<5	-	10	-	<0.1	<2	-	-		6
ERM	BH117	15	29/6/06	Area B	333722	6251516	-12.65	-	-	<5	-	-	<1	-	13	-	<5	-	14	-	<0.1	<2	-	-		8
ERM	BH118	1.5	30/6/06	Area B	333675	6251515	0.8	-	-	<5	-	-	<1	-	10	-	<5	-	12	-	<0.1	5	-	-		22
ERM	BH118	3	30/6/06	Area B	333675	6251515	-0.7	-	-	<5	-	-	<1	-	9	-	9	-	16	-	<0.1	6	-	-		48
ERM	BH118	9.5	30/6/06	Area C	333675	6251515	-7.2	-	-	<5	-	-	<1	-	12	-	<5	-	9	-	<0.1	4	-	-		24
ERM	BH119	1.6	30/6/06	Block 4	333670	6251622	0.98	-	-	<5	-	-	<1	-	32	-	36	-	634	-	0.2	7	-	-	-	283
ERM	BH119	7.5	30/6/06	Block 4	333670	6251622	-4.92	-	-	10	-	-	1	-	27	-	115	-	361	-	2.1	10	-	-	-	389
ERM	BH119	9.5	30/6/06	Block 4	333670	6251622	-6.92	-	-	<5	-	-	<1	-	13	-	<5	-	20	-	<0.1	<2	-	-	-	13
ERM	BH128	1.5	3/7/06	Public Domain Blocks 4&5	333572	6251768	0.94	-	-	<5	-	-	<1	-	10	-	8	-	27	-	<0.1	6	-	-	-	46
ERM	BH128	20	3/7/06	Public Domain Blocks 4&5	333572	6251768	-17.56	-	-	<5	-	-	<1	-	14	-	<5	-	6	-	<0.1	2	-	-	-	6
ERM	BH129	0.4	5/7/06	Public Domain Blocks 4&5	333578	6251713	2.08	-	-	<5	-	-	<1	-	16	-	41	-	153	-	0.2	13	-	-	-	154
ERM	BH129	12.5	3/7/06	Public Domain Blocks 4&5	333578	6251713	-10.02	-	-	<5	-	-	<1	-	7	-	<5	-	8	-	0.2	<2	-	-	-	<5
ERM	BH129	3	3/7/06	Public Domain Blocks 4&5	333578	6251713	-0.52	-	-	<5	-	-	<1	-	24	-	22	-	267	-	<0.1	7	-	-	-	192
ERM	BH132	1.5	6/7/06	Proposed Southern Cove	333727	6251560	0.94	-	-	33	-	-	<1	-	42	-	34	-	*12100*	-	<0.1	11	-	-	-	45
ERM	BH132	8	6/7/06	Proposed Southern Cove	333727	6251560	-5.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH133	0.3	6/7/06	Block 4	333747	6251595	2.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH133	1.5	6/7/06	Block 4	333747	6251595	0.87	-	-	11	-	-	<1	-	14	-	21	-	40	-	<0.1	<2	-	-	-	45
ERM	BH134	0.4	7/11/06	Area B	333734	6251518	2.2	-	-	<5	-	-	1	-	3	-	212	-	7	-	<0.1	5	-	-	-	57
ERM	BH134	3	7/11/06	Area B	333734	6251518	-0.4	-	-	<5	-	-	<1	-	6	-	<5	-	8	-	<0.1	<2	-	-	-	7
ERM	BH134	9.2	7/11/06	Area B	333734	6251518	-6.6	-	-	7	-	-	<1	-	22	-	<5	-	11	-	<0.1	3	-	-	-	6
ERM	BH135A	0.4	11/7/06	Block 4	333725	6251577	2.06	-	-	6	-	-	<1	-	10	-	57	-	30	-	<0.1	11	-	-	-	79
ERM	BH135A	3	11/7/06	Block 4	333725	6251577	-0.54	-	-	<5	-	-	<1	-	9	-	6	-	16	-	<0.1	4	-	-	-	28
ERM	BH136	3	6/7/06	Block 5	333703	6251780	-0.64	-	-	<5	-	-	<1	-	8	-	<5	-	12	-	<0.1	2	-	-	-	19
ERM	BH136	8	6/7/06	Block 5	333703	6251780	-5.64	-	-	10	-	-	<1	-	24	-	<5	-	15	-	<0.1	<2	-	-	-	13
ERM	BH137	1.5	6/7/06	Block 4	333664	6251636	1.24	-	-	<5	-	-	<1	-	5	-	18	-	169	-	4.1	3	-	-	-	96
ERM	BH137	12.5	6/7/06	Block 4	333664	6251636	-9.76	-	-	<5	-	-	<1	-	12	-	10	-	69	-	0.6	5	-	-	-	41
ERM	BH137	3	6/7/06	Block 4	333664	6251636	-0.26	-	-	<5	-	-	<1	-	8	-	99	-	89	-	0.2	6	-	-	-	45

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
ERM	BH141	1.5	7/7/06	Block 4	333721	6251645	0.78	-	-	<5	-	-	<1	-	25	-	16	-	17	-	<0.1	16	-	-	-	55
ERM	BH141	3	7/7/06	Block 4	333721	6251645	-0.72	-	-	<5	-	-	<1	-	5	-	9	-	99	-	<0.1	<2	-	-	-	<5
ERM	BH142	1.5	10/7/06	Southern Cove	333654	6251577	0.62	-	-	<5	-	-	<1	-	8	-	5	-	10	-	<0.1	4	-	-	-	22
ERM	BH142	9.5	10/7/06	Southern Cove	333654	6251577	-7.38	-	-	<5	-	-	<1	-	17	-	<5	-	7	-	<0.1	5	-	-	-	24
ERM	BH143	1.5	10/7/06	Southern Cove	333643	6251590	0.63	-	-	<5	-	-	<1	-	8	-	11	-	6	-	<0.1	4	-	-	-	18
ERM	BH143	9	10/7/06	Southern Cove	333643	6251590	-6.87	-	-	<5	-	-	<1	-	10	-	6	-	14	-	<0.1	8	-	-	-	43
ERM	BH145	0.3	11/7/06	Block 5	333713	6251681	1.89	-	-	5	-	-	1	-	13	-	47	-	154	-	0.3	34	-	-	-	671
ERM	BH145	3	11/7/06	Block 5	333713	6251681	-0.81	-	-	<5	-	-	<1	-	9	-	13	-	15	-	0.1	10	-	-	-	49
ERM	BH146	1.5	11/7/06	Block 4	333736	6251583	0.94	-	-	<5	-	-	<1	-	9	-	14	-	5	-	<0.1	<2	-	-	-	10
ERM	BH146	3	11/7/06	Block 4	333736	6251583	-0.56	-	-	<5	-	-	<1	-	9	-	12	-	31	-	0.3	<2	-	-	-	14
ERM	BH146	4.1	11/7/06	Block 4	333736	6251583	-1.66	-	-	<5	-	-	<1	-	18	-	<5	-	7	-	<0.1	2	-	-	-	<5
ERM	BH156	0.4	14/8/06	Proposed Southern Cove	333726	6251602	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH156	0.9	14/8/06	Proposed Southern Cove	333726	6251602	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH159		14/8/06	Block 4	333706	6251570	#VALUE!	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH160	0.3	14/8/06	Block 4	333748	6251595	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH161	0.3	14/8/06	Block 4	333723	6251577	2.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH190	5.1	26/3/08	Public Domain Blocks 4&5	333612	6251728	-2.865	-	-	<5	-	-	<1	-	22	-	182	-	182	-	4.7	8	-	-	-	207
ERM	BH190	15	10/4/08	Public Domain Blocks 4&5	333612	6251728	-12.765	-	-	<5	-	-	<1	-	<2	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH191	3.7	27/3/08	Public Domain Blocks 4&5	333591	6251690	-1.4	-	-	6	-	-	<1	-	10	-	46	-	155	-	0.2	6	-	-	-	84
ERM	BH191	5.6	11/4/08	Public Domain Blocks 4&5	333591	6251690	-3.3	-	-	<5	-	-	<1	-	7	-	18	-	135	-	<0.1	3	-	-	-	52
ERM	BH191	16.5	14/4/08	Public Domain Blocks 4&5	333591	6251690	-14.2	-	-	8	-	-	<1	-	16	-	12	-	66	-	0.4	2	-	-	-	62
ERM	BH191	18.2	14/4/08	Public Domain Blocks 4&5	333591	6251690	-15.9	-	-	9	-	-	<1	-	14	-	<5	-	12	-	0.8	<2	-	-	-	<5
ERM	BH192	3	19/3/08	Area B	333703	6251485	-0.481	-	-	<5	-	-	<1	-	8	-	14	-	184	-	0.1	2	-	-	-	127
ERM	BH192	7.4	19/3/08	Area B	333703	6251485	-4.881	-	-	<5	-	-	<1	-	10	-	11	-	30	-	0.1	6	-	-	-	77
ERM	BH192	16.5	20/3/08	Area C	333703	6251485	-13.981	-	-	<5	-	-	<1	-	10	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH193	2.5	20/3/08	Area B	333696	6251465	0.245	-	-	<5	-	-	<1	-	8	-	17	-	36	-	0.3	<2	-	-	-	12
ERM	BH193	11.3	20/3/08	Area C	333696	6251465	-8.555	-	-	9	-	-	<1	-	23	-	60	-	214	-	1.6	6	-	-	-	201
ERM	BH193	14.5	17/4/08	Area C	333696	6251465	-11.755	-	-	<5	-	-	<1	-	3	-	<5	-	<5	-	0.2	<2	-	-	-	<5
ERM	BH194	0.5	19/3/08	Area B	333685	6251446	2.417	-	-	<5	-	-	<1	-	5	-	12	-	18	-	<0.1	6	-	-	-	16
ERM	BH194	1.5	20/3/08	Area B	333685	6251446	1.417	-	-	<5	-	-	<1	-	14	-	59	-	142	-	0.4	21	-	-	-	161
ERM	BH194	3.6	20/3/08	Area B	333685	6251446	-0.683	-	-	<5	-	-	<1	-	3	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH194	10.8	20/3/08	Area C	333685	6251446	-7.883	-	-	<5	-	-	<1	-	4	-	9	-	19	-	<0.1	<2	-	-	-	25
ERM	BH194	13.6	4/7/08	Area C	333685	6251446	-10.683	-	-	<5	-	-	<1	-	6	-	<5	-	28	-	<0.1	<2	-	-	-	14
ERM	BH195	5.45	25/3/08	Area B	333707	6251426	-2.539	-	-	11	-	-	2	-	65	-	42	-	55	-	0.4	21	-	-	-	450
ERM	BH195	9.9	25/3/08	Area C	333707	6251426	-6.989	-	-	7	-	-	2	-	9	-	19	-	130	-	0.1	13	-	-	-	1890
ERM	BH195	10.5	4/9/08	Area C	333707	6251426	-7.589	-	-	12	-	-	<1	-	17	-	108	-	382	-	3.1	10	-	-	-	437
ERM	BH195	11.7	4/9/08	Area C	333707	6251426	-8.789	-	-	<5	-	-	<1	-	8	-	<5	-	24	-	<0.1	<2	-	-	-	<5
ERM	BH196	1	19/3/08	Area B	333720	6251359	1.761	-	-	16	-	-	<1	-	16	-	209	-	514	-	5.9	17	-	-	-	710
ERM	BH196	6.4	19/3/08	Area B	333720	6251359	-3.639	-	-	<5	-	-	<1	-	6	-	24	-	198	-	0.6	2	-	-	-	199
ERM	BH197	0.4	3/3/08	Block 5	333706	6251718	2.077	-	-	<5	-	-	<1	-	15	-	34	-	18	-	<0.1	63	-	-	-	49
ERM	BH197	5	9/4/08	Block 5	333706	6251718	-2.523	-	-	15	-	-	<1	-	17	-	1080	-	78	-	<0.1	14	-	-	-	706
ERM	BH197	6.5	9/4/08	Block 5	333706	6251718	-4.023	-	-	19	-	-	<1	-	30	-	5	-	10	-	<0.1	9	-	-	-	26
ERM	BH197	11.5	9/4/08	Block 5	333706	6251718	-9.023	-	-	<5	-	-	<1	-	14	-	<5	-	<5	-	<0.1	<2	-	-	-	6
ERM	BH197	15.9	10/4/08	Block 5	333706	6251718	-13.423	-	-	<5	-	-	<1	-	5	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH197	18.6	10/4/08	Block 5	333706	6251718	-16.123	-	-	<5	-	-	<1	-	4	-	<5	-	13	-	<0.1	<2	-	-	-	<5

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
ERM	BH198	3	6/3/08	Block 5	333731	6251708	-0.725	-	-	5	-	-	1	-	48	-	239	-	47	-	<0.1	28	-	-	-	473
ERM	BH198	4.5	6/3/08	Block 5	333731	6251708	-2.225	-	-	6	-	-	<1	-	5	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH198	6.9	6/3/08	Block 5	333731	6251708	-4.625	-	-	<5	-	-	<1	-	11	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH199	2.7	11/3/08	Block 5	333719	6251681	-0.459	-	-	<5	-	-	<1	-	17	-	<5	-	16	-	<0.1	6	-	-	-	20
ERM	BH199	3.7	11/3/08	Block 5	333719	6251681	-1.459	-	-	<5	-	-	<1	-	7	-	21	-	24	-	<0.1	<2	-	-	-	8
ERM	BH199	5.6	11/3/08	Block 5	333719	6251681	-3.359	-	-	7	-	-	<1	-	5	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH199	6	17/3/08	Block 5	333719	6251681	-3.759	-	-	<5	-	-	<1	-	6	-	<5	-	9	-	<0.1	4	-	-	-	16
ERM	BH200	1	7/4/08	Block 4	333721	6251658	1.298	-	-	9	-	-	<1	-	38	-	70	-	937	-	1	28	-	-	-	75
ERM	BH200	2.5	7/4/08	Block 4	333721	6251658	-0.202	-	-	<5	-	-	<1	-	17	-	19	-	101	-	0.3	4	-	-	-	27
ERM	BH200	6.53	7/4/08	Block 4	333721	6251658	-4.232	-	-	<5	-	-	<1	-	<2	-	<5	-	10	-	0.5	<2	-	-	-	<5
ERM	BH201	2.4	4/3/08	Block 5	333699	6251682	-0.167	-	-	<5	-	-	<1	-	7	-	33	-	161	-	0.1	5	-	-	-	177
ERM	BH201	10.3	18/3/08	Block 5	333699	6251682	-8.067	-	-	19	-	-	2	-	27	-	156	-	-	-	4.6	14	-	-	-	784
ERM	BH201	11	18/3/08	Block 5	333699	6251682	-8.767	-	-	5	-	-	<1	-	22	-	<5	-	23	-	0.3	<2	-	-	-	5
ERM	BH202	2.3	10/3/08	Block 4	333705	6251646	0.179	-	-	8	-	-	<1	-	13	-	146	-	579	-	0.4	12	-	-	-	369
ERM	BH202	4.7	10/3/08	Block 4	333705	6251646	-2.221	-	-	6	-	-	<1	-	6	-	142	-	93	-	0.1	8	-	-	-	80
ERM	BH202	6.8	10/3/08	Block 4	333705	6251646	-4.321	-	-	<5	-	-	<1	-	8	-	20	-	28	-	<0.1	<2	-	-	-	35
ERM	BH203	1.9	10/3/08	Block 4	333693	6251633	0.781	-	-	11	-	-	<1	-	10	-	402	-	790	-	1.2	37	-	-	-	372
ERM	BH203	7.3	10/3/08	Block 4	333693	6251633	-4.619	-	-	<5	-	-	<1	-	9	-	51	-	53	-	0.1	10	-	-	-	86
ERM	BH204	1	18/3/08	Block 4	333744	6251622	0.952	-	-	<5	-	-	<1	-	6	-	14	-	44	-	<0.1	<2	-	-	-	6
ERM	BH204D	1.5	7/4/08	Block 4	333724	6251620	0.664	-	-	<5	-	-	<1	-	48	-	8	-	172	-	4.6	40	-	-	-	146
ERM	BH204D	3	7/4/08	Block 4	333724	6251620	-0.836	-	-	<5	-	-	<1	-	6	-	6	-	19	-	0.6	<2	-	-	-	7
ERM	BH204D	4	7/4/08	Block 4	333724	6251620	-1.836	-	-	<5	-	-	<1	-	11	-	8	-	38	-	0.4	3	-	-	-	14
ERM	BH205	7.8	27/3/08	Block 4	333704	6251613	-5.394	-	-	<5	-	-	<1	-	26	-	<5	-	31	-	<0.1	3	-	-	-	7
ERM	BH205	9.3	27/3/08	Block 4	333704	6251613	-6.894	-	-	<5	-	-	<1	-	9	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH205	13	1/4/08	Block 4	333704	6251613	-10.594	-	-	<5	-	-	<1	-	21	-	15	-	24	-	<0.1	<2	-	-	-	9
ERM	BH205	13.8	1/4/08	Block 4	333704	6251613	-11.394	-	-	<5	-	-	<1	-	5	-	<5	-	19	-	<0.1	<2	-	-	-	16
ERM	BH205	19.2	2/4/08	Block 4	333704	6251613	-16.794	-	-	<5	-	-	<1	-	8	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH205	22.2	2/4/08	Block 4	333704	6251613	-19.794	-	-	<5	-	-	<1	-	15	-	<5	-	7	-	<0.1	<2	-	-	-	14
ERM	BH206	0.5	7/3/08	Block 4	333713	6251599	1.729	-	-	<5	-	-	<1	-	8	-	135	-	18	-	0.1	12	-	-	-	64
ERM	BH206	1.8	17/4/08	Block 4	333713	6251599	0.429	-	-	<5	-	-	<1	-	13	-	31	-	38	-	<0.1	12	-	-	-	152
ERM	BH206	4.6	17/4/08	Block 4	333713	6251599	-2.371	-	-	<5	-	-	<1	-	11	-	38	-	30	-	0.1	5	-	-	-	108
ERM	BH206	7.1	17/4/08	Block 4	333713	6251599	-4.871	-	-	<5	-	-	<1	-	12	-	<5	-	8	-	0.6	<2	-	-	-	12
ERM	BH206	10.7	21/4/08	Block 4	333713	6251599	-8.471	-	-	<5	-	-	<1	-	<2	-	<5	-	33	-	<0.1	<2	-	-	-	<5
ERM	BH207	7.45	3/4/08	Proposed Southern Cove	333698	6251599	-5.163	-	-	<5	-	-	<1	-	9	-	7	-	15	-	0.2	8	-	-	-	49
ERM	BH207	12	3/4/08	Proposed Southern Cove	333698	6251599	-9.713	-	-	8	-	-	<1	-	23	-	37	-	257	-	2.1	6	-	-	-	209
ERM	BH207	13.1	3/4/08	Proposed Southern Cove	333698	6251599	-10.813	-	-	<5	-	-	<1	-	4	-	<5	-	31	-	<0.1	<2	-	-	-	263
ERM	BH207	15	3/4/08	Proposed Southern Cove	333698	6251599	-12.713	-	-	<5	-	-	<1	-	15	-	<5	-	<5	-	<0.1	4	-	-	-	25
ERM	BH208	2.25	4/4/08	Block 4	333705	6251588	-0.032	-	-	<5	-	-	<1	-	29	-	8	-	6	-	<0.1	12	-	-	-	62
ERM	BH208	9.5	4/4/08	Block 4	333705	6251588	-7.282	-	-	<5	-	-	<1	-	8	-	<5	-	8	-	<0.1	6	-	-	-	38
ERM	BH208	13.5	4/4/08	Block 4	333705	6251588	-11.282	-	-	23	-	-	1	-	54	-	156	-	392	-	2.4	13	-	-	-	551
ERM	BH209	2.3	22/4/08	Block 4	333727	6251589	-0.014	-	-	<5	-	-	<1	-	11	-	21	-	29	-	<0.1	9	-	-	-	55
ERM	BH209	4.5	22/4/08	Block 4	333727	6251589	-2.214	-	-	7	-	-	<1	-	8	-	16	-	18	-	<0.1	9	-	-	-	25
ERM	BH209	6.1	22/4/08	Block 4	333727	6251589	-3.814	-	-	<5	-	-	<1	-	11	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH209	9.4	23/4/08	Block 4	333727	6251589	-7.114	-	-	<5	-	-	<1	-	3	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM	BH210	1.5	18/3/08	Proposed Southern Cove	333685	6251582	0.558	-	-	<5	-	-	<1	-	12	-	<5	-	12	-	<0.1	5	-	-	-	23

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
ERM	BH210	15.9	27/3/08	Proposed Southern Cove	333685	6251582	-13.842	-	-	<5	-	-	<1	-	7	-	<5	-	7	-	<0.1	2	-	-	-	20
ERM	BH211	14	26/3/08	Block 4	333676	6251561	-11.749	-	-	<5	-	-	<1	-	6	-	<5	-	8	-	<0.1	5	-	-	-	28
ERM	BH211	15.5	26/3/08	Block 4	333676	6251561	-13.249	-	-	11	-	-	<1	-	13	-	<5	-	5	-	<0.1	<2	-	-	-	<5
ERM	BH211	16.05	26/3/08	Block 4	333676	6251561	-13.799	-	-	<5	-	-	<1	-	21	-	<5	-	7	-	<0.1	2	-	-	-	12
ERM	BH212	3.1	18/3/08	Public Domain Blocks 4&5	333573	6251519	-0.748	-	-	6	-	-	<1	-	11	-	45	-	324	-	-	7	-	-	-	224
ERM	BH212	4.8	25/3/08	Public Domain Blocks 4&5	333573	6251519	-2.448	-	-	7	-	-	<1	-	13	-	19	-	68	-	<0.1	6	-	-	-	76
ERM	BH212	12.2	28/3/08	Public Domain Blocks 4&5	333573	6251519	-9.848	-	-	<5	-	-	<1	-	3	-	81	-	72	-	<0.1	2	-	-	-	129
ERM	BH212	26	31/3/08	Public Domain Blocks 4&5	333573	6251519	-23.648	-	-	<5	-	-	<1	-	4	-	<5	-	<5	-	<0.1	2	-	-	-	<5
ERM	BH213	3.6	14/4/08	Public Domain Blocks 4&5	333559	6251750	-1.263	-	-	<5	-	-	<1	-	12	-	<5	-	8	-	<0.1	4	-	-	-	22
ERM	BH213	10.5	14/4/08	Public Domain Blocks 4&5	333559	6251750	-8.163	-	-	<5	-	-	<1	-	9	-	<5	-	19	-	<0.1	4	-	-	-	25
ERM	BH213	18.5	17/4/08	Public Domain Blocks 4&5	333559	6251750	-16.163	-	-	24	-	-	<1	-	23	-	7	-	32	-	0.1	3	-	-	-	109
ERM 2007	BH021	0.3-0.5	ERM 2007	Barangaroo Central	333621.97	6251691.71	2.21	-	-	<5	-	-	<1	-	10	-	17	-	48	-	<0.1	12	-	-	-	40
ERM 2007	BH021	1.5-1.95	ERM 2007	Barangaroo Central	333621.97	6251691.71	2.21	-	-	<5	-	-	<1	-	22	-	24	-	70	-	0.1	21	-	-	-	65
ERM 2007	BH021	16.0-16.5	ERM 2007	Barangaroo Central	333621.97	6251691.71	2.21	-	-	<5	-	-	<1	-	9	-	8	-	56	-	0.1	<2	-	-	-	39
ERM 2007	BH022	0.3-0.5	ERM 2007	Barangaroo Central	333644.6	6251851.63	2.81	-	-	<5	-	-	<1	-	17	-	37	-	16	-	<0.1	40	-	-	-	39
ERM 2007	BH022	1.5-1.95	ERM 2007	Barangaroo Central	333644.6	6251851.63	2.81	-	-	<5	-	-	<1	-	4	-	32	-	<5	-	<0.1	<2	-	-	-	<5
ERM 2007	BH022	11.0-11.5	ERM 2007	Barangaroo Central	333644.6	6251851.63	2.81	-	-	<5	-	-	2	-	19	-	12	-	68	-	<0.1	3	-	-	-	32
ERM 2007	BH023	0.3-0.5	ERM 2007	Barangaroo Central	333682.71	6251864.66	2.51	-	-	<5	-	-	<1	-	9	-	22	-	39	-	<0.1	26	-	-	-	53
ERM 2007	BH023	1.5-1.95	ERM 2007	Barangaroo Central	333682.71	6251864.66	2.51	-	-	<5	-	-	<1	-	5	-	6	-	83	-	<0.1	<2	-	-	-	48
ERM 2007	BH023	13.5-13.8	ERM 2007	Barangaroo Central	333682.71	6251864.66	2.51	-	-	<5	-	-	<1	-	8	-	<5	-	6	-	<0.1	<2	-	-	-	5
ERM 2007	BH024	0.3-0.5	ERM 2007	Barangaroo Central	333707.06	6251850.27	2.32	-	-	<5	-	-	<1	-	11	-	46	-	120	-	0.2	35	-	-	-	121
ERM 2007	BH024	3.0-3.45	ERM 2007	Barangaroo Central	333707.06	6251850.27	2.32	-	-	<5	-	-	<1	-	7	-	<5	-	17	-	<0.1	<2	-	-	-	5
ERM 2007	BH024	10.0-10.5	ERM 2007	Barangaroo Central	333707.06	6251850.27	2.32	-	-	<5	-	-	<1	-	21	-	<5	-	8	-	<0.1	<2	-	-	-	5
ERM 2007	BH025	0.3-0.5	ERM 2007	Barangaroo Central	333713.78	6251794.82	2.22	-	-	6	-	-	<1	-	9	-	32	-	198	-	0.4	9	-	-	-	70
ERM 2007	BH025	3.0-3.65	ERM 2007	Barangaroo Central	333713.78	6251794.82	2.22	-	-	5	-	-	<1	-	6	-	99	-	197	-	0.5	4	-	-	-	326
ERM 2007	BH025	8.5-9.0	ERM 2007	Barangaroo Central	333713.78	6251794.82	2.22	-	-	<5	-	-	<1	-	8	-	<5	-	16	-	<0.1	<2	-	-	-	9
ERM 2007	BH026	0.3-0.5	ERM 2007	Barangaroo Central	333617.2	6251774.86	2.35	-	-	<5	-	-	<1	-	14	-	6	-	18	-	<0.1	6	-	-	-	37
ERM 2007	BH026	1.5-1.95	ERM 2007	Barangaroo Central	333617.2	6251774.86	2.35	-	-	<5	-	-	<1	-	13	-	20	-	111	-	0.2	11	-	-	-	67
ERM 2007	BH026	16.5-16.95	ERM 2007	Barangaroo Central	333617.2	6251774.86	2.35	-	-	<5	-	-	<1	-	32	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM 2007	BH027	0.3-0.5	ERM 2007	Barangaroo Central	333650.91	6251793.26	2.84	-	-	<5	-	-	<1	-	10	-	52	-	8	-	<0.1	80	-	-	-	43
ERM 2007	BH027	3.0-3.45	ERM 2007	Barangaroo Central	333650.91	6251793.26	2.84	-	-	11	-	-	<1	-	22	-	11	-	503	-	0.1	10	-	-	-	100
ERM 2007	BH027	14.0-14.5	ERM 2007	Barangaroo Central	333650.91	6251793.26	2.84	-	-	<5	-	-	<1	-	9	-	12	-	85	-	0.2	2	-	-	-	76
ERM 2007	BH029	0.3-0.5	ERM 2007	Barangaroo Central	333709.24	6251985.27	2.553	-	-	<5	-	-	<1	-	10	-	43	-	116	-	0.2	40	-	-	-	88
ERM 2007	BH029	3.0-3.45	ERM 2007	Barangaroo Central	333709.24	6251985.27	2.553	-	-	5	-	-	<1	-	9	-	67	-	215	-	0.5	<2	-	-	-	43
ERM 2007	BH029	9.0-9.5	ERM 2007	Barangaroo Central	333709.24	6251985.27	2.553	-	-	<5	-	-	<1	-	13	-	8	-	18	-	<0.1	3	-	-	-	8
ERM 2007	BH032	0.3-0.5	ERM 2007	Barangaroo Central	333654.69	6251923.5	2.44	-	-	<5	-	-	<1	-	10	-	23	-	21	-	<0.1	30	-	-	-	46
ERM 2007	BH032	1.5-1.95	ERM 2007	Barangaroo Central	333654.69	6251923.5	2.44	-	-	<5	-	-	<1	-	9	-	8	-	430	-	0.2	2	-	-	-	211
ERM 2007	BH032	3.0-3.34	ERM 2007	Barangaroo Central	333654.69	6251923.5	2.44	-	-	<5	-	-	<1	-	8	-	65	-	498	-	0.4	14	-	-	-	455
ERM 2007	BH040	0.3-0.5	ERM 2007	Barangaroo Central	333609.17	6251893.69	2.37	-	-	<5	-	-	<1	-	9	-	38	-	37	-	0.2	7	-	-	-	37
ERM 2007	BH040	1.5-1.95	ERM 2007	Barangaroo Central	333609.17	6251893.69	2.37	-	-	<5	-	-	<1	-	5	-	<5	-	15	-	<0.1	<2	-	-	-	11
ERM 2007	BH040	26.5-27.0	ERM 2007	Barangaroo Central	333609.17	6251893.69	2.37	-	-	<5	-	-	<1	-	7	-	<5	-	6	-	<0.1	<2	-	-	-	<5
ERM 2007	BH045	0.3-0.5	ERM 2007	Barangaroo Central	333655.53	6251722.86	2.39	-	-	<5	-	-	<1	-	12	-	43	-	22	-	<0.1	54	-	-	-	46
ERM 2007	BH045	1.5-1.95	ERM 2007	Barangaroo Central	333655.53	6251722.86	2.39	-	-	<5	-	-	<1	-	6	-	26	-	403	-	0.6	6	-	-	-	162
ERM 2007	BH045	3.0-3.45	ERM 2007	Barangaroo Central	333655.53	6251722.86	2.39	-	-	8	-	-	<1	-	8	-	16	-	223	-	0.1	4	-	-	-	160
ERM 2007	BH046	1.5-1.95	ERM 2007	Barangaroo Central	333641.38	6251752.7	2.57	-	-	6	-	-	<1	-	34	-	286	-	216	-	6.4	32	-	-	-	374
ERM 2007	BH046	3.0-3.45	ERM 2007	Barangaroo Central	333641.38	6251752.7	2.57	-	-	6	-	-	<1	-	29	-	200	-	456	-	3.5	18	-	-	-	337
ERM 2007	BH050	0.3-0.5	ERM 2007	Barangaroo Central	333618.89	6251819.47	2.44	-	-	<5	-	-	<1	-	9	-	16	-	12	-	<0.1	18	-	-	-	32

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
ERM 2007	BH050	1.5-1.8	ERM 2007	Barangaroo Central	333618.89	6251819.47	2.44	-	-	<5	-	-	<1	-	5	-	6	-	12	-	<0.1	5	-	-	-	19
ERM 2007	BH050	3.0-3.5	ERM 2007	Barangaroo Central	333618.89	6251819.47	2.44	-	-	<5	-	-	<1	-	8	-	15	-	40	-	<0.1	<2	-	-	-	33
ERM 2007	BH051	0.3-0.5	ERM 2007	Barangaroo Central	333600.24	6251794.48	2.3	-	-	<5	-	-	<1	-	14	-	<5	-	15	-	<0.1	4	-	-	-	26
ERM 2007	BH051	1.5-1.7	ERM 2007	Barangaroo Central	333600.24	6251794.48	2.3	-	-	<5	-	-	<1	-	10	-	5	-	14	-	<0.1	8	-	-	-	51
ERM 2007	BH052	1.5-1.95	ERM 2007	Barangaroo Central	333606.71	6251757.95	2.31	-	-	<5	-	-	<1	-	13	-	23	-	276	-	0.2	<2	-	-	-	145
ERM 2007	BH052	3.0-3.45	ERM 2007	Barangaroo Central	333606.71	6251757.95	2.31	-	-	<5	-	-	<1	-	16	-	37	-	197	-	0.2	8	-	-	-	194
ERM 2007	BH056	0.3-0.5	ERM 2007	Barangaroo Central	333688.86	6251817.14	2.53	-	-	<5	-	-	<1	-	7	-	26	-	20	-	0.2	32	-	-	-	35
ERM 2007	BH056	1.5-1.95	ERM 2007	Barangaroo Central	333688.86	6251817.14	2.53	-	-	<5	-	-	<1	-	4	-	<5	-	7	-	<0.1	2	-	-	-	10
ERM 2007	BH056	13.0-13.5	ERM 2007	Barangaroo Central	333688.86	6251817.14	2.53	-	-	<5	-	-	<1	-	6	-	7	-	21	-	0.2	<2	-	-	-	20
ERM 2007	BH057	1.5-1.7	ERM 2007	Barangaroo Central	333564.03	6251834.68	2.28	-	-	<5	-	-	<1	-	10	-	5	-	14	-	<0.1	6	-	-	-	6
ERM 2007	BH057	3.0-3.45	ERM 2007	Barangaroo Central	333564.03	6251834.68	2.28	-	-	<5	-	-	<1	-	36	-	29	-	12	-	<0.1	39	-	-	-	36
ERM 2007	BH057	16.5-17.0	ERM 2007	Barangaroo Central	333564.03	6251834.68	2.28	-	-	17	-	-	<1	-	35	-	<5	-	14	-	<0.1	<2	-	-	-	16
ERM 2007	BH061	1.5-1.95	ERM 2007	Barangaroo Central	333567.17	6251808.1	2.31	-	-	<5	-	-	<1	-	14	-	23	-	10	-	<0.1	20	-	-	-	46
ERM 2007	BH061	3.0-3.45	ERM 2007	Barangaroo Central	333567.17	6251808.1	2.31	-	-	<5	-	-	<1	-	12	-	<5	-	10	-	<0.1	4	-	-	-	24
ERM 2007	BH066	0.3-0.5	ERM 2007	Barangaroo Central	333654.96	6251689.34	2.24	-	-	<5	-	-	<1	-	14	-	17	-	80	-	0.2	17	-	-	-	65
ERM 2007	BH066	1.5-1.95	ERM 2007	Barangaroo Central	333654.96	6251689.34	2.24	-	-	<5	-	-	<1	-	13	-	19	-	223	-	0.1	6	-	-	-	150
ERM 2007	BH080	0.3-0.5	ERM 2007	Barangaroo Central	333669.21	6251935.85	2.543	-	-	<5	-	-	<1	-	12	-	30	-	121	-	0.1	38	-	-	-	65
ERM 2007	BH080	1.5-1.95	ERM 2007	Barangaroo Central	333669.21	6251935.85	2.543	-	-	<5	-	-	<1	-	20	-	8	-	58	-	<0.1	10	-	-	-	44
ERM 2007	BH080	19.0-19.5	ERM 2007	Barangaroo Central	333669.21	6251935.85	2.543	-	-	<5	-	-	<1	-	8	-	<5	-	7	-	<0.1	<2	-	-	-	<5
ERM 2007	BH107	1.5-1.95	ERM 2007	Barangaroo Central	333594.08	6251850.09	2.32	-	-	<5	-	-	<1	-	7	-	6	-	14	-	<0.1	4	-	-	-	24
ERM 2007	BH107	3.0-3.45	ERM 2007	Barangaroo Central	333594.08	6251850.09	2.32	-	-	<5	-	-	<1	-	15	-	24	-	14	-	<0.1	6	-	-	-	37
ERM 2007	BH107	13.5-14.0	ERM 2007	Barangaroo Central	333594.08	6251850.09	2.32	-	-	15	-	-	<1	-	40	-	9	-	30	-	<0.1	2	-	-	-	22
ERM 2007	BH128	1.5-1.7	ERM 2007	Barangaroo Central	333571.82	6251767.73	2.44	-	-	<5	-	-	<1	-	10	-	8	-	27	-	<0.1	6	-	-	-	46
ERM 2007	BH128	20-20.5	ERM 2007	Barangaroo Central	333571.82	6251767.73	2.44	-	-	<5	-	-	<1	-	14	-	<5	-	6	-	<0.1	2	-	-	-	6
ERM 2007	BH129	0.4-0.6	ERM 2007	Barangaroo Central	333577.76	6251713.33	2.4	-	-	<5	-	-	<1	-	16	-	41	-	153	-	0.2	13	-	-	-	154
ERM 2007	BH129	3.0-3.45	ERM 2007	Barangaroo Central	333577.76	6251713.33	2.4	-	-	<5	-	-	<1	-	24	-	22	-	267	-	<0.1	7	-	-	-	192
ERM 2007	BH129	12.5-13	ERM 2007	Barangaroo Central	333577.76	6251713.33	2.4	-	-	<5	-	-	<1	-	7	-	<5	-	8	-	0.2	<2	-	-	-	<5
ERM 2007	BH140	1.5-1.95	ERM 2007	Barangaroo Central	333721.59	6251809.19	2.34	-	-	<5	-	-	<1	-	10	-	103	-	160	-	0.8	4	-	-	-	99
ERM 2007	BH140	6.0-6.5	ERM 2007	Barangaroo Central	333721.59	6251809.19	2.34	-	-	<5	-	-	<1	-	18	-	<5	-	14	-	<0.1	<2	-	-	-	13
ERM 2007	BH147	1.6-2.05	ERM 2007	Barangaroo Central	333712.32	6251933.44	2.65	-	-	<5	-	-	<1	-	18	-	20	-	782	-	1.8	9	-	-	-	100
ERM 2007	BH147	3.0-3.45	ERM 2007	Barangaroo Central	333712.32	6251933.44	2.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.
ERM 2007	BH147	8.9-9.2	ERM 2007	Barangaroo Central	333712.32	6251933.44	2.65	-	-	7	-	-	<1	-	30	-	<5	-	22	-	<0.1	<2	-	-	-	7
ERM 2007	BH155	0.4-0.5	ERM 2007	Barangaroo Central	333712.78	6251933.5	2.646	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH155	0.9-1.0	ERM 2007	Barangaroo Central	333712.78	6251933.5	2.646	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2008	BH179	1.5-2.0	ERM 2008	Barangaroo Central	333708.26	6251901.896	2.458	-	-	<5	-	-	<1	-	8	-	17-21	-	169-226	-	0.3-0.6	3	-	-	-	68-105
ERM 2008	BH179	7	ERM 2008	Barangaroo Central	333708.26	6251901.896	2.458	-	-	18	-	-	1	-	35	-	188-235	-	568-668	-	4.4-5.4	15	-	-	-	565-638
ERM 2008	BH179	11	ERM 2008	Barangaroo Central	333708.26	6251901.896	2.458	-	-	<5	-	-	<1	-	29	-	<5	-	22	-	<0.1	<2	-	-	-	<5
ERM 2008	BH180	4.7	ERM 2008	Barangaroo Central	333670.087	6251872.951	2.691	-	-	<5	-	-	<1	-	5	-	<5	-	15	-	<0.1	2	-	-	-	10
ERM 2008	BH180	8.7	ERM 2008	Barangaroo Central	333670.087	6251872.951	2.691	-	-	<5	-	-	<1	-	5	-	<5	-	10	-	<0.1	<2	-	-	-	8
ERM 2008	BH180	14.3	ERM 2008	Barangaroo Central	333670.087	6251872.951	2.691	-	-	5	-	-	<1	-	11	-	<5	-	6	-	0.1	<2	-	-	-	<5
ERM 2008	BH183	2.2	ERM 2008	Barangaroo Central	333554.971	6251884.783	2.451	-	-	<5	-	-	<1	-	22	-	8	-	<5	-	<0.1	17	-	-	-	17
ERM 2008	BH183	8	ERM 2008	Barangaroo Central	333554.971	6251884.783	2.451	-	-	<5	-	-	<1	-	7	-	7	-	23	-	<0.1	3	-	-	-	35
ERM 2008	BH183	30.3	ERM 2008	Barangaroo Central	333554.971	6251884.783	2.451	-	-	<5	-	-	<1	-	2	-	<5	-	5	-	0.4	<2	-	-	-	<5
ERM 2008	BH183	31.6	ERM 2008	Barangaroo Central	333554.971	6251884.783	2.451	-	-	<5	-	-	<1	-	2	-	<5	-	6	-	<0.1	<2	-	-	-	<5
ERM 2008	BH184	4.8	ERM 2008	Barangaroo Central	333604.524	6251922.673	2.411	-	-	<5	-	-	<1	-	8	-	<5	-	26	-	<0.1	3	-	-	-	32
ERM 2008	BH184	9.6	ERM 2008	Barangaroo Central	333604.524	6251922.673	2.411	-	-	<5	-	-	<1	-	7	-	6	-	25	-	<0.1	9	-	-	-	33
ERM 2008	BH184	23.3	ERM 2008	Barangaroo Central	333604.524	6251922.673	2.411	-	-	<5	-	-	<1	-	7	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM 2008	BH186	3.6	ERM 2008	Barangaroo Central	333579.031	6251907.925	2.398	-	-	<5	-	-	<1	-	3	-	<5	-	<5	-	<0.1	<2	-	-	-	7

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Aluminium	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium (hexavalent)	Chromium (III+VI)	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Vanadium	Zinc
ERM 2008	BH186	11	ERM 2008	Barangaroo Central	333579.031	6251907.925	2.398	-	-	<5	-	-	<1	-	7	-	14	-	127	-	<0.1	5	-	-	-	41
ERM 2008	BH186	13.5	ERM 2008	Barangaroo Central	333579.031	6251907.925	2.398	-	-	12	-	-	<1	-	22	-	70	-	312	-	1.5	8	-	-	-	327
ERM 2008	BH187	3.6	ERM 2008	Barangaroo Central	333588.75	6251879.223	2.243	-	-	<5	-	-	<1	-	10	-	13	-	35	-	0.3	9	-	-	-	229
ERM 2008	BH187	10	ERM 2008	Barangaroo Central	333588.75	6251879.223	2.243	-	-	<5	-	-	<1	-	10	-	32	-	282	-	<0.1	6	-	-	-	238
ERM 2008	BH187	25	ERM 2008	Barangaroo Central	333588.75	6251879.223	2.243	-	-	<5	-	-	<1	-	4	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM 2008	BH188	2.9	ERM 2008	Barangaroo Central	333636.006	6251875.724	2.689	-	-	<5	-	-	<1	-	9	-	8	-	249	-	<0.1	3	-	-	-	156
ERM 2008	BH188	11.5	ERM 2008	Barangaroo Central	333636.006	6251875.724	2.689	-	-	<5	-	-	<1	-	4	-	10	-	17	-	0.1	<2	-	-	-	18
ERM 2008	BH188	15.1	ERM 2008	Barangaroo Central	333636.006	6251875.724	2.689	-	-	<5	-	-	<1	-	<2	-	<5	-	<5	-	<0.1	<2	-	-	-	<5
ERM 2008	BH189	16	ERM 2008	Barangaroo Central	333661.693	6251831.66	2.831	-	-	<5	-	-	<1	-	9	-	<5	-	5	-	<0.1	<2	-	-	-	<5
ERM 2008	BH189	3.7	ERM 2008	Barangaroo Central	333661.693	6251831.66	2.831	-	-	<5	-	-	<1	-	18	-	8	-	22	-	<0.1	6	-	-	-	76
ERM 2008	BH189	7.2	ERM 2008	Barangaroo Central	333661.693	6251831.66	2.831	-	-	<5	-	-	<1	-	8	-	15	-	68	-	0.2	19	-	-	-	84
ERM 2008	BH213	3.6	ERM 2008	Barangaroo Central	333558.557	6251749.964	2.337	-	-	<5	-	-	<1	-	12	-	<5	-	8	-	<0.1	4	-	-	-	22
ERM 2008	BH213	10.5	ERM 2008	Barangaroo Central	333558.557	6251749.964	2.337	-	-	<5	-	-	<1	-	9	-	<5	-	19	-	<0.1	4	-	-	-	25
ERM 2008	BH213	18.5	ERM 2008	Barangaroo Central	333558.557	6251749.964	2.337	-	-	24	-	-	<1	-	23	-	7	-	32	-	0.1	3	-	-	-	109
ERM 2008	BH214	6.3	ERM 2008	Barangaroo Central	333547.714	6251850.172	2.103	-	-	<5	-	-	<1	-	8	-	34	-	378	-	0.2	6	-	-	-	193
ERM 2008	BH214	15	ERM 2008	Barangaroo Central	333547.714	6251850.172	2.103	-	-	<5	-	-	<1	-	7	-	15	-	235	-	0.3	6	-	-	-	116
ERM 2008	BH214	16	ERM 2008	Barangaroo Central	333547.714	6251850.172	2.103	-	-	<5	-	-	<1	-	12	-	<5	-	25	-	<0.1	3	-	-	-	<5

Table 2: TPH, BTEX, Organics
All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH01	0.3	12/2/09	Area A	333622	6251528	2.09	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH01	10	12/2/09	Area A	333622	6251528	-7.61	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH01	1	12/2/09	Area A	333622	6251528	1.39	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH01	12	12/2/09	Area A	333622	6251528	-9.61	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH01	17.65	12/3/09	Area A	333622	6251528	-15.26	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH01	20.5	12/3/09	Area A	333622	6251528	-18.11	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH01	2	12/2/09	Area A	333622	6251528	0.39	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH01	25	12/10/09	Area A	333622	6251528	-22.61	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH01	4	12/2/09	Area A	333622	6251528	-1.61	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH01	7	12/2/09	Area A	333622	6251528	-4.61	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH01	9	12/2/09	Area A	333622	6251528	-6.61	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH02	11.5	12/4/09	Area C	333618	6251492	-9.03	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH02	14.5	12/4/09	Area C	333618	6251492	-12.03	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH02	19	12/7/09	Area C	333618	6251492	-16.53	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH02	3	12/4/09	Area B	333618	6251492	-0.53	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH02	5	12/4/09	Area B	333618	6251492	-2.53	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH02	7	12/4/09	Area B	333618	6251492	-4.53	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH03	3	12/10/09	Area B	333648	6251518	-0.91	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH03	17.3	12/10/09	Area C	333648	6251518	-15.21	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH03	9	12/10/09	Area C	333648	6251518	-6.91	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH04	1	12/9/09	Area B	333662	6251527	1.16	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH04	16	12/9/09	Area C	333662	6251527	-13.84	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH04	20	12/9/09	Area C	333662	6251527	-17.84	79	<50	<100	<100	<50	5.6	2.9	15	15.2	8.4	23.6	-	-
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	121	<50	<100	<100	<50	9.7	4.1	34.1	20.1	10.6	30.7	<1	<1
AECOM	BH04	22	12/10/09	Area C	333662	6251527	-19.84	51	<50	<100	<100	<50	8	1.3	8.1	6.7	3.6	10.3	-	-
AECOM	BH04	8	12/9/09	Area B	333662	6251527	-5.84	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH05	0.25	12/2/09	Area B	333692	6251518	1.84	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH05	4.1	12/2/09	Area B	333692	6251518	-2.01	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH05	6.4	12/2/09	Area B	333692	6251518	-4.31	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH05	1.7	12/2/09	Area B	333692	6251518	0.39	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH06	0.5	12/2/09	Area B	333702	6251506	1.69	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH06	2.5	12/2/09	Area B	333702	6251506	-0.31	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	0.5	<0.5	0.5	-	-
AECOM	BH06	5	12/2/09	Area B	333702	6251506	-2.81	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH07	1	12/8/09	Area B	333727	6251509	1.42	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH07	5	12/8/09	Area B	333727	6251509	-2.58	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH07	7.4	12/8/09	Area B	333727	6251509	-4.98	<10	80	1290	1250	2620	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH08	1	12/8/09	Area B	333717	6251528	1.22	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	170	100	200	<100	300	13.9	5.6	42.1	33	13.5	46.5	-	-
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	<10	<50	<100	<100	<50	1.4	<0.5	3.5	<1	<0.5	<1.5	<1	<1

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH08	5	12/8/09	Area B	333717	6251528	-2.78	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH08	9	12/8/09	Area B	333717	6251528	-6.78	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH09	1	12/7/09	Area B	333709	6251541	1.23	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH09	5	12/7/09	Area B	333709	6251541	-2.77	-	-	-	-	-	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH10	1	12/11/09	Area B	333692	6251540	1.22	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH10	12	12/11/09	Area C	333692	6251540	-9.78	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH11	1.4	2/5/10	Area B	333757	6251517	1.6	<10	210	470	<100	680	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH11	1.6	2/5/10	Area B	333757	6251517	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH11	2.6	2/5/10	Area B	333757	6251517	0.4	22	4390	9160	<100	13,500 - 13,550	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH11	3.2	2/5/10	Area B	333757	6251517	-0.2	<10	630	1440	<100	2070	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH12	12.2	2/10/10	Area B	333735	6251488	-9.54	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH12	3	2/10/10	Area B	333735	6251488	-0.34	<10	<50	1000	510	1510	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH12	7	2/10/10	Area B	333735	6251488	-4.34	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH13	1	2/5/10	Area B	333692	6251488	1.5	<10	<50	340	<100	340	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH13	12.7	2/5/10	Area C	333692	6251488	-10.2	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH13	2.4	2/5/10	Area B	333692	6251488	0.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH13	3	2/5/10	Area B	333692	6251488	-0.5	<10	<50	290	180	470	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH13	7.2	2/5/10	Area B	333692	6251488	-4.7	<10	<50	660	770	1430	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH14	13	2/10/10	Area C	333648	6251482	-10.44	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH14	2.5	2/10/10	Area B	333648	6251482	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH15	2	2/9/10	Area B	333758	6251459	0.71	<10	50	440	<100	490	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH15	5	2/9/10	Area B	333758	6251459	-2.29	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH16	1	2/9/10	Area B	333720	6251456	1.66	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH16	4.2	2/9/10	Area B	333720	6251456	-1.54	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH17	10	2/10/10	Area B	333732	6251416	-7.45	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH17	4	2/9/10	Area B	333732	6251416	-1.45	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH18	14	2/10/10	Area B	333753	6251380	-11.71	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH18	2.5	2/10/10	Area B	333753	6251380	-0.21	<10	<50	100	<100	100	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH18	7	2/10/10	Area B	333753	6251380	-4.71	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH19	1	2/9/10	Area B	333736	6251372	1.53	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH19	11.5	2/9/10	Area B	333736	6251372	-8.97	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH19	6.9	2/9/10	Area B	333736	6251372	-4.37	<10	<50	180	<100	180	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH20	1	2/11/10	Area B	333733	6251328	1.76	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	11	640	1970	1950	4560	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH20	4	2/11/10	Area B	333733	6251328	-1.24	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH21	1	2/11/10	Area B	333718	6251310	1.56	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	<10	<50	300	530	830	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH21	4	2/11/10	Area B	333718	6251310	-1.44	<10	<50	170	160	330	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH22	4	2/10/10	Area B	333639	6251295	-1.8	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH23	1.6	2/5/10	Area B	333640	6251297	0.84	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH23	4.7	2/5/10	Area B	333640	6251297	-2.26	<10	180	4990	2170	7340	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH23	7.8	2/5/10	Area B	333640	6251297	-5.36	<10	<50	240	210	440 - 450	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH24	0.75	2/12/10	Area B	333655	6251338	1.56	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5		-	-
AECOM	BH24	13	2/12/10	Area C	333655	6251338	-10.69	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH24	5	2/12/10	Area B	333655	6251338	-2.69	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH25	1	19/2/10	Area B	333697	6251356	1.87	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH25	15	19/2/10	Area C	333697	6251356	-12.13	-	-	-	-	-	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	<1
AECOM	BH25	5.2	19/2/10	Area B	333697	6251356	-2.33	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH25	7.2	19/2/10	Area B	333697	6251356	-4.33	-	-	-	-	-	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	<1
AECOM	BH26	10	2/11/10	Area C	333666	6251372	-7.41	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH26	11.4	2/11/10	Area C	333666	6251372	-8.81	<10	<50	820	800	1620	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH26	16	2/11/10	Area C	333666	6251372	-13.41	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH26	4	2/11/10	Area B	333666	6251372	-1.41	<10	<50	140	110	250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH27	0.2	15/2/10	Area B	333630	6251405	2.21	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH27	10	15/2/10	Area C	333630	6251405	-7.59	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH27	14.5	15/2/10	Area C	333630	6251405	-12.09	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH28	0.5	15/2/10	Area B	333683	6251424	1.65	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	<10	<50	1880	1110	2990	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH28	13	15/2/10	Area C	333683	6251424	-10.85	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH28	16	15/2/10	Area C	333683	6251424	-13.85	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH28	13	15/2/10	Area C	333683	6251424	-10.85	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH29	2.5	16/2/10	Area B	333662	6251448	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH29	7	16/2/10	Area B	333662	6251448	-4.38	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	<10	<50	360	280	640	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH30	7	16/2/10	Area B	333639	6251452	-4.58	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH30	13	16/2/10	Area C	333639	6251452	-10.58	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH30	19	16/2/10	Area C	333639	6251452	-16.58	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH300	0.14	8/11/10	Area B	333743	6251537	2.26	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH300	1	8/11/10	Area B	333743	6251537	1.4	<10	<50	300	330	630	3.1	<0.5	2.1	0.8	<0.5	0.8	-	-
AECOM	BH300	2	8/11/10	Area B	333743	6251537	0.4	<10	<50	130	<100	130	0.9	<0.5	0.6	<0.5	<0.5	<1	-	-
AECOM	BH300	3	8/11/10	Area B	333743	6251537	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH300	4	8/11/10	Area B	333743	6251537	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH300	5.4	8/11/10	Area B	333743	6251537	-3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH300	5	8/11/10	Area B	333743	6251537	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH300	6.2	8/11/10	Area B	333743	6251537	-3.8	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH301	1.3	10/1/10	Area B	333746	6251509	1.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH302	0.1	8/4/10	Area B	333746	6251493	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH302	1.2	8/4/10	Area B	333746	6251493	1.2	<10	<50	150	110	260	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH302	2	8/4/10	Area B	333746	6251493	0.4	<10	<50	210	230	440	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH302	3	8/4/10	Area B	333746	6251493	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH302	4	8/4/10	Area B	333746	6251493	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH302	5	8/4/10	Area B	333746	6251493	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH302	6	8/4/10	Area B	333746	6251493	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH303	0.08	8/5/10	Area B	333753	6251477	2.32	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH303	1	8/11/10	Area B	333753	6251477	1.4	<10	<50	120	<100	120	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH303	2.2	8/11/10	Area B	333753	6251477	0.2	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH303	3.9	8/11/10	Area B	333753	6251477	-1.5	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH303	4.9	8/11/10	Area B	333753	6251477	-2.5	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH303	5.8	8/11/10	Area B	333753	6251477	-3.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH303	6.9	8/11/10	Area B	333753	6251477	-4.5	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH304	0.1	8/4/10	Area B	333755	6251420	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH304	10	8/5/10	Area B	333755	6251420	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH304	1	8/4/10	Area B	333755	6251420	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH304	2	8/4/10	Area B	333755	6251420	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH304	3	8/4/10	Area B	333755	6251420	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH304	4	8/4/10	Area B	333755	6251420	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH304	5	8/5/10	Area B	333755	6251420	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH304	6	8/5/10	Area B	333755	6251420	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH304	7	8/5/10	Area B	333755	6251420	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH304	8	8/5/10	Area B	333755	6251420	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH304	9	8/5/10	Area B	333755	6251420	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH305	0.1	8/4/10	Area B	333753	6251398	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH305	1.2	8/4/10	Area B	333753	6251398	1.2	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH305	10	8/10/10	Area B	333753	6251398	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH305	11	8/11/10	Area B	333753	6251398	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH305	2	8/4/10	Area B	333753	6251398	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH305	3	8/4/10	Area B	333753	6251398	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH305	1	8/4/10	Area B	333753	6251398	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH305	5	8/4/10	Area B	333753	6251398	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH305	6	8/4/10	Area B	333753	6251398	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH305	7	8/4/10	Area B	333753	6251398	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH305	8	8/10/10	Area B	333753	6251398	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH305	9	8/10/10	Area B	333753	6251398	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH306	0.1	8/4/10	Area B	333752	6251362	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH306	0.5	8/4/10	Area B	333752	6251362	1.9	<10	<50	280	320	600	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH306	10	8/4/10	Area B	333752	6251362	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH306	11	8/4/10	Area B	333752	6251362	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH306	12	8/4/10	Area B	333752	6251362	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH306	13.4	8/4/10	Area B	333752	6251362	-11	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH306	2	8/4/10	Area B	333752	6251362	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH306	3	8/4/10	Area B	333752	6251362	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH306	4	8/4/10	Area B	333752	6251362	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH306	5	8/4/10	Area B	333752	6251362	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH306	6	8/4/10	Area B	333752	6251362	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH306	7	8/4/10	Area B	333752	6251362	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH306	8	8/4/10	Area B	333752	6251362	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH307	0.1	8/4/10	Area B	333715	6251529	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH307	1.5	8/4/10	Area B	333715	6251529	0.9	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH307	10	13/8/10	Area B	333715	6251529	-7.6	14	70	160	<100	230	<0.2	0.8	<0.5	2.4	1.5	3.9	-	-
AECOM	BH307	11	13/8/10	Area B	333715	6251529	-8.6	164	1220	1620	290	3130	4	9.1	4.8	29.4	23.6	53	-	-
AECOM	BH307	12	13/8/10	Area B	333715	6251529	-9.6	113	570	780	110	1460	6.5	5.4	3.6	20.8	15.5	36.3	-	-
AECOM	BH307	13	13/8/10	Area B	333715	6251529	-10.6	<10	90	200	<100	290	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH307	2	8/9/10	Area B	333715	6251529	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH307	3	8/9/10	Area B	333715	6251529	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH307	4	8/9/10	Area B	333715	6251529	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH307	5	8/9/10	Area B	333715	6251529	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH307	6	8/9/10	Area B	333715	6251529	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH307	7	13/8/10	Area B	333715	6251529	-4.6	<10	<50	320	280	600	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH307	9	13/8/10	Area B	333715	6251529	-6.6	88	470	650	<100	1120	1.2	9.9	3.1	9.4	11.3	20.7	-	-
AECOM	BH308	0.1	8/6/10	Area B	333735	6251438	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	10	13/8/10	Area B	333735	6251438	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	1	8/12/10	Area B	333735	6251438	1.4	<10	<50	160	<100	160	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	11	13/8/10	Area B	333735	6251438	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	12	13/8/10	Area B	333735	6251438	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	13	13/8/10	Area B	333735	6251438	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	14	13/8/10	Area B	333735	6251438	-11.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	2	8/12/10	Area B	333735	6251438	0.4	<10	<50	130	120	250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	3	8/12/10	Area B	333735	6251438	-0.6	<10	130	2560	1040	3730	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	4	8/12/10	Area B	333735	6251438	-1.6	<10	80	2940	1060	4080	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	5	13/8/10	Area B	333735	6251438	-2.6	<10	<50	710	300	1010	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	6	13/8/10	Area B	333735	6251438	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	7	13/8/10	Area B	333735	6251438	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	8	13/8/10	Area B	333735	6251438	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH308	9	13/8/10	Area B	333735	6251438	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH309	0.1	30/7/10	Area B	333736	6251400	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH309	1.5	8/4/10	Area B	333736	6251400	0.9	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH309	10.5	8/4/10	Area B	333736	6251400	-8.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH309	11.5	8/4/10	Area B	333736	6251400	-9.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH309	12.5	8/4/10	Area B	333736	6251400	-10.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH309	2.5	8/4/10	Area B	333736	6251400	-0.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH309	4.5	8/4/10	Area B	333736	6251400	-2.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH309	5.5	8/4/10	Area B	333736	6251400	-3.1	<10	<50	210	120	330	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH309	6.5	8/4/10	Area B	333736	6251400	-4.1	<10	<50	1310	620	1930	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH309	7.5	8/4/10	Area B	333736	6251400	-5.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH309	8.5	8/4/10	Area B	333736	6251400	-6.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH309	9.5	8/4/10	Area B	333736	6251400	-7.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH31	0.2	16/2/10	Area B	333646	6251473	2.25	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH31	2.5	16/2/10	Area B	333646	6251473	-0.05	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5		-	-
AECOM	BH31	16	17/2/10	Area C	333646	6251473	-13.55	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH31	23.5	17/2/10	Area C	333646	6251473	-21.05	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH310	0.1	30/7/10	Area B	333732	6251355	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH310	10	8/12/10	Area B	333732	6251355	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH310	1	8/12/10	Area B	333732	6251355	1.4	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH310	11	8/12/10	Area B	333732	6251355	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH310	12	8/12/10	Area B	333732	6251355	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH310	13	8/12/10	Area B	333732	6251355	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH310	14	8/12/10	Area B	333732	6251355	-11.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH310	15	8/12/10	Area B	333732	6251355	-12.6	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH310	16	8/12/10	Area B	333732	6251355	-13.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH310	2	8/12/10	Area B	333732	6251355	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH310	3	8/12/10	Area B	333732	6251355	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH310	5	8/12/10	Area B	333732	6251355	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH310	6	8/12/10	Area B	333732	6251355	-3.6	<10	<50	<100	160	160	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH310	9	8/12/10	Area B	333732	6251355	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	0.1	30/7/10	Area B	333742	6251341	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	0.9	8/2/10	Area B	333742	6251341	1.5	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	10	8/2/10	Area B	333742	6251341	-7.6	<10	80	530	360	970	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	11	8/2/10	Area B	333742	6251341	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	12	8/2/10	Area B	333742	6251341	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	13	8/2/10	Area B	333742	6251341	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	14	8/2/10	Area B	333742	6251341	-11.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	15	8/2/10	Area B	333742	6251341	-12.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	2	8/2/10	Area B	333742	6251341	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	3	8/2/10	Area B	333742	6251341	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	4	8/2/10	Area B	333742	6251341	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	5.8	8/2/10	Area B	333742	6251341	-3.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	5	8/2/10	Area B	333742	6251341	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	7	8/2/10	Area B	333742	6251341	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	8	8/2/10	Area B	333742	6251341	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH311	9	8/2/10	Area B	333742	6251341	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	0.1	30/7/10	Area B	333741	6251326	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	10	8/11/10	Area B	333741	6251326	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	1	8/2/10	Area B	333741	6251326	1.4	<10	<50	380	1190	1570	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	11	8/11/10	Area B	333741	6251326	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	12	8/11/10	Area B	333741	6251326	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	13	8/11/10	Area B	333741	6251326	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	14	8/11/10	Area B	333741	6251326	-11.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	15	8/11/10	Area B	333741	6251326	-12.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	16	8/11/10	Area B	333741	6251326	-13.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH312	2.8	8/2/10	Area B	333741	6251326	-0.4	<10	<50	<100	470	470	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	2	8/2/10	Area B	333741	6251326	0.4	<10	<50	240	450	690	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	4	8/11/10	Area B	333741	6251326	-1.6	<10	<50	1250	590	1840	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	5	8/11/10	Area B	333741	6251326	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	6	8/11/10	Area B	333741	6251326	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH312	8	8/11/10	Area B	333741	6251326	-5.6	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH312	9	8/11/10	Area B	333741	6251326	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH313	0.1	8/4/10	Area B	333699	6251512	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH313	1	8/9/10	Area B	333699	6251512	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH313	11	8/9/10	Area C	333699	6251512	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH313	12.5	8/9/10	Area C	333699	6251512	-10.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH313	14	8/9/10	Area C	333699	6251512	-11.6	<10	<50	190	180	370	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH313	2	8/9/10	Area B	333699	6251512	0.4	<10	<50	100	170	270	-	-	-	-	-	-	-	-
AECOM	BH313	3	8/9/10	Area B	333699	6251512	-0.6	<10	<50	310	250	560	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH313	4	8/9/10	Area B	333699	6251512	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH313	5	8/9/10	Area B	333699	6251512	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH313	6	8/9/10	Area B	333699	6251512	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH313	7	8/9/10	Area B	333699	6251512	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH313	8	8/9/10	Area B	333699	6251512	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH313	9.5	8/9/10	Area C	333699	6251512	-7.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH314	0.1	30/9/10	Area B	333711	6251398	2.3	<10	<50	290	220	510	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH314	10	30/9/10	Area C	333711	6251398	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH314	1	30/9/10	Area B	333711	6251398	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH314	11	30/9/10	Area C	333711	6251398	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH314	12	30/9/10	Area C	333711	6251398	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH314	2	30/9/10	Area B	333711	6251398	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH314	3	30/9/10	Area B	333711	6251398	-0.6	<10	<50	360	340	700	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH314	4	30/9/10	Area B	333711	6251398	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH314	5	30/9/10	Area B	333711	6251398	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH314	7	30/9/10	Area B	333711	6251398	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH314	8	30/9/10	Area B	333711	6251398	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH315	0.1	30/9/10	Area B	333709	6251379	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH315	1	30/9/10	Area B	333709	6251379	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH315	2	30/9/10	Area B	333709	6251379	0.4	<10	<50	<100	200	200	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH315	3	30/9/10	Area B	333709	6251379	-0.6	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH315	4	30/9/10	Area B	333709	6251379	-1.6	<10	70	560	350	980	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH315	5	30/9/10	Area B	333709	6251379	-2.6	<10	<50	500	490	990	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH315	6	30/9/10	Area B	333709	6251379	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH315	8	30/9/10	Area B	333709	6251379	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH316	0.1	8/4/10	Area B	333721	6251335	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH316	10	8/4/10	Area C	333721	6251335	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5		-	-
AECOM	BH316	1	8/4/10	Area B	333721	6251335	1.4	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH316	2	8/4/10	Area B	333721	6251335	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH316	3	8/4/10	Area B	333721	6251335	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH316	4	8/4/10	Area B	333721	6251335	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH316	6	8/4/10	Area B	333721	6251335	-3.6	<10	<50	170	170	340	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH316	7	8/4/10	Area B	333721	6251335	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH317	0.1	8/4/10	Area B	333681	6251474	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH317	1	8/6/10	Area B	333681	6251474	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH317	2	8/6/10	Area B	333681	6251474	0.4	<10	<50	<100	240	240	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH317	4	8/6/10	Area B	333681	6251474	-1.6	<10	<50	<100	110	110	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH317	5	8/6/10	Area B	333681	6251474	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH317	6	8/6/10	Area B	333681	6251474	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH317	7	8/6/10	Area B	333681	6251474	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH317	8	8/6/10	Area B	333681	6251474	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH317	9	8/6/10	Area C	333681	6251474	-6.6	<10	<50	130	<100	130	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH318	0.1	29/9/10	Area B	333686	6251415	2.3	<10	<50	210	210	420	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH318	1	29/9/10	Area B	333686	6251415	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH318	12	29/9/10	Area C	333686	6251415	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH318	13	29/9/10	Area C	333686	6251415	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH318	2	29/9/10	Area B	333686	6251415	0.4	<10	<50	170	180	350	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH318	3	29/9/10	Area B	333686	6251415	-0.6	<10	70	1420	890	2380	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH318	4	29/9/10	Area B	333686	6251415	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH318	5	29/9/10	Area B	333686	6251415	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH318	7	29/9/10	Area B	333686	6251415	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH318	8	29/9/10	Area B	333686	6251415	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH318	9	29/9/10	Area C	333686	6251415	-6.6	<10	<50	<100	170	170	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH319	0.1	29/9/10	Area B	333690	6251396	2.3	<10	<50	200	180	380	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH319	1	29/9/10	Area B	333690	6251396	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH319	2	29/9/10	Area B	333690	6251396	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH319	3	29/9/10	Area B	333690	6251396	-0.6	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH319	4	29/9/10	Area B	333690	6251396	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH319	5	29/9/10	Area B	333690	6251396	-2.6	<10	<50	200	<100	200	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH319	6	29/9/10	Area B	333690	6251396	-3.6	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH319	7	29/9/10	Area B	333690	6251396	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH319	8	29/9/10	Area B	333690	6251396	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	<10	<50	1190	1000	2190	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH32	14.5	2/12/10	Area C	333692	6251462	-11.68	<10	<50	870	790	1660	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH32	16	2/12/10	Area C	333692	6251462	-13.18	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH32	7	2/12/10	Area B	333692	6251462	-4.18	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH320	0.1	28/9/10	Area B	333692	6251377	2.3	<10	<50	340	510	850	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH320	10	28/9/10	Area C	333692	6251377	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH320	1	28/9/10	Area B	333692	6251377	1.4	<10	70	590	230	890	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH320	11	28/9/10	Area C	333692	6251377	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH320	12.4	28/9/10	Area C	333692	6251377	-10	<10	<50	1740	1600	3340	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH320	13	28/9/10	Area C	333692	6251377	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH320	2	28/9/10	Area B	333692	6251377	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH320	3	28/9/10	Area B	333692	6251377	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH320	5	28/9/10	Area B	333692	6251377	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH320	6	28/9/10	Area B	333692	6251377	-3.6	<10	<50	570	290	860	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH320	7	28/9/10	Area B	333692	6251377	-4.6	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH320	8	28/9/10	Area B	333692	6251377	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH320	9	28/9/10	Area C	333692	6251377	-6.6	<10	<50	340	240	580	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH321	0.23	8/4/10	Area B	333698	6251336	2.17	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH321	1	8/4/10	Area B	333698	6251336	1.4	<10	<50	430	560	990	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH321	11	8/4/10	Area C	333698	6251336	-8.6	<10	<50	<100	120	120	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH321	12.5	8/4/10	Area C	333698	6251336	-10.1	<10	<50	200	240	440	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH321	2	8/4/10	Area B	333698	6251336	0.4	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH321	3	8/4/10	Area B	333698	6251336	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH321	4	8/4/10	Area B	333698	6251336	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH321	5	8/4/10	Area B	333698	6251336	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH321	6	8/4/10	Area B	333698	6251336	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH321	7	8/4/10	Area B	333698	6251336	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH321	8	8/4/10	Area B	333698	6251336	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH321	9.5	8/4/10	Area C	333698	6251336	-7.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH322	0.1	23/7/10	Area B	333700	6251301	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH322	1	8/2/10	Area B	333700	6251301	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH322	2	8/2/10	Area B	333700	6251301	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH322	3	8/2/10	Area B	333700	6251301	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH322	4	8/2/10	Area B	333700	6251301	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH322	5.8	8/2/10	Area B	333700	6251301	-3.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH322	5	8/2/10	Area B	333700	6251301	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH322	7	8/2/10	Area B	333700	6251301	-4.6	<10	50	1920	2330	4300	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH322	8.5	8/2/10	Area C	333700	6251301	-6.1	<10	<50	130	150	280	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	16.8	8/5/10	Area C	333657	6251510	-14.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	0.1	8/4/10	Area B	333657	6251510	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	1.5	8/4/10	Area B	333657	6251510	0.9	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	10.5	8/4/10	Area C	333657	6251510	-8.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	11.5	8/4/10	Area C	333657	6251510	-9.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	12.5	8/4/10	Area C	333657	6251510	-10.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	13.5	8/5/10	Area C	333657	6251510	-11.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	14.5	8/5/10	Area C	333657	6251510	-12.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	15.5	8/5/10	Area C	333657	6251510	-13.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	2.5	8/4/10	Area B	333657	6251510	-0.1	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH323	3.5	8/4/10	Area B	333657	6251510	-1.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	4.5	8/4/10	Area B	333657	6251510	-2.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	5.5	8/4/10	Area B	333657	6251510	-3.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	6.5	8/4/10	Area B	333657	6251510	-4.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	7.5	8/4/10	Area B	333657	6251510	-5.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH323	8.5	8/4/10	Area C	333657	6251510	-6.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH323	9.5	8/4/10	Area C	333657	6251510	-7.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH324	10.5	8/9/10	Area C	333657	6251489	-8.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH324	2	8/5/10	Area B	333657	6251489	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH324	3	8/5/10	Area B	333657	6251489	-0.6	<10	<50	<100	130	130	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH324	4	8/5/10	Area B	333657	6251489	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH324	5	8/5/10	Area B	333657	6251489	-2.6	<10	<50	290	270	560	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH324	6	8/5/10	Area B	333657	6251489	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH324	7	8/5/10	Area B	333657	6251489	-4.6	<10	<50	360	240	600	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH324	8	8/5/10	Area B	333657	6251489	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH324	9	8/6/10	Area C	333657	6251489	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	0.1	8/5/10	Area B	333660	6251433	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	1.5	8/5/10	Area B	333660	6251433	0.9	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	10.5	8/6/10	Area C	333660	6251433	-8.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	11.5	8/6/10	Area C	333660	6251433	-9.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	12.5	8/6/10	Area C	333660	6251433	-10.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	2.5	8/5/10	Area B	333660	6251433	-0.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	3.5	8/5/10	Area B	333660	6251433	-1.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	4.5	8/5/10	Area B	333660	6251433	-2.1	<10	<50	420	620	1040	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	5.5	8/5/10	Area B	333660	6251433	-3.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	6.5	8/5/10	Area B	333660	6251433	-4.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	7.5	8/5/10	Area B	333660	6251433	-5.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	8.5	8/5/10	Area C	333660	6251433	-6.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH325	9.5	8/6/10	Area C	333660	6251433	-7.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH326	0.1	8/5/10	Area B	333659	6251418	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH326	1	8/6/10	Area B	333659	6251418	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH326	2	8/6/10	Area B	333659	6251418	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH326	3	8/6/10	Area B	333659	6251418	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH326	4	8/6/10	Area B	333659	6251418	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH326	5	8/6/10	Area B	333659	6251418	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH326	6	8/9/10	Area B	333659	6251418	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH326	7	8/9/10	Area B	333659	6251418	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH326	8	8/9/10	Area B	333659	6251418	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH327	0.1	8/5/10	Area B	333660	6251400	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH327	1	8/5/10	Area B	333660	6251400	1.4	<10	<50	120	130	250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH327	12	8/5/10	Area C	333660	6251400	-9.6	<10	<50	1190	1170	2360	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH327	13.5	8/5/10	Area C	333660	6251400	-11.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH327	2.	8/5/10	Area B	333660	6251400	0.4	<10	<50	170	140	310	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH327	3	8/5/10	Area B	333660	6251400	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH327	1	8/5/10	Area B	333660	6251400	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH327	5	8/5/10	Area B	333660	6251400	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH327	7	8/5/10	Area B	333660	6251400	-4.6	<10	<50	350	480	830	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH327	9	8/5/10	Area C	333660	6251400	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH328	0.1	28/9/10	Area B	333668	6251378	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH328	1	28/9/10	Area B	333668	6251378	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH328	2	28/9/10	Area B	333668	6251378	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH328	3	28/9/10	Area B	333668	6251378	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH328	4	28/9/10	Area B	333668	6251378	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH328	5	28/9/10	Area B	333668	6251378	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH328	6	28/9/10	Area B	333668	6251378	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH328	7	28/9/10	Area B	333668	6251378	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH328	8	28/9/10	Area B	333668	6251378	-5.6	<10	<50	290	<100	290	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH329	0.1	27/7/10	Area B	333670	6251356	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH329	10	27/9/10	Area C	333670	6251356	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH329	1	27/9/10	Area B	333670	6251356	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH329	12	27/9/10	Area C	333670	6251356	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH329	13	27/9/10	Area C	333670	6251356	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH329	2	27/9/10	Area B	333670	6251356	0.4	<10	<50	<100	120	120	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH329	3	27/9/10	Area B	333670	6251356	-0.6	<10	<50	160	180	340	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH329	4	27/9/10	Area B	333670	6251356	-1.6	<10	<50	400	810	1210	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH329	5	27/9/10	Area B	333670	6251356	-2.6	<10	70	390	500	960	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH329	6	27/9/10	Area B	333670	6251356	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH329	7	27/9/10	Area B	333670	6251356	-4.6	<10	<50	110	130	240	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH329	8	27/9/10	Area B	333670	6251356	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH33	0.75	12/2/10	Block 3	333699	6251546	1.55	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH33	5	12/2/10	Block 3	333699	6251546	-2.7	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH33	8	12/2/10	Block 3	333699	6251546	-5.7	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH33	0.75	2/12/10	Area B	333699	6251546	1.55	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH33	5	2/12/10	Area B	333699	6251546	-2.7	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH33	8	2/12/10	Area B	333699	6251546	-5.7	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH330	0.1	23/7/10	Area B	333674	6251337	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH330	1	8/4/10	Area B	333674	6251337	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH330	2	8/4/10	Area B	333674	6251337	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH330	3	8/4/10	Area B	333674	6251337	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH330	4	8/4/10	Area B	333674	6251337	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH330	5	8/4/10	Area B	333674	6251337	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH330	6	8/4/10	Area B	333674	6251337	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH330	7	8/4/10	Area B	333674	6251337	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH331	0.1	23/7/10	Area B	333676	6251315	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH331	10	8/4/10	Area C	333676	6251315	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH331	1	8/2/10	Area B	333676	6251315	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH331	11	8/4/10	Area C	333676	6251315	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH331	12	8/4/10	Area C	333676	6251315	-9.6	<10	<50	180	220	400	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH331	2	8/2/10	Area B	333676	6251315	0.4	<10	<50	360	380	740	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH331	3	8/2/10	Area B	333676	6251315	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH331	4	8/2/10	Area B	333676	6251315	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH331	5	8/2/10	Area B	333676	6251315	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH331	6	8/4/10	Area B	333676	6251315	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH331	7	8/4/10	Area B	333676	6251315	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH331	8	8/4/10	Area B	333676	6251315	-5.6	<10	<50	770	960	1730	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH331	9	8/4/10	Area C	333676	6251315	-6.6	<10	<50	480	790	1270	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH332	0.1	8/5/10	Area B	333642	6251451	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH332	1	8/5/10	Area B	333642	6251451	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH332	11	8/6/10	Area C	333642	6251451	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH332	12.6	8/6/10	Area C	333642	6251451	-10.2	<10	60	1450	1370	2880	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH332	2	8/5/10	Area B	333642	6251451	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH332	3	8/5/10	Area B	333642	6251451	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH332	5	8/5/10	Area B	333642	6251451	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH332	6	8/5/10	Area B	333642	6251451	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH332	7	8/5/10	Area B	333642	6251451	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH332	9.5	8/6/10	Area C	333642	6251451	-7.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH333	0.1	27/7/10	Area B	333644	6251433	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH333	1	8/2/10	Area B	333644	6251433	1.4	<10	<50	200	290	490	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH333	2	8/2/10	Area B	333644	6251433	0.4	<10	<50	180	320	500	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH333	3	8/2/10	Area B	333644	6251433	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH333	4	8/2/10	Area B	333644	6251433	-1.6	<10	<50	190	340	530	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH333	5	8/2/10	Area B	333644	6251433	-2.6	<10	<50	180	320	500	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH333	6	8/2/10	Area B	333644	6251433	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH333	7	8/2/10	Area B	333644	6251433	-4.6	<10	<50	1420	320	1740	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH333	8	8/2/10	Area B	333644	6251433	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH334	0.1	27/7/10	Area B	333645	6251412	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH334	10	8/2/10	Area C	333645	6251412	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH334	1	8/2/10	Area B	333645	6251412	1.4	<10	<50	180	160	340	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH334	11	8/2/10	Area C	333645	6251412	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH334	12	8/2/10	Area C	333645	6251412	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH334	13	8/2/10	Area C	333645	6251412	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH334	2	8/2/10	Area B	333645	6251412	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH334	4	8/2/10	Area B	333645	6251412	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH334	6	8/2/10	Area B	333645	6251412	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH334	7	8/2/10	Area B	333645	6251412	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH334	8	8/2/10	Area B	333645	6251412	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH334	9	8/2/10	Area C	333645	6251412	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH335	0.1	27/7/10	Area B	333649	6251395	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH335	1	8/5/10	Area B	333649	6251395	1.4	<10	<50	200	<100	200	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH335	3	8/5/10	Area B	333649	6251395	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH335	5	8/5/10	Area B	333649	6251395	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH335	6	8/5/10	Area B	333649	6251395	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH335	7	8/5/10	Area B	333649	6251395	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH335	8	8/5/10	Area B	333649	6251395	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH336	0.1	22/7/10	Area B	333652	6251355	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH336	1	30/7/10	Area B	333652	6251355	1.4	<10	<50	180	230	410	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH336	2	30/7/10	Area B	333652	6251355	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH336	3	30/7/10	Area B	333652	6251355	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH336	4	30/7/10	Area B	333652	6251355	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH336	5	30/7/10	Area B	333652	6251355	-2.6	<10	<50	160	180	340	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH336	6	30/7/10	Area B	333652	6251355	-3.6	<10	<50	<100	120	120	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH336	7	30/7/10	Area B	333652	6251355	-4.6	<10	<50	870	600	1470	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH336	8	30/7/10	Area B	333652	6251355	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH337	0.1	8/4/10	Area B	333661	6251315	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH337	1	8/4/10	Area B	333661	6251315	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH337	2	8/4/10	Area B	333661	6251315	0.4	<10	290	1520	620	2430	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH337	3	8/4/10	Area B	333661	6251315	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH337	4	8/4/10	Area B	333661	6251315	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH337	5	8/5/10	Area B	333661	6251315	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH337	6	8/5/10	Area B	333661	6251315	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH337	7	8/5/10	Area B	333661	6251315	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH337	8	8/5/10	Area B	333661	6251315	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH338	0	27/7/10	Area B	333659	6251299	2.4	<10	<50	100	150	250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH338	1	8/2/10	Area B	333659	6251299	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH338	3	8/2/10	Area B	333659	6251299	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH338	4	8/2/10	Area B	333659	6251299	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH338	5	8/2/10	Area B	333659	6251299	-2.6	<10	80	<100	<100	80	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH338	6	8/2/10	Area B	333659	6251299	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH338	7	8/2/10	Area B	333659	6251299	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH338	8	8/2/10	Area B	333659	6251299	-5.6	<10	<50	320	280	600	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH338	9	8/2/10	Area C	333659	6251299	-6.6	<10	<50	890	710	1600	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	0.1	22/7/10	Area B	333615	6251469	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	10	8/2/10	Area C	333615	6251469	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	1	30/7/10	Area B	333615	6251469	1.4	69	<50	1330	1390	2720	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	11	8/2/10	Area C	333615	6251469	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	12	8/2/10	Area C	333615	6251469	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	13	8/2/10	Area C	333615	6251469	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	14	8/2/10	Area C	333615	6251469	-11.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	2	30/7/10	Area B	333615	6251469	0.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	3	8/2/10	Area B	333615	6251469	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	4	8/2/10	Area B	333615	6251469	-1.6	<10	<50	130	110	240	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	5	8/2/10	Area B	333615	6251469	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	6	8/2/10	Area B	333615	6251469	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	7	8/2/10	Area B	333615	6251469	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	8	8/2/10	Area B	333615	6251469	-5.6	<10	160	140	150	450	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH339	9	8/2/10	Area C	333615	6251469	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH34	1.8	25/2/10	Block 4	333689	6251576	0.24	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH34	11	25/2/10	Block 4	333689	6251576	-8.96	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH34	3.8	25/2/10	Block 4	333689	6251576	-1.76	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH34	6	25/2/10	Block 4	333689	6251576	-3.96	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH340	0.1	21/7/10	Area B	333625	6251392	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH340	10	30/7/10	Area C	333625	6251392	-7.6	<10	<50	210	170	380	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH340	1	30/7/10	Area B	333625	6251392	1.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH340	11	30/7/10	Area C	333625	6251392	-8.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH340	12	30/7/10	Area C	333625	6251392	-9.6	<10	<50	480	510	990	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH340	13	30/7/10	Area C	333625	6251392	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH340	3	30/7/10	Area B	333625	6251392	-0.6	<10	<50	240	160	400	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH340	4	30/7/10	Area B	333625	6251392	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH340	6	30/7/10	Area B	333625	6251392	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH340	7	30/7/10	Area B	333625	6251392	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH340	8	30/7/10	Area B	333625	6251392	-5.6	<10	<50	<100	100	100	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH340	9	30/7/10	Area C	333625	6251392	-6.6	<10	<50	270	150	420	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH341	0.1	22/7/10	Area B	333627	6251372	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH341	1.5	29/7/10	Area B	333627	6251372	0.9	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH341	2.5	29/7/10	Area B	333627	6251372	-0.1	<10	<50	190	390	580	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH341	3.5	29/7/10	Area B	333627	6251372	-1.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH341	4.5	29/7/10	Area B	333627	6251372	-2.1	<10	<50	120	110	230	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH341	5.5	29/7/10	Area B	333627	6251372	-3.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH341	6.5	29/7/10	Area B	333627	6251372	-4.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH341	7.5	29/7/10	Area B	333627	6251372	-5.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH341	8.5	29/7/10	Area C	333627	6251372	-6.1	<10	<50	400	370	770	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH342	0.1	22/7/10	Area B	333633	6251335	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH342	1.0	30/7/10	Area B	333633	6251335	1.4	<10	<50	140	270	410	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH342	2	30/7/10	Area B	333633	6251335	0.4	<10	<50	470	660	1130	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH342	3	30/7/10	Area B	333633	6251335	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH342	5	30/7/10	Area B	333633	6251335	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH342	6	30/7/10	Area B	333633	6251335	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH342	7	30/7/10	Area B	333633	6251335	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH342	8	30/7/10	Area B	333633	6251335	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH343	0.1	22/7/10	Area B	333632	6251315	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH343	10.5	8/4/10	Area C	333632	6251315	-8.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH343	1	8/4/10	Area B	333632	6251315	1.4	<10	<50	230	240	470	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH343	12	8/4/10	Area C	333632	6251315	-9.6	<10	<50	230	280	510	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH343	13	8/4/10	Area C	333632	6251315	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH343	2	8/4/10	Area B	333632	6251315	0.4	<10	190	1090	380	1660	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH343	3	8/4/10	Area B	333632	6251315	-0.6	<10	<50	180	320	500	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH343	4	8/4/10	Area B	333632	6251315	-1.6	<10	<50	100	<100	100	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH343	5	8/4/10	Area B	333632	6251315	-2.6	<10	<50	360	490	850	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH343	6	8/4/10	Area B	333632	6251315	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH343	7	8/4/10	Area B	333632	6251315	-4.6	<10	120	560	660	1340	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH343	8	8/4/10	Area B	333632	6251315	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH344	0.1	22/7/10	Area B	333639	6251280	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH344	0.8	8/2/10	Area B	333639	6251280	1.6	<10	<50	1010	890	1900	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH344	1.8	8/2/10	Area B	333639	6251280	0.6	<10	140	4380	2980	7500	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH344	3	8/2/10	Area B	333639	6251280	-0.6	<10	<50	<100	140	140	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH344	4	8/2/10	Area B	333639	6251280	-1.6	<10	<50	250	410	660	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH344	5.8	8/2/10	Area B	333639	6251280	-3.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH344	5	8/2/10	Area B	333639	6251280	-2.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH344	7	8/2/10	Area B	333639	6251280	-4.6	<10	<50	710	1020	1730	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH344	8	8/2/10	Area B	333639	6251280	-5.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH344	9	8/2/10	Area C	333639	6251280	-6.6	<10	<50	180	290	470	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	0.1	21/7/10	Area A	333595	6251485	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	1.5	21/7/10	Area A	333595	6251485	0.9	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	10.5	21/7/10	Area A	333595	6251485	-8.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	12	22/7/10	Area A	333595	6251485	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	13.5	22/7/10	Area A	333595	6251485	-11.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	15	22/7/10	Area A	333595	6251485	-12.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	16.5	22/7/10	Area A	333595	6251485	-14.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	18	22/7/10	Area A	333595	6251485	-15.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	3	21/7/10	Area A	333595	6251485	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	4.5	21/7/10	Area A	333595	6251485	-2.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	6	21/7/10	Area A	333595	6251485	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	7.5	21/7/10	Area A	333595	6251485	-5.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH345	9	21/7/10	Area A	333595	6251485	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH346	0.1	21/7/10	Area A	333597	6251467	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH346	1.5	21/7/10	Area A	333597	6251467	0.9	<10	<50	100	<100	100	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH346	10.5	22/7/10	Area A	333597	6251467	-8.1	<10	<50	330	430	760	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH346	12	22/7/10	Area A	333597	6251467	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH346	13.5	22/7/10	Area A	333597	6251467	-11.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH346	15	22/7/10	Area A	333597	6251467	-12.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH346	16.5	22/7/10	Area A	333597	6251467	-14.1	<10	<50	350	210	560	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH346	17	22/7/10	Area A	333597	6251467	-14.6	<10	<50	1110	830	1940	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH346	3	21/7/10	Area A	333597	6251467	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH346	6	21/7/10	Area A	333597	6251467	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH346	7.5	21/7/10	Area A	333597	6251467	-5.1	<10	<50	220	210	430	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH346	9	21/7/10	Area A	333597	6251467	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH347	0.1	21/7/10	Area A	333603	6251446	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH347	1.5	22/7/10	Area A	333603	6251446	0.9	<10	<50	510	880	1390	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH347	10.5	23/7/10	Area A	333603	6251446	-8.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH347	12	23/7/10	Area A	333603	6251446	-9.6	<10	50	3700	1980	5730	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH347	13.5	23/7/10	Area A	333603	6251446	-11.1	<10	<50	150	130	280	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH347	15.1	23/7/10	Area A	333603	6251446	-12.7	<10	<50	470	400	870	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH347	15	23/7/10	Area A	333603	6251446	-12.6	<10	<50	390	290	680	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH347	3	22/7/10	Area A	333603	6251446	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH347	4.5	22/7/10	Area A	333603	6251446	-2.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH347	6	22/7/10	Area A	333603	6251446	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH347	7.5	22/7/10	Area A	333603	6251446	-5.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH347	9	22/7/10	Area A	333603	6251446	-6.6	<10	<50	<100	100	100	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH348	0.1	21/7/10	Area A	333602	6251429	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH348	1.5	23/7/10	Area A	333602	6251429	0.9	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH348	10.5	23/7/10	Area A	333602	6251429	-8.1	<10	70	<100	<100	70	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH348	12	26/7/10	Area A	333602	6251429	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH348	14.5	26/7/10	Area A	333602	6251429	-12.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH348	3	23/7/10	Area A	333602	6251429	-0.6	<10	<50	360	250	610	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH348	4.5	23/7/10	Area A	333602	6251429	-2.1	<10	<50	920	940	1860	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH348	6	23/7/10	Area A	333602	6251429	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH348	7.5	23/7/10	Area A	333602	6251429	-5.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH348	9	23/7/10	Area A	333602	6251429	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH349	0.1	21/7/10	Area A	333605	6251410	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH349	1.5	22/7/10	Area A	333605	6251410	0.9	<10	<50	160	350	510	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH349	10.5	23/7/10	Area A	333605	6251410	-8.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH349	12	26/7/10	Area A	333605	6251410	-9.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH349	13.6	26/7/10	Area A	333605	6251410	-11.2	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH349	3	22/7/10	Area A	333605	6251410	-0.6	<10	<50	<100	150	150	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH349	4.5	22/7/10	Area A	333605	6251410	-2.1	<10	<50	120	220	340	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH349	6	22/7/10	Area A	333605	6251410	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH349	7.5	23/7/10	Area A	333605	6251410	-5.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH349	9	23/7/10	Area A	333605	6251410	-6.6	<10	<50	190	140	330	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH35	0.9	22/2/10	Block 4	333706	6251580	1.29	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH35	4	22/2/10	Block 4	333706	6251580	-1.81	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH35	6.4	22/2/10	Block 4	333706	6251580	-4.21	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH35	9.9	22/2/10	Block 4	333706	6251580	-7.71	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH350	0.1	21/7/10	Area A	333608	6251395	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH350	1.5	30/7/10	Area A	333608	6251395	0.9	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH350	10	30/7/10	Area A	333608	6251395	-7.6	<10	<50	110	<100	110	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH350	11.5	30/7/10	Area A	333608	6251395	-9.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH350	14.5	30/7/10	Area A	333608	6251395	-12.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH350	16	30/7/10	Area A	333608	6251395	-13.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH350	2.5	30/7/10	Area A	333608	6251395	-0.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH350	4	30/7/10	Area A	333608	6251395	-1.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH350	5.5	30/7/10	Area A	333608	6251395	-3.1	<10	<50	1270	910	2180	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH350	8.5	30/7/10	Area A	333608	6251395	-6.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH351	0.1	23/7/10	Area A	333610	6251371	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH351	1.5	27/7/10	Area A	333610	6251371	0.9	<10	<50	120	270	390	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH351	10	27/7/10	Area A	333610	6251371	-7.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH351	11.5	27/7/10	Area A	333610	6251371	-9.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH351	14.5	27/7/10	Area A	333610	6251371	-12.1	<10	<50	360	500	860	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH351	2.5	27/7/10	Area A	333610	6251371	-0.1	<10	<50	230	380	610	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH351	4	27/7/10	Area A	333610	6251371	-1.6	<10	<50	210	220	430	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH351	7	27/7/10	Area A	333610	6251371	-4.6	<10	<50	220	190	410	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH351	8.5	27/7/10	Area A	333610	6251371	-6.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH352	9.5	27/7/10	Area A	333611	6251353	-7.1	<10	<50	140	150	290	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH352	0.1	23/7/10	Area A	333611	6251353	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH352	1.5	27/7/10	Area A	333611	6251353	0.9	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH352	10.5	27/7/10	Area A	333611	6251353	-8.1	<10	<50	340	470	810	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH352	12	27/7/10	Area A	333611	6251353	-9.6	<10	<50	320	400	720	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH352	13.5	27/7/10	Area A	333611	6251353	-11.1	<10	<50	370	440	810	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH352	3	27/7/10	Area A	333611	6251353	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH352	4.5	27/7/10	Area A	333611	6251353	-2.1	<10	<50	510	770	1280	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH352	6	27/7/10	Area A	333611	6251353	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH352	7.5	27/7/10	Area A	333611	6251353	-5.1	<10	<50	200	340	540	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH353	0.1	23/7/10	Area A	333613	6251333	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH353	1.5	27/7/10	Area A	333613	6251333	0.9	<10	<50	600	1450	2050	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH353	10.5	28/7/10	Area A	333613	6251333	-8.1	<10	<50	990	670	1660	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH353	11.7	29/7/10	Area A	333613	6251333	-9.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH353	13	29/7/10	Area A	333613	6251333	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH353	3	27/7/10	Area A	333613	6251333	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH353	4	27/7/10	Area A	333613	6251333	-1.6	<10	<50	<100	210	210	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH353	6	28/7/10	Area A	333613	6251333	-3.6	<10	<50	130	100	230	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH353	7.5	28/7/10	Area A	333613	6251333	-5.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH354	0.1	23/7/10	Area A	333615	6251314	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH354	1.5	29/7/10	Area A	333615	6251314	0.9	<10	<50	200	280	480	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH354	10.5	29/7/10	Area A	333615	6251314	-8.1	<10	50	520	440	1010	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH354	12	29/7/10	Area A	333615	6251314	-9.6	<10	<50	500	380	880	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH354	13.5	29/7/10	Area A	333615	6251314	-11.1	<10	<50	<100	<100	<50	0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH354	3	29/7/10	Area A	333615	6251314	-0.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH354	4.5	29/7/10	Area A	333615	6251314	-2.1	<10	<50	280	410	690	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH354	6	29/7/10	Area A	333615	6251314	-3.6	<10	<50	500	380	880	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH354	7.5	29/7/10	Area A	333615	6251314	-5.1	<10	<50	400	420	820	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH355	0	27/7/10	Area A	333617	6251295	2.4	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH355	1.5	29/7/10	Area A	333617	6251295	0.9	<10	<50	120	140	260	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH355	11.5	29/7/10	Area A	333617	6251295	-9.1	<10	<50	520	290	810	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH355	13	30/7/10	Area A	333617	6251295	-10.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH355	2.5	29/7/10	Area A	333617	6251295	-0.1	<10	<50	500	780	1280	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH355	4	29/7/10	Area A	333617	6251295	-1.6	<10	<50	220	220	440	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH355	5.5	29/7/10	Area A	333617	6251295	-3.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH355	7	29/7/10	Area A	333617	6251295	-4.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH355	8.5	29/7/10	Area A	333617	6251295	-6.1	<10	<50	360	310	670	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH356	0.1	27/7/10	Area A	333619	6251279	2.3	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH356	1.3	28/7/10	Area A	333619	6251279	1.1	<10	<50	100	140	240	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH356	10.5	29/7/10	Area A	333619	6251279	-8.1	<10	<50	140	130	270	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH356	12	29/7/10	Area A	333619	6251279	-9.6	<10	<50	240	270	510	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH356	13.5	29/7/10	Area A	333619	6251279	-11.1	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH356	3	28/7/10	Area A	333619	6251279	-0.6	<10	<50	<100	110	110	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH356	4	28/7/10	Area A	333619	6251279	-1.6	<10	<50	180	110	290	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH356	6	29/7/10	Area A	333619	6251279	-3.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH356	7.5	29/7/10	Area A	333619	6251279	-5.1	<10	<50	140	<100	140	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH356	9	29/7/10	Area A	333619	6251279	-6.6	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH36	0.7	19/2/10	Block 3	333684	6251545	1.55	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH36	1	3/3/10	Block 3	333684	6251545	1.25	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH36	13	3/3/10	Block 3	333684	6251545	-10.75	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH36	15	3/3/10	Block 3	333684	6251545	-12.75	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH36	4	3/3/10	Block 3	333684	6251545	-1.75	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH36	8.5	3/3/10	Block 3	333684	6251545	-6.25	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH36	0.7	19/2/10	Area B	333684	6251545	1.55	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH36	1	3/3/10	Area B	333684	6251545	1.25	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH36	13	3/3/10	Area C	333684	6251545	-10.75	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5		-	<1
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH36	8.5	3/3/10	Area C	333684	6251545	-6.25	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5		-	-
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	53	<50	<100	<100	<50	0.6	2.6	5.7	12.2	6.9		-	<1
AECOM	BH37	0.06	17/2/10	Area B	333655	6251543	2.17	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH37	15.8	18/2/10	Area C	333655	6251543	-13.57	-	-	-	-	-	-	-	-	-	-	-	<1	<1
AECOM	BH37	2.5	17/2/10	Area B	333655	6251543	-0.27	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	-	-	-	-	-	3.1	2.9	12	10.2	5.5		<1	<1
AECOM	BH37	5.5	18/2/10	Area B	333655	6251543	-3.27	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH37	8.3	18/2/10	Area B	333655	6251543	-6.07	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH38	0.15	18/2/10	Southern Cove	333620	6251544	2.22	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	-	-	-	-	-	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH38	14.5	19/2/10	Southern Cove	333620	6251544	-12.13	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH38	2.5	19/2/10	Southern Cove	333620	6251544	-0.13	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH38	20.5	19/2/10	Southern Cove	333620	6251544	-18.13	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH38	8.5	19/2/10	Southern Cove	333620	6251544	-6.13	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH39	0.15	18/2/10	Southern Cove	333609	6251568	2.33	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH39	11.5	24/2/10	Southern Cove	333609	6251568	-9.02	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH39	16	24/2/10	Southern Cove	333609	6251568	-13.52	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	<1
AECOM	BH39	2.5	23/2/10	Southern Cove	333609	6251568	-0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	<1
AECOM	BH39	4	24/2/10	Southern Cove	333609	6251568	-1.52	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH39	7	24/2/10	Southern Cove	333609	6251568	-4.52	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH40	1	18/2/10	Southern Cove	333642	6251571	1.12	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH40	13	18/2/10	Proposed Southern Cove	333642	6251571	-10.88	-	-	-	-	-	-	-	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH40	14.5	19/2/10	Southern Cove	333642	6251571	-12.38	-	-	-	-	-	-	-	-	-	-	-	<1	-
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	-	-	-	-	-	5.4	1.3	14	17.2	5.6	22.8	<1	<1
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	-	-	-	-	-	0.8	<0.5	1.5	2.4	1	3.4	<1	<1
AECOM	BH40	19	18/2/10	Southern Cove	333642	6251571	-16.88	<10	<50	<100	<100	<50	0.6	<0.5	0.6	<0.5	<0.5	<1	-	-
AECOM	BH40	7	18/2/10	Southern Cove	333642	6251571	-4.88	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH41	0.07	19/2/10	Southern Cove	333661	6251582	2.152	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	1	4/3/10	Southern Cove	333661	6251582	1.222	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH41	14.5	8/3/10	Southern Cove	333661	6251582	-12.278	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH41	16	8/3/10	Southern Cove	333661	6251582	-13.778	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<10	<50	<100	<100	<50	0.8	<0.5	1	<0.5	<0.5	<1	-	-
AECOM	BH41	4	4/3/10	Southern Cove	333661	6251582	-1.778	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH41	8.5	4/3/10	Southern Cove	333661	6251582	-6.278	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH42	1	23/2/10	Block 4	333738	6251549	1.51	<10	<50	110	<100	110	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH42	20.5	19/2/10	Southern Cove	333738	6251549	-17.99	-	-	-	-	-	-	-	-	-	-	-	<1	-
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	234	4680	13200	4150	22000	1	40.8	1.5	39.9	83.6	123.5	-	-
AECOM	BH42	3.5	23/2/10	Block 4	333738	6251549	-0.99	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH43	8.5	19/2/10	Southern Cove	333761	6251581	-5.92	-	-	-	-	-	-	-	-	-	-	-	<1	-
AECOM	BH44	1.4	23/2/10	Block 4	333733	6251591	0.95	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH44	1.9	23/2/10	Block 4	333733	6251591	0.45	10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	147	1040	2650	650	4340	2.1	18.1	5.4	25.7	20.9	46.6	<1	-
AECOM	BH45	0.8	23/2/10	Proposed Southern Cove	333698	6251587	1.36	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH45	13.2	23/2/10	Proposed Southern Cove	333698	6251587	-11.04	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH45	3.2	23/2/10	Proposed Southern Cove	333698	6251587	-1.04	10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH45	7.2	23/2/10	Proposed Southern Cove	333698	6251587	-5.04	12	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH46	1	23/2/10	Southern Cove	333627	6251582	1.22	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH46	14.5	23/2/10	Southern Cove	333627	6251582	-12.28	<10	200	560	200	960	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	<1
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	<1
AECOM	BH46	20.5	23/2/10	Southern Cove	333627	6251582	-18.28	<10	<50	<100	<100	<50	0.4	<0.5	<0.5	<0.5	<0.5	<1	<1	<1
AECOM	BH46	23.5	23/2/10	Southern Cove	333627	6251582	-21.28	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH46	4	23/2/10	Southern Cove	333627	6251582	-1.78	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH46	7	23/2/10	Southern Cove	333627	6251582	-4.78	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	<1
AECOM	BH47	10	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-7.62	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH47	1	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	1.38	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	<10	<50	480	380	860	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH47	18.6	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-16.22	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH47	4	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-1.62	<10	<50	850	900	1750	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH47	8.5	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-6.12	<10	<50	500	380	880	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH48	0.15	19/2/10	Block 4	333652	6251615	2.31	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH48	1	22/2/10	Block 4	333652	6251615	1.46	<10	<50	200	150	350	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	*90*	1750	3610	1040	*6400*	8.9	1.6	20.8	20.1	7	27.1	<1	-
AECOM	BH48	17	23/2/10	Block 4	333652	6251615	-14.54	<10	60	110	<100	170	0.2	<0.5	0.8	0.8	<0.5	1.05	-	-
AECOM	BH48	8.5	23/2/10	Block 4	333652	6251615	-6.04	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH48	14.5	23/2/10		333652	6251615	-12.04	-	-	-	-	-	-	-	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH49	1.5	22/2/10	Block 4	333699	6251517	1.04	11	80	1460	790	2330	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH49	10.2	22/2/10	Block 4	333699	6251517	-7.66	56	670	1240	420	2330	5.5	1.4	10.8	9.9	4.7	14.6	<1	-
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	-	-	-	-	-	10.2	2	16.6	21.2	7.7	28.9	<1	-
AECOM	BH49	4.2	22/2/10	Block 4	333699	6251517	-1.66	13	250	1610	1080	2940	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	<10	160	450	150	760	1.6	<0.5	1.8	2	0.8	2.8	<1	-
AECOM	BH49	8.2	22/2/10	Block 4	333699	6251517	-5.66	348	1160	2650	790	4600	49.7	5.2	74.6	61.5	22.6	84.1	-	-
AECOM	BH50	0.15	24/2/10	Block 4	333741	6251608	2.36	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH50	1.3	26/2/10	Block 4	333741	6251608	1.21	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH52	0.15	17/2/10	Block 4	333710	6251631	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH52	1	22/2/10	Block 4	333710	6251631	1.47	78	<50	580	370	950	0.2	2.7	3.9	20.2	8.7	28.9	-	-
AECOM	BH52	2.2	22/2/10	Block 4	333710	6251631	0.27	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH52	4.2	22/2/10	Block 4	333710	6251631	-1.73	10	<50	6600	2370	8970	1.7	1	1.1	1.4	0.7	2.1	<1	-
AECOM	BH54	0.6	18/2/10	Block 4	333737	6251636	1.53	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH54	1	23/2/10	Block 4	333737	6251636	1.13	72	4380	11700	3560	19600	2.5	3.5	7.3	25	10.5	35.5	-	-
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	13	900	2980	1000	4880	<0.2	0.8	<0.5	3.2	1.6	4.8	<1	-
AECOM	BH55	1	25/2/10	Block 4	333725	6251640	1.23	109	11300	19400	5550	36200	7.8	2.8	14	24.1	10.8	34.9	-	127
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	304	6420	10600	3740	20760	22.2	29.6	2.3	48.8	51.6	100.4	-	249
AECOM	BH55	2.7	25/2/10	Block 4	333725	6251640	-0.47	104	9150	14800	4750	28700	9.4	8.9	2	19.8	21.1	40.9	-	22
AECOM	BH56	11.5	4/3/10	Public Domain Blocks 4&5	333616	6251645	-8.89	<10	<50	200	130	330	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH56	13	5/3/10	Public Domain Blocks 4&5	333616	6251645	-10.39	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH56	17.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-14.89	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH56	2.5	4/3/10	Public Domain Blocks 4&5	333616	6251645	0.11	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH56	20.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-17.89	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH56	21.4	5/3/10	Public Domain Blocks 4&5	333616	6251645	-18.79	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	<10	70	1090	540	1700	0.3	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH57	11.5	25/2/10	Block 4	333648	6251649	-8.99	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	<1
AECOM	BH57	16.5	25/2/10	Block 4	333648	6251649	-13.99	-	-	-	-	-	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH57	4	25/2/10	Block 4	333648	6251649	-1.49	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH57	7	25/2/10	Block 4	333648	6251649	-4.49	<10	<50	410	200	610	-	-	-	-	-	-	-	<1
AECOM	BH58	0.15	17/2/10	Block 4	333697	6251651	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH58	10.2	22/2/10	Block 4	333697	6251651	-7.75	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH58	10.8	22/2/10	Block 4	333697	6251651	-8.35	<10	<50	420	430	850	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH58	1	22/2/10	Block 4	333697	6251651	1.45	<10	<50	550	460	1010	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH58	3.2	22/2/10	Block 4	333697	6251651	-0.75	<10	80	450	380	910	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH58	5.2	22/2/10	Block 4	333697	6251651	-2.75	<10	<50	320	300	620	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<10	<50	640	510	1150	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH59	0.15	17/2/10	Block 4	333730	6251655	2.22	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH59	1.9	22/2/10	Block 4	333730	6251655	0.47	<10	980	2290	860	4130	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH59	1	22/2/10	Block 4	333730	6251655	1.37	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	459	9120	19200	6140	34460	82.4	88.3	32.5	103	51.2	154.2	-	-
AECOM	BH59	4.2	22/2/10	Block 4	333730	6251655	-1.83	14	140	380	130	650	3.4	<0.5	2.9	2.4	0.9	3.3	<1	-
AECOM	BH60	0.17	24/2/10	Public Domain Blocks 4&5	333586	6251687	2.52	-	-	-	-	-	-	-	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH60	13	1/3/10	Public Domain Blocks 4&5	333586	6251687	-10.31	<10	<50	230	210	440	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH60	16	1/3/10	Public Domain Blocks 4&5	333586	6251687	-13.31	84	760	1660	620	3040	5.8	1	15.5	13.4	4.8	18.2	-	<1
AECOM	BH60	17.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-14.81	12	60	160	<100	270	0.6	<0.5	1.9	2.4	0.9	3.3	-	-
AECOM	BH60	2.5	1/3/10	Public Domain Blocks 4&5	333586	6251687	0.19	<10	<50	430	680	1135	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	15
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH60	7	1/3/10	Public Domain Blocks 4&5	333586	6251687	-4.31	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH62	1	26/2/10	Block 5	333682	6251687	1.23	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	9
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH62	3.4	26/2/10	Block 5	333682	6251687	-1.17	<10	<50	140	240	380	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH62	5.4	26/2/10	Block 5	333682	6251687	-3.17	<10	<50	390	330	720	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH62	8	26/2/10	Block 5	333682	6251687	-5.77	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH63	11.5	1/3/10	Public Domain Blocks 4&5	333642	6251713	-9.15	<10	<50	200	<100	275	0.2	<0.5	<0.5	1.7	1.4	3.1	<1	<1
AECOM	BH63	13	1/3/10	Public Domain Blocks 4&5	333642	6251713	-10.65	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	<1
AECOM	BH63	17.7	1/3/10	Public Domain Blocks 4&5	333642	6251713	-15.35	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH63	2.5	26/2/10	Public Domain Blocks 4&5	333642	6251713	-0.15	<10	<50	800	630	1455	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH63	20.5	2/3/10	Public Domain Blocks 4&5	333642	6251713	-18.15	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	<1
AECOM	BH63	6.5	26/2/10	Public Domain Blocks 4&5	333642	6251713	-4.15	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH64	0.15	1/3/10	Block 5	333717	6251694	2.22	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH64	10	1/3/10	Block 5	333717	6251694	-7.63	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH64	1	1/3/10	Block 5	333717	6251694	1.37	<10	260	1970	1000	3230	0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH64	2.5	1/3/10	Block 5	333717	6251694	-0.13	<10	<50	640	590	1230	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH64	5.5	1/3/10	Block 5	333717	6251694	-3.13	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH65	0.15	23/2/10	Block 5	333709	6251701	2.26	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	14	450	1110	220	1780	<0.2	0.8	<0.5	3.5	2.3	5.8	<1	-
AECOM	BH65	13.4	24/2/10	Block 5	333709	6251701	-10.99	<10	100	380	<100	480	<0.2	<0.5	<0.5	1.1	0.7	1.8	<1	-
AECOM	BH65	3.4	24/2/10	Block 5	333709	6251701	-0.99	<10	710	7500	5760	13970	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH65	8.2	24/2/10	Block 5	333709	6251701	-5.79	<10	<50	560	470	1030	-	-	-	-	-	-	-	-
AECOM	BH66	2.3	24/2/10	Block 5	333731	6251712	-0.02	<10	<50	420	390	810	<0.2	<0.5	<0.5	<0.5	<0.5	<1	<1	-
AECOM	BH66	3.2	24/2/10	Block 5	333731	6251712	-0.92	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH66	7	24/2/10	Block 5	333731	6251712	-4.72	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH68	2.5	2/3/10	Block 5	333758	6251752	0.06	<10	<50	320	450	770	-	-	-	-	-	-	-	-
AECOM	BH68	4	2/3/10	Block 5	333758	6251752	-1.44	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH68	7	2/3/10	Block 5	333758	6251752	-4.44	<10	<50	<100	<100	<50	-	-	-	-	-	-	-	-
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	<10	<50	420	<100	420	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH69	1	26/2/10	Block 5	333706	6251737	1.4	<10	<50	260	200	460	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	8
AECOM	BH69	4	26/2/10	Block 5	333706	6251737	-1.6	<10	<50	320	270	590	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH70	0.1	3/3/10	Block 5	333712	6251766	2.19	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH70	11.5	8/3/10	Block 5	333712	6251766	-9.21	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH70	13	8/3/10	Block 5	333712	6251766	-10.71	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	16	8/3/10	Block 5	333712	6251766	-13.71	*2640*	19400	29500	9240	*58140*	300	40.1	346	481	179	660	-	<1
AECOM	BH70	2.5	8/3/10	Block 5	333712	6251766	-0.21	14	<50	580	1250	*1830*	0.6	1.4	<0.5	1.2	1.7	2.9	-	<1
AECOM	BH70	4	8/3/10	Block 5	333712	6251766	-1.71	<10	<50	<100	<100	<50	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH70	5.5	8/3/10	Block 5	333712	6251766	-3.21	<10	<50	1640	2580	*4220*	0.3	<0.5	<0.5	<0.5	<0.5	<1	-	<1

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
AECOM	BH70	8.5	8/3/10	Block 5	333712	6251766	-6.21	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH71	0.08	3/3/10	Public Domain Blocks 4&5	333677	6251751	2.7	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH71	13	4/3/10	Public Domain Blocks 4&5	333677	6251751	-10.22	<10	<50	110	<100	185	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH71	19	4/3/10	Public Domain Blocks 4&5	333677	6251751	-16.22	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH71	23.5	5/3/10	Public Domain Blocks 4&5	333677	6251751	-20.72	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH71	7	4/3/10	Public Domain Blocks 4&5	333677	6251751	-4.22	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH72	0.15	25/2/10	Public Domain Blocks 4&5	333634	6251746	2.37	<10	<50	<100	<100	<250	-	-	-	-	-	-	-	-
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH72	13	3/3/10	Public Domain Blocks 4&5	333634	6251746	-10.48	<10	<50	1660	940	2625	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH72	16	4/3/10	Public Domain Blocks 4&5	333634	6251746	-13.48	<10	<50	520	220	740	<0.2	<0.5	<0.5	0.6	<0.5	0.85	-	-
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH72	2.5	3/3/10	Public Domain Blocks 4&5	333634	6251746	0.02	<10	<50	160	130	290	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH72	20.5	4/3/10	Public Domain Blocks 4&5	333634	6251746	-17.98	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH73	11.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-8.87	<10	<50	<100	110	110	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH73	16	2/3/10	Public Domain Blocks 4&5	333582	6251695	-13.37	<10	120	200	<100	320	0.6	<0.5	<0.5	0.7	<0.5	0.95	-	<1
AECOM	BH73	17.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-14.87	34	<50	<100	<100	<250	0.7	0.7	4.9	8.5	3.3	11.8	-	<1
AECOM	BH73	19	2/3/10	Public Domain Blocks 4&5	333582	6251695	-16.37	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH73	2.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	0.13	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH73	20.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-17.87	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH73	7	2/3/10	Public Domain Blocks 4&5	333582	6251695	-4.37	<10	<50	130	150	280	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	<10	<50	130	100	230	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	<10	<50	340	150	490	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	5
AECOM	BH74	13	3/3/10	Public Domain Blocks 4&5	333626	6251702	-10.67						-	-	-	-	-	-	-	-
AECOM	BH74	16	3/3/10	Public Domain Blocks 4&5	333626	6251702	-13.67	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH74	5.5	3/3/10	Public Domain Blocks 4&5	333626	6251702	-3.17	<10	<50	200	<100	200	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH74	8.5	3/3/10	Public Domain Blocks 4&5	333626	6251702	-6.17	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	BH75	1	25/2/10	Public Domain Blocks 4&5	333617	6251749	1.34	<10	<50	<100	<100	<250	-	-	-	-	-	-	-	-
AECOM	BH75	16	26/2/10	Public Domain Blocks 4&5	333617	6251749	-13.66	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	BH75	4	25/2/10	Public Domain Blocks 4&5	333617	6251749	-1.66	<10	<50	<100	<100	<250	-	-	-	-	-	-	-	-
AECOM	BH75	8.5	25/2/10	Public Domain Blocks 4&5	333617	6251749	-6.16	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
AECOM	SV09	0.2	26/2/10	Block 5	333585	6251733	2.21	<10	120	1920	1240	3280	0.5	<0.5	<0.5	<0.5	<0.5	<1	-	-
AECOM	SV09	1.3	26/2/10	Block 5	333585	6251733	1.11	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH001	1	1/5/06	Block 5	333728	6251686	1.39	3	2360	3280	1190	6830	0.5	<0.2	0.4	0.2	<0.2	0.3	-	322
ERM	BH001	4	2/5/06	Block 5	333728	6251686	-1.61	<2	<50	160	<100	235	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	29.6
ERM	BH017	0.5	8/5/06	Southern Cove	333724	6251690	1.86	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH017	1.5	8/5/06	Southern Cove	333724	6251690	0.86	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH017	21.5	8/5/06	Southern Cove	333724	6251690	-19.14	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH017	3	8/5/06	Southern Cove	333724	6251690	-0.64	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH018	0.3	5/8/06	Area B	333610	6251593	2.15	-	-	-	-	-	-	-	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
ERM	BH018	0	5/8/06	Area B	333610	6251593	2.45	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH018	3	5/8/06	Area B	333610	6251593	-0.55	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH019	0.3	8/5/06	Block 4	333689	6251510	1.88	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH019	1.5	8/5/06	Block 4	333689	6251510	0.68	50	100	<100	<100	200	-	-	-	-	-	-	-	-
ERM	BH019	2.5	8/5/06	Block 4	333689	6251510	-0.32	-	2180	3840	1060	-	-	-	-	-	-	-	-	-
ERM	BH019	3	8/5/06	Block 4	333689	6251510	-0.82	-	3160	5450	1870	-	-	-	-	-	-	-	-	-
ERM	BH020	0.3	9/5/06	Block 4	333724	6251628	1.9	<2	<50	460	350	835	-	-	-	-	-	-	-	-
ERM	BH020	1.5	9/5/06	Block 4	333724	6251628	0.7	<2	<50	280	340	645	-	-	-	-	-	-	-	-
ERM	BH020	3	9/5/06	Block 4	333724	6251628	-0.8	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH021	0.3	9/5/06	Block 4	333684	6251663	1.99	<2	<50	130	100	255	-	-	-	-	-	-	-	-
ERM	BH021	1.5	9/5/06	Public Domain Blocks 4&5	333684	6251663	0.79	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH021	16	9/5/06	Public Domain Blocks 4&5	333684	6251663	-13.71	32	510	1210	380	2100	-	-	-	-	-	-	-	-
ERM	BH026	0.3	12/5/06	Public Domain Blocks 4&5	333622	6251692	1.91	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH026	1.5	12/5/06	Public Domain Blocks 4&5	333622	6251692	0.71	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH026	16.5	15/5/06	Public Domain Blocks 4&5	333622	6251692	-14.29	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH028	0.3	12/5/06	Block 5	333617	6251775	2.05	<2	<50	200	140	365	-	-	-	-	-	-	-	-
ERM	BH028	13	12/5/06	Block 5	333617	6251775	-10.65	119	780	1370	250	2400	8.2	2.7	14.8	15.4	6.9	22.3	-	-
ERM	BH028	3	12/5/06	Block 5	333617	6251775	-0.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH035	0.3	18/5/06	Area B	333694	6251749	2.26	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH035	1.5	18/5/06	Area B	333694	6251749	1.06	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH035	4	18/5/06	Area B	333694	6251749	-1.44	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH042	0.3	23/5/06	Block 5	333654	6251541	1.91	<2	<50	150	<100	225	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH042	1.5	23/5/06	Block 5	333654	6251541	0.71	<2	<50	170	<100	245	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH042	6	23/5/06	Block 5	333654	6251541	-3.79	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH044	0.3	23/5/06	Block 5	333730	6251756	1.94	<2	<50	410	280	715	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH044	2.3	23/5/06	Block 5	333730	6251756	-0.06	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH044	4	23/5/06	Block 5	333730	6251756	-1.76	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH045	0.3	24/5/06	Block 5	333728	6251774	1.99	<2	<50	190	170	385	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH045	1.5	24/5/06	Block 5	333728	6251774	0.79	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH045	3	24/5/06	Block 5	333728	6251774	-0.71	<2	<50	420	460	905	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH046	1.5	24/5/06	Public Domain Blocks 4&5	333656	6251723	0.89	<2	<50	380	320	700	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH046	3	24/5/06	Public Domain Blocks 4&5	333656	6251723	-0.61	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH047	0.3	24/5/06	Area B	333641	6251753	2.33	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH047	1.5	24/5/06	Area B	333641	6251753	1.13	<2	<50	<100	<100	<250	-	-	-	-	-	-	-	-
ERM	BH048	1.5	24/5/06	Area B	333635	6251526	0.67	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH048	3	24/5/06	Area B	333635	6251526	-0.83	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH049	0.3	25/5/06	Area A	333621	6251500	2.14	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH049	3	25/5/06	Area A	333621	6251500	-0.56	<2	<50	<100	<100	<250	-	-	-	-	-	-	-	-
ERM	BH052	1.5	26/5/06	Public Domain Blocks 4&5	333617	6251533	0.94	<2	<50	<100	<100	<250	-	-	-	-	-	-	-	-
ERM	BH052	3	26/5/06	Public Domain Blocks 4&5	333617	6251533	-0.56	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH053	0.3	29/5/06	Public Domain Blocks 4&5	333607	6251758	2.01	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH053	1.5	29/5/06	Public Domain Blocks 4&5	333607	6251758	0.81	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH053	3	29/5/06	Public Domain Blocks 4&5	333607	6251758	-0.69	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
ERM	BH054	1.5	29/5/06	Public Domain Blocks 4&5	333603	6251640	1.26	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH054	3	29/5/06	Public Domain Blocks 4&5	333603	6251640	-0.24	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH055	0.8	30/5/06	Southern Cove	333663	6251601	1.51	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH055	1.8	30/5/06	Southern Cove	333663	6251601	0.51	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH055	3.3	30/5/06	Southern Cove	333663	6251601	-0.99	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH058	1.5	31/5/06	Block 5	333731	6251736	0.76	8	120	1960	1070	3150	0.3	0.3	0.2	<0.2	<0.2	<0.4	-	69.7
ERM	BH058	6	31/5/06	Block 5	333731	6251736	-3.74	40	220	510	<100	780	3.1	5.9	0.4	8.5	4.3	12.8	-	<1
ERM	BH059	1.5	31/5/06	Block 5	333712	6251751	0.79	<2	<50	290	260	575	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH059	3	31/5/06	Block 5	333712	6251751	-0.71	<2	<50	170	120	315	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH059	8.5	31/5/06	Block 5	333712	6251751	-6.21	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH060	1.7	31/5/06	Block 5	333722	6251703	0.73	<2	<50	<100	140	215	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	5.6
ERM	BH060	9.5	31/5/06	Block 5	333722	6251703	-7.07	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH062	1.5	31/5/06	Block 5	333701	6251699	0.85	8	100	610	510	1220	<0.2	<0.2	0.4	0.3	<0.2	0.4	-	489
ERM	BH062	3	31/5/06	Block 5	333701	6251699	-0.65	<2	<50	420	410	855	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	2.6
ERM	BH063	1.5	1/6/06	Public Domain Blocks 4&5	333642	6251664	0.79	<2	<50	420	400	820	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	3.3
ERM	BH063	2.8	1/6/06	Public Domain Blocks 4&5	333642	6251664	-0.51	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH064	1.5	1/6/06	Public Domain Blocks 4&5	333595	6251569	1.04	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH064	3	1/6/06	Public Domain Blocks 4&5	333595	6251569	-0.46	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH065	0.3	1/6/06	Block 4	333692	6251676	2	<2	<50	180	350	555	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	2.6
ERM	BH065	1.5	1/6/06	Block 4	333692	6251676	0.8	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH065	3	1/6/06	Block 4	333692	6251676	-0.7	3	90	1040	720	1850	<0.2	<0.2	<0.2	0.5	0.3	0.8	-	12.7
ERM	BH066	0.3	1/6/06	Block 5	333655	6251689	1.94	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH066	1.5	1/6/06	Block 5	333655	6251689	0.74	<2	<50	160	210	395	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH067	1.5	1/6/06	Block 5	333681	6251695	0.8	<2	<50	480	620	1125	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH067	3	1/6/06	Block 5	333681	6251695	-0.7	2	<50	1490	3020	4535	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH068	0.3	1/6/06	Block 4	333666	6251663	1.98	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH068	3	1/6/06	Block 4	333666	6251663	-0.72	<2	<50	<100	130	205	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH068	9.5	1/6/06	Block 4	333666	6251663	-7.22	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH070	0.3	2/5/06	Block 4	333683	6251681	1.9	<2	<50	600	210	835	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH070	1.5	2/5/06	Block 4	333683	6251681	0.7	<2	<50	230	340	595	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH071	1.5	2/5/06	Proposed Southern Cove	333666	6251589	0.84	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH071	3	2/5/06	Proposed Southern Cove	333666	6251589	-0.66	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH072	0.3	2/5/06	Proposed Southern Cove	333667	6251571	2.01	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH072	3	2/5/06	Proposed Southern Cove	333667	6251571	-0.69	<2	<50	120	<100	195	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH072	9.5	2/5/06	Proposed Southern Cove	333667	6251571	-7.19	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH073	1.5	2/5/06	Block 4	333735	6251645	0.73	<2	<50	560	270	855	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	8.7
ERM	BH073	3	2/5/06	Block 4	333735	6251645	-0.77	8	260	1340	260	1860	<0.2	2.1	<0.2	3.4	2.1	5.5	-	2.1
ERM	BH074	1.5	2/5/06	Block 5	333684	6251725	0.85	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH074	3	2/5/06	Block 5	333684	6251725	-0.65	3	<50	260	<100	335	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH074	9.5	2/5/06	Block 5	333684	6251725	-7.15	122	1510	2480	870	4860	14.9	1.6	21.1	20.7	7.6	28.3	-	<1
ERM	BH075	0.3	6/6/06	Block 4	333708	6251660	1.98	<2	<50	570	440	1035	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	7.6
ERM	BH075	3	6/6/06	Block 4	333708	6251660	-0.72	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	1.5
ERM	BH076	0.3	6/6/06	Public Domain Blocks 4&5	333586	6251646	2.32	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
ERM	BH076	1.5	6/6/06	Public Domain Blocks 4&5	333586	6251646	1.12	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	2.4
ERM	BH077	0.3	6/6/06	Block 5	333670	6251771	2.53	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH077	3	6/6/06	Block 5	333670	6251771	-0.17	<2	260	1210	490	*1960*	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH078	1.5	6/6/06	Block 5	333694	6251773	1.01	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH078	3	6/6/06	Block 5	333694	6251773	-0.49	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH079	0.3	6/6/06	Block 5	333671	6251743	2.44	<2	<50	110	<100	185	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH079	1.5	6/6/06	Block 5	333671	6251743	1.24	<2	<50	150	100	275	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH087	1.5	8/6/06	Block 4	333732	6251613	0.79	20	2230	5820	1520	9570	0.7	1.2	0.8	7.3	3.2	10.5	-	9.8
ERM	BH087	3	8/6/06	Block 4	333732	6251613	-0.71	271	4560	7310	1670	13540	15	47.5	24.9	79.9	38.6	118.5	-	26.7
ERM	BH087	7	8/6/06	Block 4	333732	6251613	-4.71	442	4360	6720	1550	12630	82.7	24.3	149	116	57.1	173.1	-	2.1
ERM	BH089	0.3	9/6/06	Block 4	333678	6251627	2.38	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH089	1.5	9/6/06	Block 4	333678	6251627	1.18	<2	70	440	170	680	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	2.1
ERM	BH089	3	9/6/06	Block 4	333678	6251627	-0.32	<2	<50	170	<100	245	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH090	1.5	9/6/06	Block 4	333682	6251647	1.02	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH090	3	9/6/06	Block 4	333682	6251647	-0.48	<2	<50	140	<100	215	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH091	0.3	13/6/06	Area B	333761	6251440	2.13	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH091	3	13/6/06	Area B	333761	6251440	-0.57	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH093	0.3	13/6/06	Area B	333679	6251281	1.73	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH093	1.5	13/6/06	Area B	333679	6251281	0.53	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH093	3	13/6/06	Area B	333679	6251281	-0.97	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH094	1.5	13/6/06	Area D	333756	6251343	1.02	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2		-	-
ERM	BH094	3	13/6/06	Area D	333756	6251343	-0.48	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH095	1.5	13/6/06	Area B	333663	6251334	0.93	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH095	3	13/6/06	Area B	333663	6251334	-0.57	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH096	1.5	13/6/06	Area B	333705	6251326	1.19	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH096	3	13/6/06	Area B	333705	6251326	-0.31	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH097	0.3	13/6/06	Area B	333731	6251385	2.3	<2	<50	380	430	810	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH098	1.7	13/6/06	Area B	333668	6251367	0.94	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH098	3	13/6/06	Area B	333668	6251367	-0.36	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH099	0.3	15/6/06	Area B	333649	6251404	2.07	<2	<50	140	130	270	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH100	1.5	15/6/06	Area B	333663	6251466	1.13	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH100	14	15/6/06	Area C	333663	6251466	-11.37	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH100	3	15/6/06	Area B	333663	6251466	-0.37	<2	<50	470	510	980	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH101	1.5	15/6/06	Area B	333722	6251441	1.17	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH101	14	15/6/06	Area C	333722	6251441	-11.33	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH102	1.5	16/6/06	Area B	333621	6251480	1.03	<2	<50	100	110	210	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH102	17.8	16/6/06	Area C	333621	6251480	-15.27	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH102	3	16/6/06	Area B	333621	6251480	-0.47	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH103	1.5	19/6/06	Area B	333625	6251434	1.05	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH103	3	19/6/06	Area B	333625	6251434	-0.45	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH104	0.3	19/6/06	Area B	333642	6251285	2.16	<2	<50	170	170	340	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH104	3	19/6/06	Area B	333642	6251285	-0.54	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH108	1.5	26/6/06	Area B	333633	6251360	1.05	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
ERM	BH108	3	27/6/06	Area B	333633	6251360	-0.45	<2	<50	260	270	530	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH109	0.3	27/6/06	Block 4	333683	6251569	1.81	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH109	3	27/6/06	Block 4	333683	6251569	-0.89	<2	<50	<100	130	205	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH109	9.5	27/6/06	Block 4	333683	6251569	-7.39	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH110	0.3	27/6/06	Area B	333671	6251531	2.01	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH110	1.5	27/6/06	Area B	333671	6251531	0.81	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH110	23.3	27/6/06	Area C	333671	6251531	-20.99	46	180	300	<100	480	7.8	2.2	14.1	11.5	6	17.5	-	-
ERM	BH110	3	27/6/06	Area B	333671	6251531	-0.69	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH111	1.5	27/6/06	Area B	333691	6251530	0.61	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	2.2
ERM	BH111	3	27/6/06	Area B	333691	6251530	-0.89	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH111	9.5	27/6/06	Area C	333691	6251530	-7.39	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2		-	-
ERM	BH112	1.5	27/6/06	Area B	333709	6251539	0.7	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH112	3	27/6/06	Area B	333709	6251539	-0.8	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH112	7	27/6/06	Area B	333709	6251539	-4.8	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	1
ERM	BH113	1.5	27/6/06	Block 4	333706	6251570	0.68	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH113	3	27/6/06	Block 4	333706	6251570	-0.82	<2	70	540	470	1080	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	1
ERM	BH114	0.3	28/6/06	Block 4	333718	6251554	1.98	<2	<50	130	210	365	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH114	3	28/6/06	Block 4	333718	6251554	-0.72	<2	60	620	360	1040	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH115	0.8	28/6/06	Block 4	333689	6251605	1.48	<2	<50	560	340	925	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH115	1.5	28/6/06	Block 4	333689	6251605	0.78	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	1.1
ERM	BH115	3	28/6/06	Block 4	333689	6251605	-0.72	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH116	1.5	28/6/06	Southern Cove	333607	6251595	0.97	<2	<50	350	410	760	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH116	3	28/6/06	Southern Cove	333607	6251595	-0.53	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH117	1.5	29/6/06	Area B	333722	6251516	0.85	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH117	10	29/6/06	Area B	333722	6251516	-7.65	10	170	<100	<100	170	<0.2	0.5	1.2	2.6	1.4	4	-	<1
ERM	BH117	15	29/6/06	Area B	333722	6251516	-12.65	244	3090	2180	310	5580	19.4	10.5	65.9	54.1	29.1	83.2	-	<1
ERM	BH118	1.5	30/6/06	Area B	333675	6251515	0.8	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH118	3	30/6/06	Area B	333675	6251515	-0.7	<2	50	<100	<100	50	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH118	9.5	30/6/06	Area C	333675	6251515	-7.2	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2		-	-
ERM	BH119	1.6	30/6/06	Block 4	333670	6251622	0.98	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH119	7.5	30/6/06	Block 4	333670	6251622	-4.92	1140	6750	13000	4690	24440	82.4	63	118	182	69.8	251.8	-	<1
ERM	BH119	9.5	30/6/06	Block 4	333670	6251622	-6.92	1060	5320	7940	2110	15370	97.8	14.7	124	152	53	205	-	<1
ERM	BH128	1.5	3/7/06	Public Domain Blocks 4&5	333572	6251768	0.94	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH128	20	3/7/06	Public Domain Blocks 4&5	333572	6251768	-17.56	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH129	0.4	5/7/06	Public Domain Blocks 4&5	333578	6251713	2.08	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH129	12.5	3/7/06	Public Domain Blocks 4&5	333578	6251713	-10.02	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH129	3	3/7/06	Public Domain Blocks 4&5	333578	6251713	-0.52	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH132	1.5	6/7/06	Proposed Southern Cove	333727	6251560	0.94	<2	<50	500	390	915	0.5	<0.2	<0.2	<0.2	<0.2	<0.4	-	20.5
ERM	BH132	8	6/7/06	Proposed Southern Cove	333727	6251560	-5.56	*1050*	1870	3040	1190	*6100*	140	44.7	232	225	120	345	-	-
ERM	BH133	0.3	6/7/06	Block 4	333747	6251595	2.07	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH133	1.5	6/7/06	Block 4	333747	6251595	0.87	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH134	0.4	7/11/06	Area B	333734	6251518	2.2	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH134	3	7/11/06	Area B	333734	6251518	-0.4	-	-	-	-	-	-	-	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
ERM	BH134	9.2	7/11/06	Area B	333734	6251518	-6.6	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH135A	0.4	11/7/06	Block 4	333725	6251577	2.06	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH135A	3	11/7/06	Block 4	333725	6251577	-0.54	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH136	3	6/7/06	Block 5	333703	6251780	-0.64	<2	<50	<100	<100	<250	-	-	-	-	-	-	-	2
ERM	BH136	8	6/7/06	Block 5	333703	6251780	-5.64	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH137	1.5	6/7/06	Block 4	333664	6251636	1.24	<2	70	1600	590	2260	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH137	12.5	6/7/06	Block 4	333664	6251636	-9.76	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH137	3	6/7/06	Block 4	333664	6251636	-0.26	325	1800	4490	1430	7720	-	-	-	-	-	-	-	-
ERM	BH141	1.5	7/7/06	Block 4	333721	6251645	0.78	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	71.7
ERM	BH141	3	7/7/06	Block 4	333721	6251645	-0.72	<2	<50	<100	<100	<250	41.8	49.1	17.3	86.5	60.3	146.8	-	-
ERM	BH142	1.5	10/7/06	Southern Cove	333654	6251577	0.62	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH142	9.5	10/7/06	Southern Cove	333654	6251577	-7.38	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH143	1.5	10/7/06	Southern Cove	333643	6251590	0.63	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH143	9	10/7/06	Southern Cove	333643	6251590	-6.87	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH145	0.3	11/7/06	Block 5	333713	6251681	1.89	4	80	2120	1270	3470	0.2	<0.2	0.4	0.3	<0.2	0.4	-	-
ERM	BH145	3	11/7/06	Block 5	333713	6251681	-0.81	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH146	1.5	11/7/06	Block 4	333736	6251583	0.94	2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	8.6
ERM	BH146	3	11/7/06	Block 4	333736	6251583	-0.56	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH146	4.1	11/7/06	Block 4	333736	6251583	-1.66	222	3020	3750	860	7630	15.2	13.9	25.3	56	31	87	-	1.2
ERM	BH156	0.4	14/8/06	Proposed Southern Cove	333726	6251602	2	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	<1
ERM	BH156	0.9	14/8/06	Proposed Southern Cove	333726	6251602	1.5	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	
ERM	BH159		14/8/06	Block 4	333706	6251570	#VALUE!	<2	<50	270	960	1255	<0.2	<0.2	<0.2	0.3	<0.2	0.4	-	<1
ERM	BH160	0.3	14/8/06	Block 4	333748	6251595	2.1	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH161	0.3	14/8/06	Block 4	333723	6251577	2.1	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	-	-
ERM	BH190	5.1	26/3/08	Public Domain Blocks 4&5	333612	6251728	-2.865	<10	<50	400	240	640	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH190	15	10/4/08	Public Domain Blocks 4&5	333612	6251728	-12.765	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH191	3.7	27/3/08	Public Domain Blocks 4&5	333591	6251690	-1.4	<10	120	700	380	1200	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	2
ERM	BH191	5.6	11/4/08	Public Domain Blocks 4&5	333591	6251690	-3.3	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH191	16.5	14/4/08	Public Domain Blocks 4&5	333591	6251690	-14.2	14	170	680	310	1160	2.2	0.6	5.1	5.7	2.1	7.8	-	<1
ERM	BH191	18.2	14/4/08	Public Domain Blocks 4&5	333591	6251690	-15.9	<10	<50	<100	<100	<250	0.3	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH192	3	19/3/08	Area B	333703	6251485	-0.481	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH192	7.4	19/3/08	Area B	333703	6251485	-4.881	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH192	16.5	20/3/08	Area C	333703	6251485	-13.981	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH193	2.5	20/3/08	Area B	333696	6251465	0.245	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH193	11.3	20/3/08	Area C	333696	6251465	-8.555	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH193	14.5	17/4/08	Area C	333696	6251465	-11.755	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	2
ERM	BH194	0.5	19/3/08	Area B	333685	6251446	2.417	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH194	1.5	20/3/08	Area B	333685	6251446	1.417	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH194	3.6	20/3/08	Area B	333685	6251446	-0.683	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH194	10.8	20/3/08	Area C	333685	6251446	-7.883	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH194	13.6	4/7/08	Area C	333685	6251446	-10.683	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH195	5.45	25/3/08	Area B	333707	6251426	-2.539	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH195	9.9	25/3/08	Area C	333707	6251426	-6.989	<10	<50	380	280	660	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
ERM	BH195	10.5	4/9/08	Area C	333707	6251426	-7.589	<10	<50	1240	950	2190	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH195	11.7	4/9/08	Area C	333707	6251426	-8.789	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH196	1	19/3/08	Area B	333720	6251359	1.761	<10	<50	190	<100	190	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH196	6.4	19/3/08	Area B	333720	6251359	-3.639	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH197	0.4	3/3/08	Block 5	333706	6251718	2.077	<10	<50	150	450	625	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH197	5	9/4/08	Block 5	333706	6251718	-2.523	26	560	3820	1480	5860	4.8	1.9	8	4.2	1.9	6.1	-	<1
ERM	BH197	6.5	9/4/08	Block 5	333706	6251718	-4.023	<10	<50	<100	<100	<250	0.5	<0.5	0.8	0.6	<0.5	0.85	-	<1
ERM	BH197	11.5	9/4/08	Block 5	333706	6251718	-9.023	<10	160	400	<100	610	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH197	15.9	10/4/08	Block 5	333706	6251718	-13.423	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH197	18.6	10/4/08	Block 5	333706	6251718	-16.123	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH198	3	6/3/08	Block 5	333731	6251708	-0.725	<10	1360	6690	1440	9490	<0.2	<0.5	<0.5	0.7	<0.5	0.95	-	3
ERM	BH198	4.5	6/3/08	Block 5	333731	6251708	-2.225	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH198	6.9	6/3/08	Block 5	333731	6251708	-4.625	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH199	2.7	11/3/08	Block 5	333719	6251681	-0.459	<10	<50	740	380	1145	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	11
ERM	BH199	3.7	11/3/08	Block 5	333719	6251681	-1.459	96	950	2620	920	4490	6.4	16.3	2.6	22.4	22.9	45.3	-	1
ERM	BH199	5.6	11/3/08	Block 5	333719	6251681	-3.359	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	1
ERM	BH199	6	17/3/08	Block 5	333719	6251681	-3.759	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH200	1	7/4/08	Block 4	333721	6251658	1.298	<10	520	10200	4730	15450	1.6	<0.5	2.2	2	0.8	2.8	-	200
ERM	BH200	2.5	7/4/08	Block 4	333721	6251658	-0.202	<10	110	1060	500	1670	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	44
ERM	BH200	6.53	7/4/08	Block 4	333721	6251658	-4.232	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH201	2.4	4/3/08	Block 5	333699	6251682	-0.167	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH201	10.3	18/3/08	Block 5	333699	6251682	-8.067	<10	<50	1930	1350	3305	<0.2	0.7	<0.5	<0.5	<0.5	<1	-	2
ERM	BH201	11	18/3/08	Block 5	333699	6251682	-8.767	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	2
ERM	BH202	2.3	10/3/08	Block 4	333705	6251646	0.179	<10	<50	240	270	535	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH202	4.7	10/3/08	Block 4	333705	6251646	-2.221	<10	<50	280	340	645	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH202	6.8	10/3/08	Block 4	333705	6251646	-4.321	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH203	1.9	10/3/08	Block 4	333693	6251633	0.781	<10	<50	330	360	715	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH203	7.3	10/3/08	Block 4	333693	6251633	-4.619	<10	<50	560	450	1035	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH204	1	18/3/08	Block 4	333744	6251622	0.952	20	2890	9620	3070	15580	0.6	3.5	1.4	4.2	4.4	8.6	-	8
ERM	BH204D	1.5	7/4/08	Block 4	333724	6251620	0.664	226	54200	72400	20600	147200	61	7	69.2	67.2	26.9	94.1	-	575
ERM	BH204D	3	7/4/08	Block 4	333724	6251620	-0.836	289	11600	19400	6340	37340	36.8	34.9	49.3	112	39.9	151.9	-	76
ERM	BH204D	4	7/4/08	Block 4	333724	6251620	-1.836	215	12600	22400	7020	42020	44.3	15.1	53	72.8	26.7	99.5	-	44
ERM	BH205	7.8	27/3/08	Block 4	333704	6251613	-5.394	<10	<50	<100	<100	<250	1.4	<0.5	0.7	<0.5	<0.5	<1	-	<1
ERM	BH205	9.3	27/3/08	Block 4	333704	6251613	-6.894	138	1500	2710	640	4850	7.5	5.4	34.7	42.4	21.9	64.3	-	<1
ERM	BH205	13	1/4/08	Block 4	333704	6251613	-10.594	13	<50	<100	<100	<250	2.5	<0.5	3.3	2.8	1.2	4	-	<1
ERM	BH205	13.8	1/4/08	Block 4	333704	6251613	-11.394	<10	<50	<100	<100	<250	0.7	<0.5	0.5	<0.5	<0.5	<1	-	<1
ERM	BH205	19.2	2/4/08	Block 4	333704	6251613	-16.794	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	0.5	<0.5	0.75	-	<1
ERM	BH205	22.2	2/4/08	Block 4	333704	6251613	-19.794	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH206	0.5	7/3/08	Block 4	333713	6251599	1.729	<10	<50	310	180	515	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	8
ERM	BH206	1.8	17/4/08	Block 4	333713	6251599	0.429	<10	<50	190	340	555	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH206	4.6	17/4/08	Block 4	333713	6251599	-2.371	<10	<50	230	230	485	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH206	7.1	17/4/08	Block 4	333713	6251599	-4.871	15	200	350	<100	600	<0.2	1	<0.5	2.7	2.2	4.9	-	<1
ERM	BH206	10.7	21/4/08	Block 4	333713	6251599	-8.471	<10	<50	110	<100	185	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
ERM	BH207	7.45	3/4/08	Proposed Southern Cove	333698	6251599	-5.163	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH207	12	3/4/08	Proposed Southern Cove	333698	6251599	-9.713	<10	<50	430	340	795	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH207	13.1	3/4/08	Proposed Southern Cove	333698	6251599	-10.813	<10	<50	140	<100	215	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH207	15	3/4/08	Proposed Southern Cove	333698	6251599	-12.713	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH208	2.25	4/4/08	Block 4	333705	6251588	-0.032	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH208	9.5	4/4/08	Block 4	333705	6251588	-7.282	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH208	13.5	4/4/08	Block 4	333705	6251588	-11.282	<10	80	3320	2520	5920	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH209	2.3	22/4/08	Block 4	333727	6251589	-0.014	<10	<50	880	580	1485	<0.2	<0.5	0.5	<0.5	<0.5	<1	-	<1
ERM	BH209	4.5	22/4/08	Block 4	333727	6251589	-2.214	227	1190	1950	460	3600	15.5	37.2	4.3	36	50	86	-	4
ERM	BH209	6.1	22/4/08	Block 4	333727	6251589	-3.814	929	2280	2350	430	5060	88.2	34.8	213	165	94.8	259.8	-	<1
ERM	BH209	9.4	23/4/08	Block 4	333727	6251589	-7.114	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH210	1.5	18/3/08	Proposed Southern Cove	333685	6251582	0.558	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH210	15.9	27/3/08	Proposed Southern Cove	333685	6251582	-13.842	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH211	14	26/3/08	Block 4	333676	6251561	-11.749	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH211	15.5	26/3/08	Block 4	333676	6251561	-13.249	19	<50	<100	<100	<250	3.4	0.6	5.5	3.3	1.8	5.1	-	<1
ERM	BH211	16.05	26/3/08	Block 4	333676	6251561	-13.799	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH212	3.1	18/3/08	Public Domain Blocks 4&5	333573	6251519	-0.748	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM	BH212	4.8	25/3/08	Public Domain Blocks 4&5	333573	6251519	-2.448	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH212	12.2	28/3/08	Public Domain Blocks 4&5	333573	6251519	-9.848	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH212	26	31/3/08	Public Domain Blocks 4&5	333573	6251519	-23.648	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH213	3.6	14/4/08	Public Domain Blocks 4&5	333559	6251750	-1.263	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH213	10.5	14/4/08	Public Domain Blocks 4&5	333559	6251750	-8.163	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	<0.5	<0.5	<1	-	<1
ERM	BH213	18.5	17/4/08	Public Domain Blocks 4&5	333559	6251750	-16.163	<10	<50	130	<100	205	<0.2	<0.5	0.5	<0.5	<0.5	<1	-	1
ERM 2007	BH021	0.3-0.5	ERM 2007	Barangaroo Central	333621.97	6251691.71	2.21	<2	<50	130	100	280	-	-	-	-	-	-	-	-
ERM 2007	BH021	1.5-1.95	ERM 2007	Barangaroo Central	333621.97	6251691.71	2.21	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH021	16.0-16.5	ERM 2007	Barangaroo Central	333621.97	6251691.71	2.21	32	510	1210	380	2100	-	-	-	-	-	-	-	-
ERM 2007	BH022	0.3-0.5	ERM 2007	Barangaroo Central	333644.6	6251851.63	2.81	<2	<50	<100	120	270	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH022	1.5-1.95	ERM 2007	Barangaroo Central	333644.6	6251851.63	2.81	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH022	11.0-11.5	ERM 2007	Barangaroo Central	333644.6	6251851.63	2.81	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH023	0.3-0.5	ERM 2007	Barangaroo Central	333682.71	6251864.66	2.51	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH023	1.5-1.95	ERM 2007	Barangaroo Central	333682.71	6251864.66	2.51	<2	<50	100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH023	13.5-13.8	ERM 2007	Barangaroo Central	333682.71	6251864.66	2.51	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH024	0.3-0.5	ERM 2007	Barangaroo Central	333707.06	6251850.27	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH024	3.0-3.45	ERM 2007	Barangaroo Central	333707.06	6251850.27	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH024	10.0-10.5	ERM 2007	Barangaroo Central	333707.06	6251850.27	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH025	0.3-0.5	ERM 2007	Barangaroo Central	333713.78	6251794.82	2.22	<2	<50	110	<100	260	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH025	3.0-3.65	ERM 2007	Barangaroo Central	333713.78	6251794.82	2.22	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH025	8.5-9.0	ERM 2007	Barangaroo Central	333713.78	6251794.82	2.22	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH026	0.3-0.5	ERM 2007	Barangaroo Central	333617.2	6251774.86	2.35	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH026	1.5-1.95	ERM 2007	Barangaroo Central	333617.2	6251774.86	2.35	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH026	16.5-16.95	ERM 2007	Barangaroo Central	333617.2	6251774.86	2.35	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH027	0.3-0.5	ERM 2007	Barangaroo Central	333650.91	6251793.26	2.84	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH027	3.0-3.45	ERM 2007	Barangaroo Central	333650.91	6251793.26	2.84	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH027	14.0-14.5	ERM 2007	Barangaroo Central	333650.91	6251793.26	2.84	-	-	-	-	-	-	-	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
ERM 2007	BH029	0.3-0.5	ERM 2007	Barangaroo Central	333709.24	6251985.27	2.553	<2	<50	<100	<100	<250	-	-	-	-	-	-	-	-
ERM 2007	BH029	3.0-3.45	ERM 2007	Barangaroo Central	333709.24	6251985.27	2.553	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH029	9.0-9.5	ERM 2007	Barangaroo Central	333709.24	6251985.27	2.553	<2	<50	<100	<100	<250	-	-	-	-	-	-	-	-
ERM 2007	BH032	0.3-0.5	ERM 2007	Barangaroo Central	333654.69	6251923.5	2.44	<2	<50	<100	<100	<250	-	-	-	-	-	-	-	-
ERM 2007	BH032	1.5-1.95	ERM 2007	Barangaroo Central	333654.69	6251923.5	2.44	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH032	3.0-3.34	ERM 2007	Barangaroo Central	333654.69	6251923.5	2.44	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH040	0.3-0.5	ERM 2007	Barangaroo Central	333609.17	6251893.69	2.37	<2	<50	<100	<100	<250	-	-	-	-	-	-	-	-
ERM 2007	BH040	1.5-1.95	ERM 2007	Barangaroo Central	333609.17	6251893.69	2.37	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH040	26.5-27.0	ERM 2007	Barangaroo Central	333609.17	6251893.69	2.37	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH045	0.3-0.5	ERM 2007	Barangaroo Central	333655.53	6251722.86	2.39	<2	<50	190	170	410	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH045	1.5-1.95	ERM 2007	Barangaroo Central	333655.53	6251722.86	2.39	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH045	3.0-3.45	ERM 2007	Barangaroo Central	333655.53	6251722.86	2.39	<2	<50	420	460	930	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH046	1.5-1.95	ERM 2007	Barangaroo Central	333641.38	6251752.7	2.57	<2	<50	380	320	750	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH046	3.0-3.45	ERM 2007	Barangaroo Central	333641.38	6251752.7	2.57	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH050	0.3-0.5	ERM 2007	Barangaroo Central	333618.89	6251819.47	2.44	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH050	1.5-1.8	ERM 2007	Barangaroo Central	333618.89	6251819.47	2.44	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH050	3.0-3.5	ERM 2007	Barangaroo Central	333618.89	6251819.47	2.44	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH051	0.3-0.5	ERM 2007	Barangaroo Central	333600.24	6251794.48	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH051	1.5-1.7	ERM 2007	Barangaroo Central	333600.24	6251794.48	2.3	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH052	1.5-1.95	ERM 2007	Barangaroo Central	333606.71	6251757.95	2.31	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH052	3.0-3.45	ERM 2007	Barangaroo Central	333606.71	6251757.95	2.31	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH056	0.3-0.5	ERM 2007	Barangaroo Central	333688.86	6251817.14	2.53	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH056	1.5-1.95	ERM 2007	Barangaroo Central	333688.86	6251817.14	2.53	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH056	13.0-13.5	ERM 2007	Barangaroo Central	333688.86	6251817.14	2.53	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH057	1.5-1.7	ERM 2007	Barangaroo Central	333564.03	6251834.68	2.28	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH057	3.0-3.45	ERM 2007	Barangaroo Central	333564.03	6251834.68	2.28	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH057	16.5-17.0	ERM 2007	Barangaroo Central	333564.03	6251834.68	2.28	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH061	1.5-1.95	ERM 2007	Barangaroo Central	333567.17	6251808.1	2.31	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH061	3.0-3.45	ERM 2007	Barangaroo Central	333567.17	6251808.1	2.31	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH066	0.3-0.5	ERM 2007	Barangaroo Central	333654.96	6251689.34	2.24	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	<1
ERM 2007	BH066	1.5-1.95	ERM 2007	Barangaroo Central	333654.96	6251689.34	2.24	<2	<50	160	210	420	<0.2	<0.2	<0.2	-	-	<0.4	-	<1
ERM 2007	BH080	0.3-0.5	ERM 2007	Barangaroo Central	333669.21	6251935.85	2.543	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH080	1.5-1.95	ERM 2007	Barangaroo Central	333669.21	6251935.85	2.543	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH080	19.0-19.5	ERM 2007	Barangaroo Central	333669.21	6251935.85	2.543	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH107	1.5-1.95	ERM 2007	Barangaroo Central	333594.08	6251850.09	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH107	3.0-3.45	ERM 2007	Barangaroo Central	333594.08	6251850.09	2.32	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH107	13.5-14.0	ERM 2007	Barangaroo Central	333594.08	6251850.09	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH128	1.5-1.7	ERM 2007	Barangaroo Central	333571.82	6251767.73	2.44	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH128	20-20.5	ERM 2007	Barangaroo Central	333571.82	6251767.73	2.44	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH129	0.4-0.6	ERM 2007	Barangaroo Central	333577.76	6251713.33	2.4	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH129	3.0-3.45	ERM 2007	Barangaroo Central	333577.76	6251713.33	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH129	12.5-13	ERM 2007	Barangaroo Central	333577.76	6251713.33	2.4	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH140	1.5-1.95	ERM 2007	Barangaroo Central	333721.59	6251809.19	2.34	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH140	6.0-6.5	ERM 2007	Barangaroo Central	333721.59	6251809.19	2.34	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	TPH C6 - C9	TPH C10 - C14	TPH C15 - C28	TPH C29-C36	TPH+C10 - C36 (Sum of total)	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	Cyanide (Free)	Cyanide Total
ERM 2007	BH147	1.6-2.05	ERM 2007	Barangaroo Central	333712.32	6251933.44	2.65	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH147	3.0-3.45	ERM 2007	Barangaroo Central	333712.32	6251933.44	2.65	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH147	8.9-9.2	ERM 2007	Barangaroo Central	333712.32	6251933.44	2.65	-	-	-	-	-	-	-	-	-	-	-	-	-
ERM 2007	BH155	0.4-0.5	ERM 2007	Barangaroo Central	333712.78	6251933.5	2.646	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	-
ERM 2007	BH155	0.9-1.0	ERM 2007	Barangaroo Central	333712.78	6251933.5	2.646	<2	<50	<100	<100	<250	<0.2	<0.2	<0.2	-	-	<0.4	-	<1
ERM 2008	BH179	1.5-2.0	ERM 2008	Barangaroo Central	333708.26	6251901.896	2.458	-	-	-	-	-	-	-	-	-	-	-	-	<1
ERM 2008	BH179	7	ERM 2008	Barangaroo Central	333708.26	6251901.896	2.458	-	-	-	-	-	-	-	-	-	-	-	-	1
ERM 2008	BH179	11	ERM 2008	Barangaroo Central	333708.26	6251901.896	2.458	-	-	-	-	-	-	-	-	-	-	-	-	<1
ERM 2008	BH180	4.7	ERM 2008	Barangaroo Central	333670.087	6251872.951	2.691	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH180	8.7	ERM 2008	Barangaroo Central	333670.087	6251872.951	2.691	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH180	14.3	ERM 2008	Barangaroo Central	333670.087	6251872.951	2.691	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH183	2.2	ERM 2008	Barangaroo Central	333554.971	6251884.783	2.451	<10	<50	740	480	1245	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH183	8	ERM 2008	Barangaroo Central	333554.971	6251884.783	2.451	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH183	30.3	ERM 2008	Barangaroo Central	333554.971	6251884.783	2.451	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH183	31.6	ERM 2008	Barangaroo Central	333554.971	6251884.783	2.451	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH184	4.8	ERM 2008	Barangaroo Central	333604.524	6251922.673	2.411	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH184	9.6	ERM 2008	Barangaroo Central	333604.524	6251922.673	2.411	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH184	23.3	ERM 2008	Barangaroo Central	333604.524	6251922.673	2.411	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH186	3.6	ERM 2008	Barangaroo Central	333579.031	6251907.925	2.398	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH186	11	ERM 2008	Barangaroo Central	333579.031	6251907.925	2.398	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH186	13.5	ERM 2008	Barangaroo Central	333579.031	6251907.925	2.398	<10	<50	530	430	985	<0.2	<0.5	<0.5	-	-	<0.5	-	3
ERM 2008	BH187	3.6	ERM 2008	Barangaroo Central	333588.75	6251879.223	2.243	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH187	10	ERM 2008	Barangaroo Central	333588.75	6251879.223	2.243	<10	<50	230	210	465	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH187	25	ERM 2008	Barangaroo Central	333588.75	6251879.223	2.243	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	2
ERM 2008	BH188	2.9	ERM 2008	Barangaroo Central	333636.006	6251875.724	2.689	<10	<50	190	140	355	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH188	11.5	ERM 2008	Barangaroo Central	333636.006	6251875.724	2.689	<10	<50	290	190	505	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH188	15.1	ERM 2008	Barangaroo Central	333636.006	6251875.724	2.689	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH189	16	ERM 2008	Barangaroo Central	333661.693	6251831.66	2.831	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH189	3.7	ERM 2008	Barangaroo Central	333661.693	6251831.66	2.831	<10	<50	230	320	575	<0.2	0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH189	7.2	ERM 2008	Barangaroo Central	333661.693	6251831.66	2.831	<10	<50	120	110	255	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH213	3.6	ERM 2008	Barangaroo Central	333558.557	6251749.964	2.337	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH213	10.5	ERM 2008	Barangaroo Central	333558.557	6251749.964	2.337	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH213	18.5	ERM 2008	Barangaroo Central	333558.557	6251749.964	2.337	<10	<50	130	<100	205	<0.2	0.5	<0.5	-	-	<0.5	-	1
ERM 2008	BH214	6.3	ERM 2008	Barangaroo Central	333547.714	6251850.172	2.103	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH214	15	ERM 2008	Barangaroo Central	333547.714	6251850.172	2.103	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1
ERM 2008	BH214	16	ERM 2008	Barangaroo Central	333547.714	6251850.172	2.103	<10	<50	<100	<100	<250	<0.2	<0.5	<0.5	-	-	<0.5	-	<1

Table 3: VOCs

All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-butylbenzene	n-propylbenzene	p-isopropyltoluene	sec-butylbenzene	Styrene	tert-butylbenzene	Methyl Ethyl Ketone	2-hexanone (MBK)	4-Methyl-2-pentanone	Vinyl acetate	Carbon disulfide	1,2-dibromoethane	1,2-dichloropropane	2,2-dichloropropane	cis-1,3-dichloropropene
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	12.7	3.7	<0.5	<0.5	0.6	<0.5	<0.5	13.6	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	19	4.4	<0.5	<0.5	<0.5	<0.5	<0.5	21.4	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH16	4.2	2/9/10	Area B	333720	6251456	-1.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH19	1	2/9/10	Area B	333736	6251372	1.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH19	6.9	2/9/10	Area B	333736	6251372	-4.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH20	4	2/11/10	Area B	333733	6251328	-1.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH21	4	2/11/10	Area B	333718	6251310	-1.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH25	15	19/2/10	Area C	333697	6251356	-12.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH25	7.2	19/2/10	Area B	333697	6251356	-4.33	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH26	11.4	2/11/10	Area C	333666	6251372	-8.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH36	15	3/3/10	Block 3	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	<0.5	<0.5	<0.5
AECOM	BH36	4	3/3/10	Block 3	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	<0.5	<0.5	<0.5
AECOM	BH36	8.5	3/3/10	Block 3	333684	6251545	-6.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH36	1	3/3/10	Area B	333684	6251545	1.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH36	8.5	3/3/10	Area C	333684	6251545	-6.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	6.8	1.8	<0.5	<0.5	<0.5	<0.5	<0.5	6.1	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	<0.5	<0.5	<0.5
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	<0.5	<0.5	<0.5
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	7.5	3	<0.5	<0.5	<0.5	<0.5	<0.5	6.7	<0.5	<5	<5	<5	<5	<0.5	-	<0.5	<0.5	<0.5
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	1.3	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<5	<5	<5	<5	<0.5	-	<0.5	<0.5	<0.5
AECOM	BH41	1	4/3/10	Southern Cove	333661	6251582	1.222	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	14.5	8/3/10	Southern Cove	333661	6251582	-12.278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	16	8/3/10	Southern Cove	333661	6251582	-13.778	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	<0.5	<0.5	<0.5

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-butylbenzene	n-propylbenzene	p-isopropyltoluene	sec-butylbenzene	Styrene	tert-butylbenzene	Methyl Ethyl Ketone	2-hexanone (MBK)	4-Methyl-2-pentanone	Vinyl acetate	Carbon disulfide	1,2-dibromoethane	1,2-dichloropropane	2,2-dichloropropane	cis-1,3-dichloropropene
AECOM	BH41	4	4/3/10	Southern Cove	333661	6251582	-1.778	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	8.5	4/3/10	Southern Cove	333661	6251582	-6.278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	92.9	31	7.3	<0.5	4.9	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	22	8.4	<0.5	<0.5	0.9	<0.5	<0.5	11.8	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	<0.5	<0.5	<0.5
AECOM	BH47	1	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	1.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	8.7	3.9	<0.5	<0.5	<0.5	<0.5	<0.5	9.1	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH48	14.5	23/2/10		333652	6251615	-12.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	9.5	3.8	<0.5	<0.5	<0.5	<0.5	<0.5	8.7	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH54	1	23/2/10	Block 4	333737	6251636	1.13	16.4	5.8	<0.5	<0.5	<0.5	<0.5	<0.5	4.8	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	2.8	1.2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH55	1	25/2/10	Block 4	333725	6251640	1.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	76.5	31.2	0.6	<0.5	1.4	<0.5	<0.5	6.2	<0.5	<5	<5	<5	<5	<0.5	-	<0.5	<0.5	<0.5
AECOM	BH55	2.7	25/2/10	Block 4	333725	6251640	-0.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	59.3	24.2	0.8	<0.5	1.2	<0.5	<0.5	5.5	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH60	16	1/3/10	Public Domain Blocks 4&5	333586	6251687	-13.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH60	17.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-14.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH60	2.5	1/3/10	Public Domain Blocks 4&5	333586	6251687	0.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH62	1	26/2/10	Block 5	333682	6251687	1.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	<0.5	<0.5	<0.5
AECOM	BH62	3.4	26/2/10	Block 5	333682	6251687	-1.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH62	5.4	26/2/10	Block 5	333682	6251687	-3.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH64	10	1/3/10	Block 5	333717	6251694	-7.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH64	2.5	1/3/10	Block 5	333717	6251694	-0.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	<0.5	<0.5	<0.5
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	3	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	2	<0.5	<5	<5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	<0.5	<0.5	<0.5
AECOM	BH69	1	26/2/10	Block 5	333706	6251737	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH69	4	26/2/10	Block 5	333706	6251737	-1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	0.1	3/3/10	Block 5	333712	6251766	2.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	11.5	8/3/10	Block 5	333712	6251766	-9.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	16	8/3/10	Block 5	333712	6251766	-13.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	4	8/3/10	Block 5	333712	6251766	-1.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	5.5	8/3/10	Block 5	333712	6251766	-3.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH71	0.08	3/3/10	Public Domain Blocks 4&5	333677	6251751	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH71	13	4/3/10	Public Domain Blocks 4&5	333677	6251751	-10.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH71	19	4/3/10	Public Domain Blocks 4&5	333677	6251751	-16.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	1,2,4-trimethylbenzene	1,3,5-trimethylbenzene	Isopropylbenzene	n-butylbenzene	n-propylbenzene	p-isopropyltoluene	sec-butylbenzene	Styrene	tert-butylbenzene	Methyl Ethyl Ketone	2-hexanone (MBK)	4-Methyl-2-pentanone	Vinyl acetate	Carbon disulfide	1,2-dibromoethane	1,2-dichloropropane	2,2-dichloropropane	cis-1,3-dichloropropene
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH71	7	4/3/10	Public Domain Blocks 4&5	333677	6251751	-4.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	0.15	25/2/10	Public Domain Blocks 4&5	333634	6251746	2.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH72	13	3/3/10	Public Domain Blocks 4&5	333634	6251746	-10.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	16	4/3/10	Public Domain Blocks 4&5	333634	6251746	-13.48	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	2.5	3/3/10	Public Domain Blocks 4&5	333634	6251746	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	20.5	4/3/10	Public Domain Blocks 4&5	333634	6251746	-17.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH73	11.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-8.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH73	16	2/3/10	Public Domain Blocks 4&5	333582	6251695	-13.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH73	17.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-14.87	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<5	<5	<0.5	-	-	-	<0.5
AECOM	SV09	0.2	26/2/10	Block 5	333585	6251733	2.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 3: VOCs

All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	trans-1,3-dichloropropene	1,1,1,2-tetrachloroethane	1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	1,1,2-trichloroethane	1,1-dichloroethane	1,1-dichloroethene	1,1-dichloropropene	1,2,3-trichloropropane	1,2-dibromo-3-chloropropane	1,2-dichloroethane	1,3-dichloropropane	Bromomethane	Carbon tetrachloride	Chloroethane	Chloromethane	cis-1,2-dichloroethene	cis-1,4-Dichloro-2-butene
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5				<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	-	-	-							<0.5		<0.5						
AECOM	BH16	4.2	2/9/10	Area B	333720	6251456	-1.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH19	1	2/9/10	Area B	333736	6251372	1.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH19	6.9	2/9/10	Area B	333736	6251372	-4.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH20	4	2/11/10	Area B	333733	6251328	-1.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-
AECOM	BH21	4	2/11/10	Area B	333718	6251310	-1.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	-	-	-	-	-	-	-	-	-	<0.5	-	<0.5	-	-	-	-	-	-
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	-	-	-	-	-	-	-	-	-			-	-	-	-	-	-	-
AECOM	BH25	15	19/2/10	Area C	333697	6251356	-12.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	-	-	-	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH25	7.2	19/2/10	Area B	333697	6251356	-4.33	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH26	11.4	2/11/10	Area C	333666	6251372	-8.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	-	-	-	-	-	-	-	-	-	<0.5	-	<0.5	-	-	-	-	-	-
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	-	-	-	-	-	-	-	-	-	<0.5	-	<0.5	-	-	-	-	-	-
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	-	-	-	-	-	-	-	-	-	<0.5	-	<0.5	-	-	-	-	-	-
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH36	15	3/3/10	Block 3	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH36	4	3/3/10	Block 3	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH36	8.5	3/3/10	Block 3	333684	6251545	-6.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH36	1	3/3/10	Area B	333684	6251545	1.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	-	-	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH36	8.5	3/3/10	Area C	333684	6251545	-6.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-	-	-	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH41	1	4/3/10	Southern Cove	333661	6251582	1.222	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	14.5	8/3/10	Southern Cove	333661	6251582	-12.278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	16	8/3/10	Southern Cove	333661	6251582	-13.778	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	trans-1,3-dichloropropene	1,1,1,2-tetrachloroethane	1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	1,1,2-trichloroethane	1,1-dichloroethane	1,1-dichloroethene	1,1-dichloropropene	1,2,3-trichloropropane	1,2-dibromo-3-chloropropane	1,2-dichloroethane	1,3-dichloropropane	Bromomethane	Carbon tetrachloride	Chloroethane	Chloromethane	cis-1,2-dichloroethene	cis-1,4-Dichloro-2-butene
AECOM	BH41	4	4/3/10	Southern Cove	333661	6251582	-1.778	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	8.5	4/3/10	Southern Cove	333661	6251582	-6.278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH47	1	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	1.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH48	14.5	23/2/10		333652	6251615	-12.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH54	1	23/2/10	Block 4	333737	6251636	1.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH55	1	25/2/10	Block 4	333725	6251640	1.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH55	2.7	25/2/10	Block 4	333725	6251640	-0.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH60	16	1/3/10	Public Domain Blocks 4&5	333586	6251687	-13.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH60	17.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-14.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH60	2.5	1/3/10	Public Domain Blocks 4&5	333586	6251687	0.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH62	1	26/2/10	Block 5	333682	6251687	1.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH62	3.4	26/2/10	Block 5	333682	6251687	-1.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH62	5.4	26/2/10	Block 5	333682	6251687	-3.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH64	10	1/3/10	Block 5	333717	6251694	-7.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH64	2.5	1/3/10	Block 5	333717	6251694	-0.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH69	1	26/2/10	Block 5	333706	6251737	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH69	4	26/2/10	Block 5	333706	6251737	-1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	0.1	3/3/10	Block 5	333712	6251766	2.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	11.5	8/3/10	Block 5	333712	6251766	-9.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	16	8/3/10	Block 5	333712	6251766	-13.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	4	8/3/10	Block 5	333712	6251766	-1.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	5.5	8/3/10	Block 5	333712	6251766	-3.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH71	0.08	3/3/10	Public Domain Blocks 4&5	333677	6251751	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH71	13	4/3/10	Public Domain Blocks 4&5	333677	6251751	-10.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH71	19	4/3/10	Public Domain Blocks 4&5	333677	6251751	-16.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	trans-1,3-dichloropropene	1,1,1,2-tetrachloroethane	1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	1,1,2-trichloroethane	1,1-dichloroethane	1,1-dichloroethene	1,1-dichloropropene	1,2,3-trichloropropane	1,2-dibromo-3-chloropropane	1,2-dichloroethane	1,3-dichloropropane	Bromomethane	Carbon tetrachloride	Chloroethane	Chloromethane	cis-1,2-dichloroethene	cis-1,4-Dichloro-2-butene
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH71	7	4/3/10	Public Domain Blocks 4&5	333677	6251751	-4.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	0.15	25/2/10	Public Domain Blocks 4&5	333634	6251746	2.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH72	13	3/3/10	Public Domain Blocks 4&5	333634	6251746	-10.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	16	4/3/10	Public Domain Blocks 4&5	333634	6251746	-13.48	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	2.5	3/3/10	Public Domain Blocks 4&5	333634	6251746	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	20.5	4/3/10	Public Domain Blocks 4&5	333634	6251746	-17.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH73	11.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-8.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH73	16	2/3/10	Public Domain Blocks 4&5	333582	6251695	-13.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH73	17.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-14.87	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5	<5	<5	<0.5	<0.5
AECOM	SV09	0.2	26/2/10	Block 5	333585	6251733	2.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 3: VOCs

All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Dibromomethane	Dichlorodifluoromethane	Hexachlorobutadiene	Iodomethane	Pentachloroethane	Trichloroethene	Tetrachloroethene	trans-1,2-dichloroethene	trans-1,4-Dichloro-2-butene	Trichlorofluoromethane	Vinyl chloride	1,2,3-trichlorobenzene	1,2,4-trichlorobenzene	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene	2-chlorotoluene	4-chlorotoluene
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78		<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78		<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44			<0.5	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
AECOM	BH16	4.2	2/9/10	Area B	333720	6251456	-1.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH19	1	2/9/10	Area B	333736	6251372	1.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH19	6.9	2/9/10	Area B	333736	6251372	-4.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	-	-	<0.5	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	0.7	-	-
AECOM	BH20	4	2/11/10	Area B	333733	6251328	-1.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	-	-	<0.5	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	-	-
AECOM	BH21	4	2/11/10	Area B	333718	6251310	-1.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	-	-	<0.5	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	-	-
AECOM	BH25	15	19/2/10	Area C	333697	6251356	-12.13	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH25	7.2	19/2/10	Area B	333697	6251356	-4.33		<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH26	11.4	2/11/10	Area C	333666	6251372	-8.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	-	-
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	-	-	<0.5	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	-	-
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	-	-	-	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	-	-
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	-	-	<0.5	-	-	-	-	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	-	-
AECOM	BH36	15	3/3/10	Block 3	333684	6251545	-12.75	<0.5	<5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	-	-	-	-	<0.5	<0.5
AECOM	BH36	4	3/3/10	Block 3	333684	6251545	-1.75	<0.5	<5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	-	-	-	-	<0.5	<0.5
AECOM	BH36	8.5	3/3/10	Block 3	333684	6251545	-6.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH36	1	3/3/10	Area B	333684	6251545	1.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	-	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH36	8.5	3/3/10	Area C	333684	6251545	-6.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<0.5	<5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	-	-	-	-	<0.5	<0.5
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<0.5	<5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	<0.5	<5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	-	-	-	-	<0.5	<0.5
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	<0.5	<5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	-	-	-	-	<0.5	<0.5
AECOM	BH41	1	4/3/10	Southern Cove	333661	6251582	1.222	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	14.5	8/3/10	Southern Cove	333661	6251582	-12.278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	16	8/3/10	Southern Cove	333661	6251582	-13.778	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<0.5	<5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	-	-	-	-	<0.5	<0.5

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Dibromomethane	Dichlorodifluoromethane	Hexachlorobutadiene	Iodomethane	Pentachloroethane	Trichloroethene	Tetrachloroethene	trans-1,2-dichloroethene	trans-1,4-Dichloro-2-butene	Trichlorofluoromethane	Vinyl chloride	1,2,3-trichlorobenzene	1,2,4-trichlorobenzene	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene	2-chlorotoluene	4-chlorotoluene
AECOM	BH41	4	4/3/10	Southern Cove	333661	6251582	-1.778	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH41	8.5	4/3/10	Southern Cove	333661	6251582	-6.278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<0.5	<5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH47	1	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	1.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	-	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5					<0.5	<0.5	<0.5
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH48	14.5	23/2/10		333652	6251615	-12.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH54	1	23/2/10	Block 4	333737	6251636	1.13	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH55	1	25/2/10	Block 4	333725	6251640	1.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH55	2.7	25/2/10	Block 4	333725	6251640	-0.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89		<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5					<0.5	<0.5	<0.5
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39		<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5					<0.5	<0.5	<0.5
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH60	16	1/3/10	Public Domain Blocks 4&5	333586	6251687	-13.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH60	17.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-14.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH60	2.5	1/3/10	Public Domain Blocks 4&5	333586	6251687	0.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	-	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH62	1	26/2/10	Block 5	333682	6251687	1.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH62	3.4	26/2/10	Block 5	333682	6251687	-1.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH62	5.4	26/2/10	Block 5	333682	6251687	-3.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH64	10	1/3/10	Block 5	333717	6251694	-7.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH64	2.5	1/3/10	Block 5	333717	6251694	-0.13	<0.5	<5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	-	-	-	-	<0.5	<0.5
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	<0.5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH69	1	26/2/10	Block 5	333706	6251737	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH69	4	26/2/10	Block 5	333706	6251737	-1.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	0.1	3/3/10	Block 5	333712	6251766	2.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	11.5	8/3/10	Block 5	333712	6251766	-9.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	16	8/3/10	Block 5	333712	6251766	-13.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	4	8/3/10	Block 5	333712	6251766	-1.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH70	5.5	8/3/10	Block 5	333712	6251766	-3.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH71	0.08	3/3/10	Public Domain Blocks 4&5	333677	6251751	2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	-	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH71	13	4/3/10	Public Domain Blocks 4&5	333677	6251751	-10.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	-	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH71	19	4/3/10	Public Domain Blocks 4&5	333677	6251751	-16.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Dibromomethane	Dichlorodifluoromethane	Hexachlorobutadiene	Iodomethane	Pentachloroethane	Trichloroethene	Tetrachloroethene	trans-1,2-dichloroethene	trans-1,4-Dichloro-2-butene	Trichlorofluoromethane	Vinyl chloride	1,2,3-trichlorobenzene	1,2,4-trichlorobenzene	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene	2-chlorotoluene	4-chlorotoluene
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	-	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH71	7	4/3/10	Public Domain Blocks 4&5	333677	6251751	-4.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	0.15	25/2/10	Public Domain Blocks 4&5	333634	6251746	2.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	-	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH72	13	3/3/10	Public Domain Blocks 4&5	333634	6251746	-10.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	16	4/3/10	Public Domain Blocks 4&5	333634	6251746	-13.48	-	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	2.5	3/3/10	Public Domain Blocks 4&5	333634	6251746	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	20.5	4/3/10	Public Domain Blocks 4&5	333634	6251746	-17.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	-	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH73	11.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-8.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH73	16	2/3/10	Public Domain Blocks 4&5	333582	6251695	-13.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH73	17.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-14.87	-	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	-	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	-	<5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<5	-	-	-	-	<0.5	<0.5	<0.5
AECOM	SV09	0.2	26/2/10	Block 5	333585	6251733	2.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 3: VOCs

All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Bromobenzene	Chlorobenzene	Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	37.5	<0.5
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	15.7	<0.5
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	-	-	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH16	4.2	2/9/10	Area B	333720	6251456	-1.54	-	-	-	-	-	-	-	<0.5	-
AECOM	BH19	1	2/9/10	Area B	333736	6251372	1.53	-	-	-	-	-	-	-	<0.5	-
AECOM	BH19	6.9	2/9/10	Area B	333736	6251372	-4.37	-	-	-	-	-	-	-	<0.5	-
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	-	-	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH20	4	2/11/10	Area B	333733	6251328	-1.24	-	-	-	-	-	-	-	<0.5	-
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	-	-	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH21	4	2/11/10	Area B	333718	6251310	-1.44	-	-	-	-	-	-	-	<0.5	-
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	-	-	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	-	-	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH25	15	19/2/10	Area C	333697	6251356	-12.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-
AECOM	BH25	7.2	19/2/10	Area B	333697	6251356	-4.33	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-
AECOM	BH26	11.4	2/11/10	Area C	333666	6251372	-8.81	-	-	-	-	-	-	-	<0.5	-
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	-	-	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	-	-	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	-	-	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	-	-	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	-	-	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	-	-	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH36	15	3/3/10	Block 3	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	<0.5
AECOM	BH36	4	3/3/10	Block 3	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH36	8.5	3/3/10	Block 3	333684	6251545	-6.25	-	-	-	-	-	-	-	<0.5	-
AECOM	BH36	1	3/3/10	Area B	333684	6251545	1.25	-	-	-	-	-	-		<0.5	
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	<0.5
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH36	8.5	3/3/10	Area C	333684	6251545	-6.25	-	-	-	-	-	-	-	<0.5	-
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	-	-	-	-	-	-	<0.6	396	<0.6
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	14.4	<0.5
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	28.6	<0.5
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5
AECOM	BH41	1	4/3/10	Southern Cove	333661	6251582	1.222	-	-	-	-	-	-	-	<0.5	-
AECOM	BH41	14.5	8/3/10	Southern Cove	333661	6251582	-12.278	-	-	-	-	-	-	-	<0.5	-
AECOM	BH41	16	8/3/10	Southern Cove	333661	6251582	-13.778	-	-	-	-	-	-	-	0.5	-
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	<0.5

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Bromobenzene	Chlorobenzene	Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene
AECOM	BH41	4	4/3/10	Southern Cove	333661	6251582	-1.778	-	-	-	-	-	-	-	<0.5	-
AECOM	BH41	8.5	4/3/10	Southern Cove	333661	6251582	-6.278	-	-	-	-	-	-	-	<0.5	-
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.2	431	<1.2
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.2	204	<1.2
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH47	1	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	1.38	-	-	-	-	-	-	<0.5	<0.5	<0.5
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.2	144	<1.2
AECOM	BH48	14.5	23/2/10		333652	6251615	-12.04	-	-	-	-	-	-	-	144	-
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.2	211	<1.2
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4	<0.5
AECOM	BH54	1	23/2/10	Block 4	333737	6251636	1.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.2	41.8	<1.2
AECOM	BH55	1	25/2/10	Block 4	333725	6251640	1.23	-	-	-	-	-	-	-	<4	-
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.2	308	<1.2
AECOM	BH55	2.7	25/2/10	Block 4	333725	6251640	-0.47	-	-	-	-	-	-	-	<4	-
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	1.8
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.2	967	<1.2
AECOM	BH60	16	1/3/10	Public Domain Blocks 4&5	333586	6251687	-13.31	-	-	-	-	-	-	-	0.8	-
AECOM	BH60	17.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-14.81	-	-	-	-	-	-	-	<0.5	-
AECOM	BH60	2.5	1/3/10	Public Domain Blocks 4&5	333586	6251687	0.19	-	-	-	-	-	-	-	<0.5	-
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
AECOM	BH62	1	26/2/10	Block 5	333682	6251687	1.23	-	-	-	-	-	-	-	<0.5	-
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH62	3.4	26/2/10	Block 5	333682	6251687	-1.17	-	-	-	-	-	-	-	<0.5	-
AECOM	BH62	5.4	26/2/10	Block 5	333682	6251687	-3.17	-	-	-	-	-	-	-	<0.5	-
AECOM	BH64	10	1/3/10	Block 5	333717	6251694	-7.63	-	-	-	-	-	-	-	1	-
AECOM	BH64	2.5	1/3/10	Block 5	333717	6251694	-0.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	57.6	<0.5
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH69	1	26/2/10	Block 5	333706	6251737	1.4	-	-	-	-	-	-	-	<0.5	-
AECOM	BH69	4	26/2/10	Block 5	333706	6251737	-1.6	-	-	-	-	-	-	-	<0.5	-
AECOM	BH70	0.1	3/3/10	Block 5	333712	6251766	2.19	-	-	-	-	-	-	-	<0.5	-
AECOM	BH70	11.5	8/3/10	Block 5	333712	6251766	-9.21	-	-	-	-	-	-	-	<0.5	-
AECOM	BH70	16	8/3/10	Block 5	333712	6251766	-13.71	-	-	-	-	-	-	-	776	-
AECOM	BH70	4	8/3/10	Block 5	333712	6251766	-1.71	-	-	-	-	-	-	-	<0.5	-
AECOM	BH70	5.5	8/3/10	Block 5	333712	6251766	-3.21	-	-	-	-	-	-	-	<0.8	-
AECOM	BH71	0.08	3/3/10	Public Domain Blocks 4&5	333677	6251751	2.7	-	-	-	-	-	-	-	<0.5	-
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
AECOM	BH71	13	4/3/10	Public Domain Blocks 4&5	333677	6251751	-10.22	-	-	-	-	-	-	-	<0.5	-
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
AECOM	BH71	19	4/3/10	Public Domain Blocks 4&5	333677	6251751	-16.22	-	-	-	-	-	-	-	<0.5	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Bromobenzene	Chlorobenzene	Bromodichloromethane	Bromoform	Chlorodibromomethane	Chloroform	2-chloronaphthalene	2-methylnaphthalene	3-methylcholanthrene
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
AECOM	BH71	7	4/3/10	Public Domain Blocks 4&5	333677	6251751	-4.22	-	-	-	-	-	-	-	<0.5	-
AECOM	BH72	0.15	25/2/10	Public Domain Blocks 4&5	333634	6251746	2.37	-	-	-	-	-	-	-		-
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
AECOM	BH72	13	3/3/10	Public Domain Blocks 4&5	333634	6251746	-10.48	-	-	-	-	-	-	-	<0.5	-
AECOM	BH72	16	4/3/10	Public Domain Blocks 4&5	333634	6251746	-13.48	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	-
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	-	-	-	-	-	-	-	<0.5	<0.5
AECOM	BH72	2.5	3/3/10	Public Domain Blocks 4&5	333634	6251746	0.02	-	-	-	-	-	-	-	<0.5	-
AECOM	BH72	20.5	4/3/10	Public Domain Blocks 4&5	333634	6251746	-17.98	-	-	-	-	-	-	-	<0.5	-
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.9
AECOM	BH73	11.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-8.87	-	-	-	-	-	-	-	-	-
AECOM	BH73	16	2/3/10	Public Domain Blocks 4&5	333582	6251695	-13.37	-	-	-	-	-	-	-	-	-
AECOM	BH73	17.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-14.87	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	2.8
AECOM	SV09	0.2	26/2/10	Block 5	333585	6251733	2.21	-	-	-	-	-	-	-	<0.5	-

Table 4: PAHs

All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH01	0.3	12/2/09	Area A	333622	6251528	2.09	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH01	10	12/2/09	Area A	333622	6251528	-7.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH01	1	12/2/09	Area A	333622	6251528	1.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH01	12	12/2/09	Area A	333622	6251528	-9.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AECOM	BH01	17.65	12/3/09	Area A	333622	6251528	-15.26	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH01	20.5	12/3/09	Area A	333622	6251528	-18.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH01	2	12/2/09	Area A	333622	6251528	0.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH01	25	12/10/09	Area A	333622	6251528	-22.61	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH01	4	12/2/09	Area A	333622	6251528	-1.61	<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	1.65
AECOM	BH01	7	12/2/09	Area A	333622	6251528	-4.61	<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	1.641
AECOM	BH01	9	12/2/09	Area A	333622	6251528	-6.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH02	11.5	12/4/09	Area C	333618	6251492	-9.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH02	14.5	12/4/09	Area C	333618	6251492	-12.03	<0.5	<0.5	0.6	1.2	1.1	-	1.2	0.5	0.6	1	<0.5	2.6	<0.5	<0.5	<0.5	-	1.2	2.6	1.415
AECOM	BH02	19	12/7/09	Area C	333618	6251492	-16.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH02	3	12/4/09	Area B	333618	6251492	-0.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH02	5	12/4/09	Area B	333618	6251492	-2.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH02	7	12/4/09	Area B	333618	6251492	-4.53	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH03	3	12/10/09	Area B	333648	6251518	-0.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH03	17.3	12/10/09	Area C	333648	6251518	-15.21	<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
AECOM	BH03	9	12/10/09	Area C	333648	6251518	-6.91	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH04	1	12/9/09	Area B	333662	6251527	1.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH04	16	12/9/09	Area C	333662	6251527	-13.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH04	20	12/9/09	Area C	333662	6251527	-17.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	1.8	10.4	5.1	5.6	2.7	4	-	0.7		4.2	<0.5	5.8	7	0.6	80.8	-	18.2	8.1	3.369
AECOM	BH04	22	12/10/09	Area C	333662	6251527	-19.84	<0.5	2.3	1.4	0.8	<0.5	-	<0.5	<0.5	<0.5	0.5	<0.5	1.2	1.7	<0.5	14.3	-	3.6	2	0.085
AECOM	BH04	8	12/9/09	Area B	333662	6251527	-5.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH05	0.25	12/2/09	Area B	333692	6251518	1.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH05	4.1	12/2/09	Area B	333692	6251518	-2.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH05	6.4	12/2/09	Area B	333692	6251518	-4.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH05	1.7	12/2/09	Area B	333692	6251518	0.39	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH06	0.5	12/2/09	Area B	333702	6251506	1.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH06	2.5	12/2/09	Area B	333702	6251506	-0.31	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH06	5	12/2/09	Area B	333702	6251506	-2.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH07	1	12/8/09	Area B	333727	6251509	1.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH07	5	12/8/09	Area B	333727	6251509	-2.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH07	7.4	12/8/09	Area B	333727	6251509	-4.98	10.7	0.9	18.6	12.5	9.3	-	9.4	4.4	5.5	10.8	0.8	35.4	13	3.5	13.6	-	64.6	38.3	13.342
AECOM	BH08	1	12/8/09	Area B	333717	6251528	1.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	0.6	6	2.4	1.7	1	<1	-	<0.5	-	1.4	<0.5	2.6	2.8	<0.5	29.1	-	8.4	4	1.184
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	<0.5	0.7	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	-	1.2	0.5	0
AECOM	BH08	5	12/8/09	Area B	333717	6251528	-2.78	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH08	9	12/8/09	Area B	333717	6251528	-6.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH09	1	12/7/09	Area B	333709	6251541	1.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH09	5	12/7/09	Area B	333709	6251541	-2.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH10	1	12/11/09	Area B	333692	6251540	1.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH10	12	12/11/09	Area C	333692	6251540	-9.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH11	1.4	2/5/10	Area B	333757	6251517	1.6	<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	1.1	-	<0.5	<0.5	0
AECOM	BH11	1.6	2/5/10	Area B	333757	6251517	1.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH11	2.6	2/5/10	Area B	333757	6251517	0.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH11	3.2	2/5/10	Area B	333757	6251517	-0.2	1.4	8.5	17.9	23.8	16		23.5	9.4	7.7	18.9	2.2	61.8	7.2	7.5	2	-	55.1	61.4	24.733
AECOM	BH12	12.2	2/10/10	Area B	333735	6251488	-9.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH12	3	2/10/10	Area B	333735	6251488	-0.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH12	7	2/10/10	Area B	333735	6251488	-4.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH13	1	2/5/10	Area B	333692	6251488	1.5	<0.5	<0.5	<0.5	0.8	0.5	-	0.8	<0.5	<0.5	0.6	<0.5	0.9	<0.5	<0.5	<0.5	-	0.8	1	0.666
AECOM	BH13	12.7	2/5/10	Area C	333692	6251488	-10.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH13	2.4	2/5/10	Area B	333692	6251488	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH13	3	2/5/10	Area B	333692	6251488	-0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH13	7.2	2/5/10	Area B	333692	6251488	-4.7	<0.5	0.9	0.8	2.8	2.8	-	4.6	1.5	2.1	1.8	<0.5	0.6	<0.5	1.1	<0.5	-	0.6	13.7	3.893
AECOM	BH14	13	2/10/10	Area C	333648	6251482	-10.44	<0.5	<0.5	<0.5	0.7	0.5	-	0.7	<0.5	<0.5	0.5	<0.5	1.5	<0.5	<0.5	<0.5	-	0.9	1.6	0.645
AECOM	BH14	2.5	2/10/10	Area B	333648	6251482	0.06	<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	0
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	<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
AECOM	BH15	2	2/9/10	Area B	333758	6251459	0.71	<0.5	<0.5	<0.5	1	1.3	-	1.6	2.2	0.7	0.9	<0.5	1.6	<0.5	1.7	<0.5	-	1.5	1.5	1.831
AECOM	BH15	5	2/9/10	Area B	333758	6251459	-2.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH16	1	2/9/10	Area B	333720	6251456	1.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH16	4.2	2/9/10	Area B	333720	6251456	-1.54	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH17	10	2/10/10	Area B	333732	6251416	-7.45	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH17	4	2/9/10	Area B	333732	6251416	-1.45	<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	0
AECOM	BH18	14	2/10/10	Area B	333753	6251380	-11.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH18	2.5	2/10/10	Area B	333753	6251380	-0.21	<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
AECOM	BH18	7	2/10/10	Area B	333753	6251380	-4.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH19	1	2/9/10	Area B	333736	6251372	1.53	<0.5	<0.5	<0.5	0.7	1.2	-	0.8	1.3	<0.5	0.6	<0.5	1.2	<0.5	0.9	<0.5	8.1	<0.5	1.4	1.459
AECOM	BH19	11.5	2/9/10	Area B	333736	6251372	-8.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH19	6.9	2/9/10	Area B	333736	6251372	-4.37	<0.5	1.1	2.4	3.6	4.2	-	3.5	2.2	1.5	3	0.6	7.9	0.8	2	1.3	47.6	5.4	8.1	5.912
AECOM	BH20	1	2/11/10	Area B	333733	6251328	1.76	4.4	7.5	15.1	21	18.1	-	21.8	10.6	10.3	19	2.4	49.3	7.1	8.6	4.7	-	46	54.8	26.966
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	<0.5	0.6	1.2	2.8	2.6	4		1		2.3	<0.5	4.7	<0.5	1	<0.5	-	2.4	6.2	3.013
AECOM	BH20	4	2/11/10	Area B	333733	6251328	-1.24	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH21	1	2/11/10	Area B	333718	6251310	1.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	0.6	<0.5	<0.5	<0.5	-	<0.5	0.7	0
AECOM	BH21	4	2/11/10	Area B	333718	6251310	-1.44	<0.5	0.6	<0.5	<0.5	1.6	-	2	0.8	1	<0.5	<0.5	0.7	<0.5	0.6	<0.5	16.3	<0.5	9	1.968
AECOM	BH22	4	2/10/10	Area B	333639	6251295	-1.8	<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
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	<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
AECOM	BH23	1.6	2/5/10	Area B	333640	6251297	0.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH23	4.7	2/5/10	Area B	333640	6251297	-2.26	<2	4.1	5.5	31.7	17.2	-	26.7	8.7	7.3	17.7	<2	44.7	<2	6.8	<2	-	4.8	102	24.714
AECOM	BH23	7.8	2/5/10	Area B	333640	6251297	-5.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH24	0.75	2/12/10	Area B	333655	6251338	1.56	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	<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
AECOM	BH24	13	2/12/10	Area C	333655	6251338	-10.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH24	5	2/12/10	Area B	333655	6251338	-2.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH25	1	19/2/10	Area B	333697	6251356	1.87	<0.5	<0.5	0.7	2.3	1.9	-	2.8	1	0.9	2	<0.5	3.4	<0.5	0.8	<0.5	-	1.7	3.9	2.61
AECOM	BH25	15	19/2/10	Area C	333697	6251356	-12.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH25	5.2	19/2/10	Area B	333697	6251356	-2.33	<0.5	<0.5	<0.5	0.9	2.6	-	4.1	1.4	1.4	0.8	<0.5	1	<0.5	1.2	<0.5	-	<0.5	3.1	3.382
AECOM	BH25	7.2	19/2/10	Area B	333697	6251356	-4.33	<0.5	<0.5	<0.5	1.7	1.6	-	2.3	0.9	0.7	1.4	<0.5	3.1	<0.5	0.7	<0.5	-	1.8	3.2	2.163
AECOM	BH26	10	2/11/10	Area C	333666	6251372	-7.41	<0.5	<0.5	0.7	0.9	0.6	-	0.8	<0.5	<0.5	0.8	<0.5	2.6	<0.5	<0.5	<0.5	-	2.6	2.8	0.778
AECOM	BH26	11.4	2/11/10	Area C	333666	6251372	-8.81	<0.5	1.4	1.7	3.4	4.3	-	5.7	2.7	1.9	2.7	0.5	6.2	<0.5	2.1	0.5	44.2	2.2	8.9	6.164
AECOM	BH26	16	2/11/10	Area C	333666	6251372	-13.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH26	4	2/11/10	Area B	333666	6251372	-1.41	<0.5	<0.5	1.2	1.9	1.4	-	1.8	0.8	0.9	1.5	<0.5	4.8	0.7	0.7	<0.5	-	4.2	4.5	1.953
AECOM	BH27	0.2	15/2/10	Area B	333630	6251405	2.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH27	10	15/2/10	Area C	333630	6251405	-7.59	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH27	14.5	15/2/10	Area C	333630	6251405	-12.09	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	<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	0.6	0
AECOM	BH28	0.5	15/2/10	Area B	333683	6251424	1.65	<0.5	<0.5	0.8	1.5	0.9	-	1.6	0.5	<0.5	1.2	<0.5	3	<0.5	<0.5	<0.5	-	2.8	2.6	1.227
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	<0.5	0.9	1.2	3.6	3.9	5		1.2	-	3	<0.5	6.5	0.6	1.1	0.5	-	2.2	7.4	4.412
AECOM	BH28	13	15/2/10	Area C	333683	6251424	-10.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH28	16	15/2/10	Area C	333683	6251424	-13.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH28	13	15/2/10	Area C	333683	6251424	-10.85	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH29	2.5	16/2/10	Area B	333662	6251448	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH29	7	16/2/10	Area B	333662	6251448	-4.38	<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	0
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	<0.5	1.8	4.5	10.3	8.7	11	-	3.4	-	8.3	1	19.3	0.7	3.2	<0.5	-	17.8	19.9	11.167
AECOM	BH30	7	16/2/10	Area B	333639	6251452	-4.58	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.8	0
AECOM	BH30	13	16/2/10	Area C	333639	6251452	-10.58	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH30	19	16/2/10	Area C	333639	6251452	-16.58	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH300	0.14	8/11/10	Area B	333743	6251537	2.26	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH300	1	8/11/10	Area B	333743	6251537	1.4	<0.5	1.8	1.9	3.8	4.8	-	5.4	2.8	2.1	3.2	<0.5	6.2	<0.5	2.3	0.8	-	3.5	6.7	6.22
AECOM	BH300	2	8/11/10	Area B	333743	6251537	0.4	<0.5	0.5	0.8	2.1	2.1	-	2.3	0.9	1	1.8	<0.5	3.7	<0.5	0.8	0.5	-	2.4	3.6	2.747
AECOM	BH300	3	8/11/10	Area B	333743	6251537	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH300	4	8/11/10	Area B	333743	6251537	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH300	5.4	8/11/10	Area B	333743	6251537	-3	<0.5	1.1	0.9	0.9	<0.5	-	<0.5	<0.5	<0.5	0.6	<0.5	1.2	0.7	<0.5	<0.5	-	3.2	1.8	0.096
AECOM	BH300	5	8/11/10	Area B	333743	6251537	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH300	6.2	8/11/10	Area B	333743	6251537	-3.8	<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
AECOM	BH301	1.3	10/1/10	Area B	333746	6251509	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH302	0.1	8/4/10	Area B	333746	6251493	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH302	1.2	8/4/10	Area B	333746	6251493	1.2	<0.5	0.6	1.4	3.4	2.7	-	3	1	1.1	2.4	<0.5	6.2	<0.5	0.9	<0.5	-	3	5.9	3.574
AECOM	BH302	2	8/4/10	Area B	333746	6251493	0.4	<0.5	1	1.4	4.9	6	-	6	2.8	2.4	4	0.5	8.2	<0.5	2.4	<0.5	-	2.7	9	8.138
AECOM	BH302	3	8/4/10	Area B	333746	6251493	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH302	4	8/4/10	Area B	333746	6251493	-1.6	<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	0.5	0
AECOM	BH302	5	8/4/10	Area B	333746	6251493	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH302	6	8/4/10	Area B	333746	6251493	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH303	0.08	8/5/10	Area B	333753	6251477	2.32	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH303	1	8/11/10	Area B	333753	6251477	1.4	<0.5	0.5	0.9	3.7	4.2	-	4.9	1.9	2	3.8	<0.5	7	<0.5	1.6	<0.5	-	2.8	7.4	5.477

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH303	2.2	8/11/10	Area B	333753	6251477	0.2	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH303	3.9	8/11/10	Area B	333753	6251477	-1.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH303	4.9	8/11/10	Area B	333753	6251477	-2.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH303	5.8	8/11/10	Area B	333753	6251477	-3.4	<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	-	<0.5	<0.5	0
AECOM	BH303	6.9	8/11/10	Area B	333753	6251477	-4.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH304	0.1	8/4/10	Area B	333755	6251420	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH304	10	8/5/10	Area B	333755	6251420	-7.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH304	1	8/4/10	Area B	333755	6251420	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	-	<0.5	<0.5	0
AECOM	BH304	2	8/4/10	Area B	333755	6251420	0.4	<0.5	<0.5	<0.5	0.6	0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	-	<0.5	0.9	0.56
AECOM	BH304	3	8/4/10	Area B	333755	6251420	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH304	4	8/4/10	Area B	333755	6251420	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH304	5	8/5/10	Area B	333755	6251420	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH304	6	8/5/10	Area B	333755	6251420	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH304	7	8/5/10	Area B	333755	6251420	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH304	8	8/5/10	Area B	333755	6251420	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH304	9	8/5/10	Area B	333755	6251420	-6.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH305	0.1	8/4/10	Area B	333753	6251398	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH305	1.2	8/4/10	Area B	333753	6251398	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	<0.5	-	<0.5	<0.5	0
AECOM	BH305	10	8/10/10	Area B	333753	6251398	-7.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH305	11	8/11/10	Area B	333753	6251398	-8.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH305	2	8/4/10	Area B	333753	6251398	0.4	<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	-	<0.5	<0.5	0
AECOM	BH305	3	8/4/10	Area B	333753	6251398	-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	<0.5	-	<0.5	0.6	0
AECOM	BH305	1	8/4/10	Area B	333753	6251398	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	-	<0.5	<0.5	0
AECOM	BH305	5	8/4/10	Area B	333753	6251398	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH305	6	8/4/10	Area B	333753	6251398	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH305	7	8/4/10	Area B	333753	6251398	-4.6	<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	<0.5	0
AECOM	BH305	8	8/10/10	Area B	333753	6251398	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH305	9	8/10/10	Area B	333753	6251398	-6.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH306	0.1	8/4/10	Area B	333752	6251362	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH306	0.5	8/4/10	Area B	333752	6251362	1.9	<0.5	0.5	<0.5	4.1	3.5	-	<0.5	<0.5	<0.5	3.2	<0.5	7.2	<0.5	<0.5	<0.5	-	<0.5	7.3	3.942
AECOM	BH306	10	8/4/10	Area B	333752	6251362	-7.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH306	11	8/4/10	Area B	333752	6251362	-8.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH306	12	8/4/10	Area B	333752	6251362	-9.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH306	13.4	8/4/10	Area B	333752	6251362	-11	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH306	2	8/4/10	Area B	333752	6251362	0.4	<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	-	<0.5	<0.5	0
AECOM	BH306	3	8/4/10	Area B	333752	6251362	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH306	4	8/4/10	Area B	333752	6251362	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH306	5	8/4/10	Area B	333752	6251362	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH306	6	8/4/10	Area B	333752	6251362	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH306	7	8/4/10	Area B	333752	6251362	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH306	8	8/4/10	Area B	333752	6251362	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH307	0.1	8/4/10	Area B	333715	6251529	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH307	1.5	8/4/10	Area B	333715	6251529	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH307	10	13/8/10	Area B	333715	6251529	-7.6	<0.5	2.2	1.5	0.9	<0.5	-	<0.5	<0.5	<0.5	0.6	<0.5	1.6	1.6	<0.5	7.7	-	3.4	2.3	0.096

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH307	11	13/8/10	Area B	333715	6251529	-8.6	6.2	30.8	18.8	14.4	8.7	-	6.7	2.9	3.1	11.9	0.8	21.3	23.7	2.4	241	-	55.6	29.9	12.308
AECOM	BH307	12	13/8/10	Area B	333715	6251529	-9.6	3	19.5	9.2	7.2	4	-	3.2	1.3	1.4	5	<0.5	10.2	12.5	1.1	105	-	29.1	15.2	5.353
AECOM	BH307	13	13/8/10	Area B	333715	6251529	-10.6	0.9	5.9	2.8	2	1.1	-	0.9	<0.5	<0.5	1.6	<0.5	3.1	3.6	<0.5	22.8	-	8.9	4.5	1.406
AECOM	BH307	2	8/9/10	Area B	333715	6251529	0.4	<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	-	<0.5	<0.5	0
AECOM	BH307	3	8/9/10	Area B	333715	6251529	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH307	4	8/9/10	Area B	333715	6251529	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH307	5	8/9/10	Area B	333715	6251529	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH307	6	8/9/10	Area B	333715	6251529	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH307	7	13/8/10	Area B	333715	6251529	-4.6	<0.5	1.2	1.8	4.9	4.3	-	4.9	1.9	3	3.7	<0.5	9.6	0.5	1.7	0.6	-	3.9	9.8	5.806
AECOM	BH307	9	13/8/10	Area B	333715	6251529	-6.6	2.7	15.2	7.3	5.9	3.4	-	2.6	1.1	1.2	4.5	<0.5	8.8	10.2	0.8	69.4	-	24.1	13.6	4.506
AECOM	BH308	0.1	8/6/10	Area B	333735	6251438	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH308	10	13/8/10	Area B	333735	6251438	-7.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH308	1	8/12/10	Area B	333735	6251438	1.4	<0.5	1.2	2.1	3.4	2.9	-	3.1	1.4	1.3	2.7	<0.5	8.3	0.6	1.2	<0.5	-	6.5	7.8	3.841
AECOM	BH308	11	13/8/10	Area B	333735	6251438	-8.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH308	12	13/8/10	Area B	333735	6251438	-9.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH308	13	13/8/10	Area B	333735	6251438	-10.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH308	14	13/8/10	Area B	333735	6251438	-11.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH308	2	8/12/10	Area B	333735	6251438	0.4	<0.5	1.2	1.1	2.8	2.8	-	3	1.7	1.1	2.2	<0.5	6.3	<0.5	1.3	<0.5	-	1.8	6.3	3.659
AECOM	BH308	3	8/12/10	Area B	333735	6251438	-0.6	4.9	25.8	44.3	46.8	32.9	-	33.6	11.7	15.9	34.4	3	107	25.5	11.1	14.8	-	110	99.5	47.101
AECOM	BH308	4	8/12/10	Area B	333735	6251438	-1.6	1.5	4.5	9.1	18.9	15.4	-	16	5.6	7	14	1.3	43	2.6	5.2	1.8	-	12.5	41.2	21.606
AECOM	BH308	5	13/8/10	Area B	333735	6251438	-2.6	<0.8	0.8	1.9	4.4	3.7	-	4.1	2.2	1.7	3.2	<0.8	8.3	<0.8	1.7	<0.8	-	2.8	9	4.944
AECOM	BH308	6	13/8/10	Area B	333735	6251438	-3.6	<0.5	<0.5	1.2	2.3	1.8	-	1.9	1	0.9	1.7	<0.5	4.4	<0.5	0.8	<0.5	-	2.3	4.1	2.417
AECOM	BH308	7	13/8/10	Area B	333735	6251438	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH308	8	13/8/10	Area B	333735	6251438	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH308	9	13/8/10	Area B	333735	6251438	-6.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH309	0.1	30/7/10	Area B	333736	6251400	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH309	1.5	8/4/10	Area B	333736	6251400	0.9	<0.5	<0.5	<0.5	1.1	1.2	-	1.4	0.7	<0.5	1	<0.5	1.6	<0.5	0.5	<0.5	-	<0.5	1.7	1.517
AECOM	BH309	10.5	8/4/10	Area B	333736	6251400	-8.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH309	11.5	8/4/10	Area B	333736	6251400	-9.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH309	12.5	8/4/10	Area B	333736	6251400	-10.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH309	2.5	8/4/10	Area B	333736	6251400	-0.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH309	4.5	8/4/10	Area B	333736	6251400	-2.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH309	5.5	8/4/10	Area B	333736	6251400	-3.1	<0.5	<0.5	0.7	2.3	2.2	-	2.7	1	1	1.9	<0.5	4.1	<0.5	0.9	<0.5	-	1.2	3.8	2.919
AECOM	BH309	6.5	8/4/10	Area B	333736	6251400	-4.1	8.5	1.2	24.8	40.2	27.3	-	30	8.6	16.7	33.1	2.9	79.3	10.9	9	0.8	-	69	62	40.207
AECOM	BH309	7.5	8/4/10	Area B	333736	6251400	-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	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH309	8.5	8/4/10	Area B	333736	6251400	-6.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH309	9.5	8/4/10	Area B	333736	6251400	-7.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH31	0.2	16/2/10	Area B	333646	6251473	2.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH31	2.5	16/2/10	Area B	333646	6251473	-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
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	<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
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	<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
AECOM	BH31	16	17/2/10	Area C	333646	6251473	-13.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH31	23.5	17/2/10	Area C	333646	6251473	-21.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH310	0.1	30/7/10	Area B	333732	6251355	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH310	10	8/12/10	Area B	333732	6251355	-7.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH310	1	8/12/10	Area B	333732	6251355	1.4	<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	-	0.6	0.9	0
AECOM	BH310	11	8/12/10	Area B	333732	6251355	-8.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH310	12	8/12/10	Area B	333732	6251355	-9.6	<0.5	<0.5	<0.5	1	1.2	-	1.2	0.7	<0.5	0.8	<0.5	1.8	<0.5	0.6	<0.5	-	0.7	2.1	1.495
AECOM	BH310	13	8/12/10	Area B	333732	6251355	-10.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH310	14	8/12/10	Area B	333732	6251355	-11.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH310	15	8/12/10	Area B	333732	6251355	-12.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH310	16	8/12/10	Area B	333732	6251355	-13.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH310	2	8/12/10	Area B	333732	6251355	0.4	<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	-	<0.5	<0.5	0
AECOM	BH310	3	8/12/10	Area B	333732	6251355	-0.6	<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	0
AECOM	BH310	5	8/12/10	Area B	333732	6251355	-2.6	<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	<0.5	-	<0.5	0.5	0
AECOM	BH310	6	8/12/10	Area B	333732	6251355	-3.6	<0.5	<0.5	<0.5	0.7	0.6	-	0.6	<0.5	<0.5	0.6	<0.5	1.2	<0.5	<0.5	<0.5	-	1.2	1.5	0.736
AECOM	BH310	9	8/12/10	Area B	333732	6251355	-6.6	<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	0
AECOM	BH311	0.1	30/7/10	Area B	333742	6251341	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH311	0.9	8/2/10	Area B	333742	6251341	1.5	<0.5	<0.5	<0.5	0.9	0.8	-	0.9	<0.5	<0.5	0.8	<0.5	1.7	<0.5	<0.5	<0.5	-	1.1	1.9	0.988
AECOM	BH311	10	8/2/10	Area B	333742	6251341	-7.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH311	11	8/2/10	Area B	333742	6251341	-8.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH311	12	8/2/10	Area B	333742	6251341	-9.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH311	13	8/2/10	Area B	333742	6251341	-10.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH311	14	8/2/10	Area B	333742	6251341	-11.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH311	15	8/2/10	Area B	333742	6251341	-12.6	<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	0
AECOM	BH311	2	8/2/10	Area B	333742	6251341	0.4	<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	-	<0.5	<0.5	0
AECOM	BH311	3	8/2/10	Area B	333742	6251341	-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	<0.5	-	<0.5	0.6	0
AECOM	BH311	4	8/2/10	Area B	333742	6251341	-1.6	<0.5	<0.5	<0.5	1.4	2.2	-	1.5	1.4	0.8	1.3	<0.5	1.1	<0.5	1	<0.5	-	0.7	1.4	2.697
AECOM	BH311	5.8	8/2/10	Area B	333742	6251341	-3.4	0.6	<0.5	1.9	4.6	4.2	-	6.1	1.4	2.9	4.1	<0.5	7	0.9	1.2	0.8	-	7.8	6.3	5.735
AECOM	BH311	5	8/2/10	Area B	333742	6251341	-2.6	1.7	<0.5	1.6	0.8	<0.5	-	<0.5	<0.5	<0.5	0.6	<0.5	4.6	1.2	<0.5	0.9	-	4.6	4	0.086
AECOM	BH311	7	8/2/10	Area B	333742	6251341	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH311	8	8/2/10	Area B	333742	6251341	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH311	9	8/2/10	Area B	333742	6251341	-6.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH312	0.1	30/7/10	Area B	333741	6251326	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH312	10	8/11/10	Area B	333741	6251326	-7.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH312	1	8/2/10	Area B	333741	6251326	1.4	<0.5	2	2.4	5	4.6	-	5.3	2.3	2.2	4	<0.5	9.6	<0.5	1.6	<0.5	-	4.4	10.3	6.073
AECOM	BH312	11	8/11/10	Area B	333741	6251326	-8.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH312	12	8/11/10	Area B	333741	6251326	-9.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH312	13	8/11/10	Area B	333741	6251326	-10.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH312	14	8/11/10	Area B	333741	6251326	-11.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH312	15	8/11/10	Area B	333741	6251326	-12.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH312	16	8/11/10	Area B	333741	6251326	-13.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH312	2.8	8/2/10	Area B	333741	6251326	-0.4	<0.5	1.2	1.1	3.2	3	-	3.1	1.4	1.1	2.9	<0.5	4.8	<0.5	1.2	<0.5	-	1.7	5.1	3.903
AECOM	BH312	2	8/2/10	Area B	333741	6251326	0.4	<0.5	2.5	4.2	10.8	9.4	-	11.5	4.6	5.6	9.9	1.2	16.1	<0.5	4.2	0.6	-	6	15.7	13.955
AECOM	BH312	4	8/11/10	Area B	333741	6251326	-1.6	1.3	9.2	24	41.9	32.6	-	43.3	14.7	13.1	29.3	3	96.1	6.8	13.6	2.7	-	53.2	90.4	47.23
AECOM	BH312	5	8/11/10	Area B	333741	6251326	-2.6	<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	0
AECOM	BH312	6	8/11/10	Area B	333741	6251326	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH312	8	8/11/10	Area B	333741	6251326	-5.6	<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	<0.5	-	<0.5	<0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH312	9	8/11/10	Area B	333741	6251326	-6.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH313	0.1	8/4/10	Area B	333699	6251512	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH313	1	8/9/10	Area B	333699	6251512	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	-	<0.5	<0.5	0
AECOM	BH313	11	8/9/10	Area C	333699	6251512	-8.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH313	12.5	8/9/10	Area C	333699	6251512	-10.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH313	14	8/9/10	Area C	333699	6251512	-11.6	<0.5	<0.5	1.1	2.3	1.8	-	2.3	0.6	0.7	1.8	<0.5	4.8	<0.5	0.5	<0.5	-	2.6	4.8	2.404
AECOM	BH313	2	8/9/10	Area B	333699	6251512	0.4	<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	-	<0.5	<0.5	0
AECOM	BH313	3	8/9/10	Area B	333699	6251512	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH313	4	8/9/10	Area B	333699	6251512	-1.6	<0.5	<0.5	<0.5	0.6	0.6	-	0.6	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	-	<0.5	1.4	0.72
AECOM	BH313	5	8/9/10	Area B	333699	6251512	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH313	6	8/9/10	Area B	333699	6251512	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH313	7	8/9/10	Area B	333699	6251512	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH313	8	8/9/10	Area B	333699	6251512	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH313	9.5	8/9/10	Area C	333699	6251512	-7.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH314	0.1	30/9/10	Area B	333711	6251398	2.3	<0.5	2.9	4.6	10.8	8.9	-	9.4	4.2	4	7.9	1.2	19.9	1.2	3.7	1.6	-	11.1	18.9	13.011
AECOM	BH314	10	30/9/10	Area C	333711	6251398	-7.6	<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	0
AECOM	BH314	1	30/9/10	Area B	333711	6251398	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	-	<0.5	<0.5	0
AECOM	BH314	11	30/9/10	Area C	333711	6251398	-8.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH314	12	30/9/10	Area C	333711	6251398	-9.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH314	2	30/9/10	Area B	333711	6251398	0.4	<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	-	<0.5	<0.5	0
AECOM	BH314	3	30/9/10	Area B	333711	6251398	-0.6	<0.5	<0.5	<0.5	1.4	2.2	-	2.2	0.9	0.8	1	<0.5	1.9	<0.5	0.7	<0.5	-	0.9	3.6	2.729
AECOM	BH314	4	30/9/10	Area B	333711	6251398	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH314	5	30/9/10	Area B	333711	6251398	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH314	7	30/9/10	Area B	333711	6251398	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH314	8	30/9/10	Area B	333711	6251398	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH315	0.1	30/9/10	Area B	333709	6251379	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH315	1	30/9/10	Area B	333709	6251379	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	-	<0.5	<0.5	0
AECOM	BH315	2	30/9/10	Area B	333709	6251379	0.4	<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	0
AECOM	BH315	3	30/9/10	Area B	333709	6251379	-0.6	<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	-	0.6	1.2	0.05
AECOM	BH315	4	30/9/10	Area B	333709	6251379	-1.6	6.7	1.9	9.5	11.1	9	-	8.4	2.7	4.9	9.8	0.5	31	6.1	2.6	6.1	-	31.8	26.3	12.325
AECOM	BH315	5	30/9/10	Area B	333709	6251379	-2.6	3.7	3	13	19.7	13.9	-	12.9	3.4	4.8	16	0.8	38	6	3.3	3.3	-	33.2	39	18.964
AECOM	BH315	6	30/9/10	Area B	333709	6251379	-3.6	<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	0
AECOM	BH315	8	30/9/10	Area B	333709	6251379	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH316	0.1	8/4/10	Area B	333721	6251335	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH316	10	8/4/10	Area C	333721	6251335	-7.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH316	1	8/4/10	Area B	333721	6251335	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	-	<0.5	<0.5	0
AECOM	BH316	2	8/4/10	Area B	333721	6251335	0.4	<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	-	<0.5	<0.5	0
AECOM	BH316	3	8/4/10	Area B	333721	6251335	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH316	4	8/4/10	Area B	333721	6251335	-1.6	<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	<0.5	-	0.6	<0.5	0
AECOM	BH316	6	8/4/10	Area B	333721	6251335	-3.6	<0.5	<0.5	0.5	1	1.5	-	1.2	0.6	0.5	0.8	<0.5	2.6	<0.5	0.5	<0.5	-	<0.5	6	1.834
AECOM	BH316	7	8/4/10	Area B	333721	6251335	-4.6	<0.5	<0.5	<0.5	0.5	0.6	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	-	<0.5	1.1	0.65
AECOM	BH317	0.1	8/4/10	Area B	333681	6251474	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH317	1	8/6/10	Area B	333681	6251474	1.4	<0.5	<0.5	<0.5	1	1.3	-	1.6	0.9	<0.5	0.9	<0.5	1.8	<0.5	0.7	<0.5	-	0.9	2	1.648
AECOM	BH317	2	8/6/10	Area B	333681	6251474	0.4	<0.5	<0.5	0.7	1.8	1.6	-	2.1	0.8	0.5	1.6	<0.5	4	<0.5	0.7	<0.5	-	1.5	3.9	2.134

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH317	4	8/6/10	Area B	333681	6251474	-1.6	<0.5	0.8	1.4	2.2	2.3	-	2.6	1.3	0.9	1.8	<0.5	5.1	<0.5	1.1	<0.5	-	4.9	5.1	3.011
AECOM	BH317	5	8/6/10	Area B	333681	6251474	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH317	6	8/6/10	Area B	333681	6251474	-3.6	<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	<0.5	-	<0.5	0.5	0
AECOM	BH317	7	8/6/10	Area B	333681	6251474	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH317	8	8/6/10	Area B	333681	6251474	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH317	9	8/6/10	Area C	333681	6251474	-6.6	<0.5	0.6	0.9	2.1	1.9	-	2.2	0.9	0.7	1.7	<0.5	4.9	<0.5	0.8	<0.5	-	2.6	5	2.506
AECOM	BH318	0.1	29/9/10	Area B	333686	6251415	2.3	<0.5	<0.5	0.9	2.8	2.8	-	3	1.3	1.5	2.4	<0.5	5.3	<0.5	1.1	<0.5	-	2.4	5.7	3.677
AECOM	BH318	1	29/9/10	Area B	333686	6251415	1.4	<0.5	<0.5	<0.5	0.7	0.7	-	0.8	<0.5	<0.5	0.6	<0.5	1.2	<0.5	<0.5	<0.5	-	<0.5	1.2	0.856
AECOM	BH318	12	29/9/10	Area C	333686	6251415	-9.6	<0.5	1.4	1.6	5	5.5	-	5.1	1.8	2.8	4	<0.5	9	<0.5	1.6	<0.5	-	2.5	11.1	7.008
AECOM	BH318	13	29/9/10	Area C	333686	6251415	-10.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH318	2	29/9/10	Area B	333686	6251415	0.4	<0.5	0.6	<0.5	3.4	4.7	-	4.4	1.9	1.7	3	<0.5	3.9	<0.5	1.6	<0.5	-	0.7	9.7	5.859
AECOM	BH318	3	29/9/10	Area B	333686	6251415	-0.6	0.6	4.3	5.5	9	15.4	-	15.9	4.7	6.3	8.1	0.9	20.8	1.6	4.5	<0.5	-	15.7	61.9	19.998
AECOM	BH318	4	29/9/10	Area B	333686	6251415	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH318	5	29/9/10	Area B	333686	6251415	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH318	7	29/9/10	Area B	333686	6251415	-4.6	0.6	<0.5	0.7	2.5	2.2	-	2.5	0.9	0.9	2.2	<0.5	6	<0.5	0.8	0.7	-	4.3	5.2	2.901
AECOM	BH318	8	29/9/10	Area B	333686	6251415	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH318	9	29/9/10	Area C	333686	6251415	-6.6	<0.5	<0.5	<0.5	1.1	1.2	-	1.2	<0.5	<0.5	1	<0.5	2.6	<0.5	<0.5	<0.5	-	0.8	3.4	1.44
AECOM	BH319	0.1	29/9/10	Area B	333690	6251396	2.3	0.8	<0.5	1.3	2	1.8	-	2	1	0.8	1.7	<0.5	4.8	<0.5	0.8	0.6	-	4	4.7	2.387
AECOM	BH319	1	29/9/10	Area B	333690	6251396	1.4	<0.5	<0.5	<0.5	1	1.1	-	1.2	0.6	<0.5	0.9	<0.5	1.8	<0.5	<0.5	0.6	-	1	1.9	1.335
AECOM	BH319	2	29/9/10	Area B	333690	6251396	0.4	<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	-	<0.5	0.5	0
AECOM	BH319	3	29/9/10	Area B	333690	6251396	-0.6	<0.5	<0.5	<0.5	0.6	0.5	-	0.6	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	-	0.6	1.2	0.62
AECOM	BH319	4	29/9/10	Area B	333690	6251396	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH319	5	29/9/10	Area B	333690	6251396	-2.6	<0.5	1	1.9	4.6	3.4	-	4	1.4	1.7	3.9	<0.5	11.7	<0.5	1.3	<0.5	-	5.3	11.1	4.613
AECOM	BH319	6	29/9/10	Area B	333690	6251396	-3.6	<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	0.6	0.06
AECOM	BH319	7	29/9/10	Area B	333690	6251396	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH319	8	29/9/10	Area B	333690	6251396	-5.6	<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	<0.5	-	<0.5	0.6	0
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	<0.5	1.2	1.4	3.9	3.8	5	-	1.6	-	3.2	<0.5	6.6	<0.5	1.4	<0.5	-	2.3	7.1	4.378
AECOM	BH32	14.5	2/12/10	Area C	333692	6251462	-11.68	<0.5	2.2	2.8	5.3	4.8	-	6.6	2.5	2.4	4.2	0.6	11.1	0.9	2.1	0.7	64.4	4.4	13.8	7.107
AECOM	BH32	16	2/12/10	Area C	333692	6251462	-13.18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH32	7	2/12/10	Area B	333692	6251462	-4.18	<0.5	1	1.9	2.7	1.6	-	2.4	0.9	1.2	2.2	<0.5	7.2	1	0.7	<0.5	-	5.4	6.8	2.331
AECOM	BH320	0.1	28/9/10	Area B	333692	6251377	2.3	<0.5	<0.5	1.2	1.9	1.7	-	1.8	1.4	2.1	1.5	<0.5	4.8	<0.5	1.1	<0.5	-	2.7	5.4	2.419
AECOM	BH320	10	28/9/10	Area C	333692	6251377	-7.6	<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	<0.5	-	<0.5	0.6	0
AECOM	BH320	1	28/9/10	Area B	333692	6251377	1.4	2.4	0.5	3	3.4	1.8	-	2.1	1.3	2.1	2.3	<0.5	12.2	1.4	1	2.7	-	8	11.5	2.696
AECOM	BH320	11	28/9/10	Area C	333692	6251377	-8.6	<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	1	0
AECOM	BH320	12.4	28/9/10	Area C	333692	6251377	-10	<0.5	2.1	2.7	6	6.5	-	6.6	4.3	5.9	4.4	<0.5	11.9	0.6	3.9	0.9	-	3.1	15.5	8.827
AECOM	BH320	13	28/9/10	Area C	333692	6251377	-10.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH320	2	28/9/10	Area B	333692	6251377	0.4	<0.5	<0.5	<0.5	0.9	<0.5	-	1	1.3	1.2	1.2	<0.5	2.2	<0.5	1	<0.5	-	<0.5	2.5	0.435
AECOM	BH320	3	28/9/10	Area B	333692	6251377	-0.6	<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	-	0.7	1	0
AECOM	BH320	5	28/9/10	Area B	333692	6251377	-2.6	0.6	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.6	<0.5	<0.5	<0.5	-	1.5	1.7	0
AECOM	BH320	6	28/9/10	Area B	333692	6251377	-3.6	18.1	118	146	182	155	-	144	108	89.8	166	25.6	353	131	80.7	28.1	-	455	361	232.99
AECOM	BH320	7	28/9/10	Area B	333692	6251377	-4.6	<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	-	0.6	1	0
AECOM	BH320	8	28/9/10	Area B	333692	6251377	-5.6	<0.5	<0.5	0.9	0.7	<0.5	-	0.6	<0.5	0.5	0.8	<0.5	2.8	<0.5	<0.5	<0.5	-	2.3	3	0.188
AECOM	BH320	9	28/9/10	Area C	333692	6251377	-6.6	<0.5	0.9	1.4	2.8	1.9	-	2.8	1.3	1.7	2.1	<0.5	11.2	<0.5	1.1	<0.5	-	4.6	11.7	2.774
AECOM	BH321	0.23	8/4/10	Area B	333698	6251336	2.17	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH321	1	8/4/10	Area B	333698	6251336	1.4	1	0.7	<0.5	2.7	2.7	-	<0.5	1.1	<0.5	2.3	<0.5	6.1	0.6	0.9	0.5	-	<0.5	8.1	3.094
AECOM	BH321	11	8/4/10	Area C	333698	6251336	-8.6	<0.5	<0.5	<0.5	1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	2.3	<0.5	<0.5	<0.5	-	<0.5	2.8	0.1
AECOM	BH321	12.5	8/4/10	Area C	333698	6251336	-10.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	3.9	<0.5	<0.5	1	-	<0.5	4.4	0
AECOM	BH321	2	8/4/10	Area B	333698	6251336	0.4	<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	-	<0.5	<0.5	0
AECOM	BH321	3	8/4/10	Area B	333698	6251336	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH321	4	8/4/10	Area B	333698	6251336	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH321	5	8/4/10	Area B	333698	6251336	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH321	6	8/4/10	Area B	333698	6251336	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH321	7	8/4/10	Area B	333698	6251336	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH321	8	8/4/10	Area B	333698	6251336	-5.6	<0.5	<0.5	<0.5	0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.3	<0.5	<0.5	<0.5	-	<0.5	1.4	0.05
AECOM	BH321	9.5	8/4/10	Area C	333698	6251336	-7.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.5	0
AECOM	BH322	0.1	23/7/10	Area B	333700	6251301	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH322	1	8/2/10	Area B	333700	6251301	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	-	<0.5	<0.5	0
AECOM	BH322	2	8/2/10	Area B	333700	6251301	0.4	<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	-	<0.5	<0.5	0
AECOM	BH322	3	8/2/10	Area B	333700	6251301	-0.6	<0.5	<0.5	<0.5	0.9	0.6	-	0.6	<0.5	<0.5	0.6	<0.5	1.1	<0.5	<0.5	<0.5	-	<0.5	1.3	0.756
AECOM	BH322	4	8/2/10	Area B	333700	6251301	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH322	5.8	8/2/10	Area B	333700	6251301	-3.4	<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	-	<0.5	<0.5	0
AECOM	BH322	5	8/2/10	Area B	333700	6251301	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH322	7	8/2/10	Area B	333700	6251301	-4.6	<0.5	0.7	2.1	2.4	2.9	-	4.1	1.5	1.4	2	<0.5	5	<0.5	1.2	<0.5	-	2.4	6.7	3.845
AECOM	BH322	8.5	8/2/10	Area C	333700	6251301	-6.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	0.7	<0.5	<0.5	<0.5	<0.5	1	<0.5	<0.5	<0.5	-	<0.5	1.1	0.07
AECOM	BH323	16.8	8/5/10	Area C	333657	6251510	-14.4	<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	-	<0.5	<0.5	0
AECOM	BH323	0.1	8/4/10	Area B	333657	6251510	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	1.5	8/4/10	Area B	333657	6251510	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	10.5	8/4/10	Area C	333657	6251510	-8.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	11.5	8/4/10	Area C	333657	6251510	-9.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	12.5	8/4/10	Area C	333657	6251510	-10.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	13.5	8/5/10	Area C	333657	6251510	-11.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	14.5	8/5/10	Area C	333657	6251510	-12.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	15.5	8/5/10	Area C	333657	6251510	-13.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	2.5	8/4/10	Area B	333657	6251510	-0.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	3.5	8/4/10	Area B	333657	6251510	-1.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	4.5	8/4/10	Area B	333657	6251510	-2.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	5.5	8/4/10	Area B	333657	6251510	-3.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	6.5	8/4/10	Area B	333657	6251510	-4.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	7.5	8/4/10	Area B	333657	6251510	-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	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	8.5	8/4/10	Area C	333657	6251510	-6.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH323	9.5	8/4/10	Area C	333657	6251510	-7.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH324	10.5	8/9/10	Area C	333657	6251489	-8.1	<0.5	<0.5	<0.5	<0.5	0.7	-	0.8	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	-	<0.5	2.3	0.78
AECOM	BH324	2	8/5/10	Area B	333657	6251489	0.4	<0.5	<0.5	<0.5	0.6	0.6	-	0.6	<0.5	<0.5	0.5	<0.5	1.4	<0.5	<0.5	<0.5	-	0.8	1.4	0.725
AECOM	BH324	3	8/5/10	Area B	333657	6251489	-0.6	<0.5	<0.5	<0.5	1	1.4	-	1.1	0.9	0.5	0.8	<0.5	1.5	<0.5	0.6	<0.5	-	<0.5	1.9	1.737
AECOM	BH324	4	8/5/10	Area B	333657	6251489	-1.6	<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	-	0.7	1	0
AECOM	BH324	5	8/5/10	Area B	333657	6251489	-2.6	<0.5	0.8	0.8	5.8	3.7	-	5	1.6	1.3	2.9	<0.5	10.5	<0.5	1.4	<0.5	-	1	19.2	5.095
AECOM	BH324	6	8/5/10	Area B	333657	6251489	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH324	7	8/5/10	Area B	333657	6251489	-4.6	0.6	2.2	6.5	13.4	7.6	-	12.7	2.6	3.3	10	1	27.8	1.6	2.7	1.3	-	14	21.2	11.936

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH324	8	8/5/10	Area B	333657	6251489	-5.6	<0.5	<0.5	<0.5	0.8	0.6	-	0.8	<0.5	<0.5	0.6	<0.5	1.6	<0.5	<0.5	<0.5	-	0.9	1.4	0.766
AECOM	BH324	9	8/6/10	Area C	333657	6251489	-6.6	<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	0.6	0.06
AECOM	BH325	0.1	8/5/10	Area B	333660	6251433	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH325	1.5	8/5/10	Area B	333660	6251433	0.9	<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	1.2	0.72
AECOM	BH325	10.5	8/6/10	Area C	333660	6251433	-8.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH325	11.5	8/6/10	Area C	333660	6251433	-9.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH325	12.5	8/6/10	Area C	333660	6251433	-10.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH325	2.5	8/5/10	Area B	333660	6251433	-0.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH325	3.5	8/5/10	Area B	333660	6251433	-1.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH325	4.5	8/5/10	Area B	333660	6251433	-2.1	0.5	<0.5	4.6	8.1	8.1	-	8.5	3.7	4.2	6.5	0.8	23.7	<0.5	3.4	<0.5	-	1.7	23.2	11.422
AECOM	BH325	5.5	8/5/10	Area B	333660	6251433	-3.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH325	6.5	8/5/10	Area B	333660	6251433	-4.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH325	7.5	8/5/10	Area B	333660	6251433	-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	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH325	8.5	8/5/10	Area C	333660	6251433	-6.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH325	9.5	8/6/10	Area C	333660	6251433	-7.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH326	0.1	8/5/10	Area B	333659	6251418	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH326	1	8/6/10	Area B	333659	6251418	1.4	<0.5	<0.5	<0.5	0.5	<0.5	-	0.6	<0.5	<0.5	<0.5	<0.5	1	<0.5	<0.5	<0.5	-	0.9	1.1	0.11
AECOM	BH326	2	8/6/10	Area B	333659	6251418	0.4	<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	-	<0.5	<0.5	0
AECOM	BH326	3	8/6/10	Area B	333659	6251418	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH326	4	8/6/10	Area B	333659	6251418	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH326	5	8/6/10	Area B	333659	6251418	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH326	6	8/9/10	Area B	333659	6251418	-3.6	<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	0
AECOM	BH326	7	8/9/10	Area B	333659	6251418	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH326	8	8/9/10	Area B	333659	6251418	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH327	0.1	8/5/10	Area B	333660	6251400	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH327	1	8/5/10	Area B	333660	6251400	1.4	<0.5	<0.5	<0.5	0.5	1.3	-	1	1.4	<0.5	0.5	<0.5	<0.5	<0.5	1	<0.5	-	<0.5	0.7	1.569
AECOM	BH327	12	8/5/10	Area C	333660	6251400	-9.6	<0.5	2	2.6	6.6	8.2	-	9.2	3.7	4.1	5.7	0.9	11.5	0.7	3.4	0.7	-	3.7	14.9	11.524
AECOM	BH327	13.5	8/5/10	Area C	333660	6251400	-11.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH327	2.	8/5/10	Area B	333660	6251400	0.4	<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	-	<0.5	<0.5	0
AECOM	BH327	3	8/5/10	Area B	333660	6251400	-0.6	<0.5	<0.5	<0.5	0.6	0.7	-	0.9	<0.5	<0.5	0.5	<0.5	0.9	<0.5	<0.5	<0.5	-	<0.5	1	0.855
AECOM	BH327	1	8/5/10	Area B	333660	6251400	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	-	<0.5	<0.5	0
AECOM	BH327	5	8/5/10	Area B	333660	6251400	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH327	7	8/5/10	Area B	333660	6251400	-4.6	0.7	<0.5	0.8	1.4	1.4	-	1.7	0.8	0.5	1.2	<0.5	3.1	0.8	0.7	2.3	-	3	3.2	1.85
AECOM	BH327	9	8/5/10	Area C	333660	6251400	-6.6	<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	<0.5	-	<0.5	0.6	0
AECOM	BH328	0.1	28/9/10	Area B	333668	6251378	2.3	<0.5	<0.5	<0.5	0.7	0.6	-	0.7	<0.5	<0.5	0.5	<0.5	1.1	<0.5	<0.5	<0.5	-	0.5	1.1	0.745
AECOM	BH328	1	28/9/10	Area B	333668	6251378	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	-	<0.5	<0.5	0
AECOM	BH328	2	28/9/10	Area B	333668	6251378	0.4	<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	-	<0.5	<0.5	0
AECOM	BH328	3	28/9/10	Area B	333668	6251378	-0.6	<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	-	0.8	1	0
AECOM	BH328	4	28/9/10	Area B	333668	6251378	-1.6	<0.5	<0.5	<0.5	0.7	0.8	-	0.8	<0.5	<0.5	0.5	<0.5	1	<0.5	<0.5	<0.5	-	0.6	1.8	0.955
AECOM	BH328	5	28/9/10	Area B	333668	6251378	-2.6	<0.5	<0.5	<0.5	<0.5	0.6	-	0.6	<0.5	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	-	0.6	0.9	0.66
AECOM	BH328	6	28/9/10	Area B	333668	6251378	-3.6	<0.5	<0.5	1.4	1.6	1.5	-	2.3	0.7	2.7	1.6	<0.5	3.6	<0.5	0.6	<0.5	-	1.4	3.6	2.243
AECOM	BH328	7	28/9/10	Area B	333668	6251378	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH328	8	28/9/10	Area B	333668	6251378	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH329	0.1	27/7/10	Area B	333670	6251356	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH329	10	27/9/10	Area C	333670	6251356	-7.6	<0.5	<0.5	<0.5	0.5	0.7	-	0.7	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	-	<0.5	0.9	0.82
AECOM	BH329	1	27/9/10	Area B	333670	6251356	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	-	<0.5	<0.5	0
AECOM	BH329	12	27/9/10	Area C	333670	6251356	-9.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH329	13	27/9/10	Area C	333670	6251356	-10.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH329	2	27/9/10	Area B	333670	6251356	0.4	<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	-	<0.5	<0.5	0
AECOM	BH329	3	27/9/10	Area B	333670	6251356	-0.6	<0.5	<0.5	<0.5	0.6	0.6	-	0.8	<0.5	<0.5	<0.5	<0.5	1	<0.5	<0.5	<0.5	-	<0.5	1.2	0.74
AECOM	BH329	4	27/9/10	Area B	333670	6251356	-1.6	3	<0.5	4.6	1.9	1.5	-	1.8	0.8	0.5	1.6	<0.5	7.3	4.8	0.6	1.5	-	17.6	6	2.004
AECOM	BH329	5	27/9/10	Area B	333670	6251356	-2.6	5.8	<0.5	2.6	1.1	0.7	-	0.9	<0.5	<0.5	0.9	<0.5	4.6	3.2	<0.5	15.7	-	9.6	3.9	0.909
AECOM	BH329	6	27/9/10	Area B	333670	6251356	-3.6	<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	<0.5	-	0.5	0.5	0
AECOM	BH329	7	27/9/10	Area B	333670	6251356	-4.6	<0.5	<0.5	<0.5	1.2	1.1	-	1.1	0.6	0.5	1	<0.5	2.4	<0.5	<0.5	<0.5	-	1.1	2.5	1.396
AECOM	BH329	8	27/9/10	Area B	333670	6251356	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH33	0.75	12/2/10	Block 3	333699	6251546	1.55	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
AECOM	BH33	5	12/2/10	Block 3	333699	6251546	-2.7	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH33	8	12/2/10	Block 3	333699	6251546	-5.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH33	0.75	2/12/10	Area B	333699	6251546	1.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH33	5	2/12/10	Area B	333699	6251546	-2.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH33	8	2/12/10	Area B	333699	6251546	-5.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH330	0.1	23/7/10	Area B	333674	6251337	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	-	<0.5	0.5	0
AECOM	BH330	1	8/4/10	Area B	333674	6251337	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	-	<0.5	0.6	0.55
AECOM	BH330	2	8/4/10	Area B	333674	6251337	0.4	<0.5	<0.5	<0.5	0.5	0.6	-	0.5	<0.5	<0.5	0.5	<0.5	1.1	<0.5	<0.5	<0.5	-	0.5	1.2	0.705
AECOM	BH330	3	8/4/10	Area B	333674	6251337	-0.6	<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	0.8	0.05
AECOM	BH330	4	8/4/10	Area B	333674	6251337	-1.6	<0.5	<0.5	<0.5	0.6	0.6	-	0.6	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	-	<0.5	1.2	0.72
AECOM	BH330	5	8/4/10	Area B	333674	6251337	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH330	6	8/4/10	Area B	333674	6251337	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH330	7	8/4/10	Area B	333674	6251337	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH331	0.1	23/7/10	Area B	333676	6251315	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH331	10	8/4/10	Area C	333676	6251315	-7.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH331	1	8/2/10	Area B	333676	6251315	1.4	<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	1.2	0
AECOM	BH331	11	8/4/10	Area C	333676	6251315	-8.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH331	12	8/4/10	Area C	333676	6251315	-9.6	<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	0.9	0
AECOM	BH331	2	8/2/10	Area B	333676	6251315	0.4	<0.5	1.5	2	2.4	2.7	-	2.7	1.5	1.3	2	<0.5	7.4	<0.5	1.4	<0.5	-	1.2	8.7	3.515
AECOM	BH331	3	8/2/10	Area B	333676	6251315	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH331	4	8/2/10	Area B	333676	6251315	-1.6	<0.5	<0.5	<0.5	0.6	<0.5	-	0.6	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	-	0.6	1.4	0.12
AECOM	BH331	5	8/2/10	Area B	333676	6251315	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH331	6	8/4/10	Area B	333676	6251315	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH331	7	8/4/10	Area B	333676	6251315	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH331	8	8/4/10	Area B	333676	6251315	-5.6	<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	1.3	-	<0.5	<0.5	0
AECOM	BH331	9	8/4/10	Area C	333676	6251315	-6.6	<0.5	1	<0.5	2.3	<0.5	-	<0.5	<0.5	<0.5	1.5	<0.5	5.5	0.7	<0.5	<0.5	-	<0.5	<0.5	0.245
AECOM	BH332	0.1	8/5/10	Area B	333642	6251451	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH332	1	8/5/10	Area B	333642	6251451	1.4	<0.5	<0.5	<0.5	1.2	1.5	-	1.7	1	0.6	1.1	<0.5	1.9	<0.5	0.8	<0.5	-	0.6	2.5	1.951
AECOM	BH332	11	8/6/10	Area C	333642	6251451	-8.6	<0.5	<0.5	0.6	1.3	1.2	-	1.4	0.6	<0.5	1.2	<0.5	3	<0.5	0.5	<0.5	-	2	2.9	1.538
AECOM	BH332	12.6	8/6/10	Area C	333642	6251451	-10.2	0.5	3.7	4.3	10.8	12	-	12.8	5.6	6.3	9	1.3	20	1.2	5	1.8	-	8.3	23.3	16.936
AECOM	BH332	2	8/5/10	Area B	333642	6251451	0.4	<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	1.1	0.06
AECOM	BH332	3	8/5/10	Area B	333642	6251451	-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	<0.5	-	<0.5	<0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH332	5	8/5/10	Area B	333642	6251451	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH332	6	8/5/10	Area B	333642	6251451	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH332	7	8/5/10	Area B	333642	6251451	-4.6	<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	<0.5	-	<0.5	0.5	0
AECOM	BH332	9.5	8/6/10	Area C	333642	6251451	-7.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH333	0.1	27/7/10	Area B	333644	6251433	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH333	1	8/2/10	Area B	333644	6251433	1.4	<0.5	1.9	2.1	5.9	5.7	-	7.1	3.3	2.4	4.7	0.8	9.1	<0.5	2.5	<0.5	-	3.4	10.3	8.37
AECOM	BH333	2	8/2/10	Area B	333644	6251433	0.4	<0.5	0.6	1	2.5	2.3	-	3.1	1.5	0.9	2.1	<0.5	4.4	<0.5	1	<0.5	-	2.4	4.9	3.086
AECOM	BH333	3	8/2/10	Area B	333644	6251433	-0.6	<0.5	<0.5	<0.5	0.9	0.9	-	1	0.6	<0.5	0.8	<0.5	1.7	<0.5	<0.5	<0.5	-	0.9	1.9	1.104
AECOM	BH333	4	8/2/10	Area B	333644	6251433	-1.6	1.1	<0.5	1.4	1.6	1.5	-	1.7	0.8	0.9	1.2	<0.5	4	0.8	0.6	<0.5	-	4.8	4	2
AECOM	BH333	5	8/2/10	Area B	333644	6251433	-2.6	<0.5	0.7	1.1	3.3	3.1	-	3.4	2.1	1.7	2.4	<0.5	6.9	<0.5	1.8	<0.5	-	3.4	7.7	4.165
AECOM	BH333	6	8/2/10	Area B	333644	6251433	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH333	7	8/2/10	Area B	333644	6251433	-4.6	<0.5	<0.5	<0.5	0.5	0.8	-	1	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	-	0.8	1	0.95
AECOM	BH333	8	8/2/10	Area B	333644	6251433	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH334	0.1	27/7/10	Area B	333645	6251412	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH334	10	8/2/10	Area C	333645	6251412	-7.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH334	1	8/2/10	Area B	333645	6251412	1.4	<0.5	0.6	2.1	6.3	5.8	-	6	2.6	2.7	6.1	0.5	11	<0.5	2.2	<0.5	-	4.2	12	8.107
AECOM	BH334	11	8/2/10	Area C	333645	6251412	-8.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH334	12	8/2/10	Area C	333645	6251412	-9.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH334	13	8/2/10	Area C	333645	6251412	-10.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH334	2	8/2/10	Area B	333645	6251412	0.4	<0.5	<0.5	<0.5	1.4	1.2	-	0.9	0.7	<0.5	1.2	<0.5	2.4	<0.5	0.5	<0.5	-	1.2	2.3	1.499
AECOM	BH334	4	8/2/10	Area B	333645	6251412	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH334	6	8/2/10	Area B	333645	6251412	-3.6	<0.5	<0.5	<0.5	1.8	1.7	-	1.5	<0.5	0.7	1.5	<0.5	2.7	<0.5	<0.5	<0.5	-	1.2	2.5	2.115
AECOM	BH334	7	8/2/10	Area B	333645	6251412	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH334	8	8/2/10	Area B	333645	6251412	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH334	9	8/2/10	Area C	333645	6251412	-6.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH335	0.1	27/7/10	Area B	333649	6251395	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH335	1	8/5/10	Area B	333649	6251395	1.4	<0.5	1.3	2.3	6.5	6.1	-	7	4.1	2.8	6.6	0.8	13.4	<0.5	3.2	<0.5	-	9.3	14.5	8.957
AECOM	BH335	3	8/5/10	Area B	333649	6251395	-0.6	<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	0
AECOM	BH335	5	8/5/10	Area B	333649	6251395	-2.6	<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	<0.5	-	<0.5	0.6	0
AECOM	BH335	6	8/5/10	Area B	333649	6251395	-3.6	<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	0
AECOM	BH335	7	8/5/10	Area B	333649	6251395	-4.6	<0.5	<0.5	0.5	2	1.9	-	2.2	1	0.8	2	<0.5	3.9	<0.5	0.8	<0.5	-	1.8	4.3	2.51
AECOM	BH335	8	8/5/10	Area B	333649	6251395	-5.6	<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	<0.5	-	<0.5	0.6	0
AECOM	BH336	0.1	22/7/10	Area B	333652	6251355	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH336	1	30/7/10	Area B	333652	6251355	1.4	1.6	<0.5	3.8	4.7	3.2	-	4.5	1.8	1.5	3.5	<0.5	11.1	1.2	1.5	1	-	12.6	9.8	4.473
AECOM	BH336	2	30/7/10	Area B	333652	6251355	0.4	<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	0
AECOM	BH336	3	30/7/10	Area B	333652	6251355	-0.6	<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	0.7	0.06
AECOM	BH336	4	30/7/10	Area B	333652	6251355	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH336	5	30/7/10	Area B	333652	6251355	-2.6	<0.5	1.1	2.7	5.2	3.5	-	4.4	1.5	2.4	4.1	<0.5	10.9	0.6	1.3	0.5	-	6.2	12.9	4.886
AECOM	BH336	6	30/7/10	Area B	333652	6251355	-3.6	<0.5	<0.5	1.8	3.3	2.7	-	3.1	1.2	1.7	2.9	<0.5	5	0.6	1	0.6	-	5.2	5.2	3.651
AECOM	BH336	7	30/7/10	Area B	333652	6251355	-4.6	2.2	0.8	8.5	20.6	18.5	-	34.1	6.6	11.4	17.6	1.8	33.8	3	7.3	3.7	-	23	44.2	27.882
AECOM	BH336	8	30/7/10	Area B	333652	6251355	-5.6	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.6	<0.5	<0.5	<0.5	-	1.5	1.6	0
AECOM	BH337	0.1	8/4/10	Area B	333661	6251315	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH337	1	8/4/10	Area B	333661	6251315	1.4	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	-	<0.5	1.4	0
AECOM	BH337	2	8/4/10	Area B	333661	6251315	0.4	<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	-	<0.5	1.1	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH337	3	8/4/10	Area B	333661	6251315	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH337	4	8/4/10	Area B	333661	6251315	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH337	5	8/5/10	Area B	333661	6251315	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH337	6	8/5/10	Area B	333661	6251315	-3.6	<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	<0.5	-	<0.5	0.5	0
AECOM	BH337	7	8/5/10	Area B	333661	6251315	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH337	8	8/5/10	Area B	333661	6251315	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH338	0	27/7/10	Area B	333659	6251299	2.4	<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	-	0.8	1	0
AECOM	BH338	1	8/2/10	Area B	333659	6251299	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	-	<0.5	<0.5	0
AECOM	BH338	3	8/2/10	Area B	333659	6251299	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH338	4	8/2/10	Area B	333659	6251299	-1.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH338	5	8/2/10	Area B	333659	6251299	-2.6	<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	<0.5		<0.5	<0.5	0
AECOM	BH338	6	8/2/10	Area B	333659	6251299	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH338	7	8/2/10	Area B	333659	6251299	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH338	8	8/2/10	Area B	333659	6251299	-5.6	<0.5	<0.5	<0.5	1.3	1.6	-	1.4	0.8	0.5	1.1	<0.5	2.4	<0.5	0.6	<0.5	-	0.8	2.9	1.999
AECOM	BH338	9	8/2/10	Area C	333659	6251299	-6.6	<0.5	<0.5	0.7	1.8	2.2	-	2.7	1.4	1	1.5	<0.5	3.1	<0.5	1.1	<0.5	-	1.1	3.8	2.889
AECOM	BH339	0.1	22/7/10	Area B	333615	6251469	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH339	10	8/2/10	Area C	333615	6251469	-7.6	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	-	1.9	1.2	0
AECOM	BH339	1	30/7/10	Area B	333615	6251469	1.4	1.6	12	21.3	50.6	41.6	-	50.2	17.8	16	39.9	4.8	94.2	3.2	16.7	1.2	-	34.8	99	60.327
AECOM	BH339	11	8/2/10	Area C	333615	6251469	-8.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH339	12	8/2/10	Area C	333615	6251469	-9.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH339	13	8/2/10	Area C	333615	6251469	-10.6	<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	1	0.05
AECOM	BH339	14	8/2/10	Area C	333615	6251469	-11.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH339	2	30/7/10	Area B	333615	6251469	0.4	<0.5	<0.5	<0.5	0.8	0.9	-	0.9	0.5	<0.5	0.7	<0.5	1.2	<0.5	<0.5	<0.5	-	<0.5	1.4	1.082
AECOM	BH339	3	8/2/10	Area B	333615	6251469	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH339	4	8/2/10	Area B	333615	6251469	-1.6	<0.5	<0.5	1.5	4.1	3.9	-	3.7	1.8	1.8	3.9	<0.5	9.2	<0.5	1.5	<0.5	-	4.7	10.3	5.067
AECOM	BH339	5	8/2/10	Area B	333615	6251469	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH339	6	8/2/10	Area B	333615	6251469	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH339	7	8/2/10	Area B	333615	6251469	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH339	8	8/2/10	Area B	333615	6251469	-5.6	<0.5	0.7	2.7	6.2	6.3	-	6.8	2.8	3.4	5.6	0.6	11.4	<0.5	2.6	1.4	-	6.8	18.2	8.884
AECOM	BH339	9	8/2/10	Area C	333615	6251469	-6.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH34	1.8	25/2/10	Block 4	333689	6251576	0.24	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
AECOM	BH34	11	25/2/10	Block 4	333689	6251576	-8.96	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
AECOM	BH34	3.8	25/2/10	Block 4	333689	6251576	-1.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH34	6	25/2/10	Block 4	333689	6251576	-3.96	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
AECOM	BH340	0.1	21/7/10	Area B	333625	6251392	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH340	10	30/7/10	Area C	333625	6251392	-7.6	1	0.9	3.8	5.4	4.8	-	4.8	2.4	2.4	4.8	<0.5	9.6	1.4	2.1	0.5	-	11.8	9.3	6.342
AECOM	BH340	1	30/7/10	Area B	333625	6251392	1.4	<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	-	<0.5	0.9	0
AECOM	BH340	11	30/7/10	Area C	333625	6251392	-8.6	<0.5	0.6	1.5	2.6	2.3	-	2.4	1.1	1.2	2.4	<0.5	5.9	<0.5	1	<0.5	-	4.8	5.8	3.055
AECOM	BH340	12	30/7/10	Area C	333625	6251392	-9.6	<0.5	1	2.7	4.5	5	-	5.6	2.8	2.9	3.9	0.5	10.2	1.6	2.4	<0.5	-	6.1	11.1	7.107
AECOM	BH340	13	30/7/10	Area C	333625	6251392	-10.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH340	3	30/7/10	Area B	333625	6251392	-0.6	1.6	1.2	4.4	5.2	4.5	-	3.6	2.1	1.2	4.1	<0.5	15.5	1.8	1.8	2.2	-	9.8	14.2	5.742
AECOM	BH340	4	30/7/10	Area B	333625	6251392	-1.6	<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	0.505
AECOM	BH340	6	30/7/10	Area B	333625	6251392	-3.6	<0.5	<0.5	<0.5	0.7	0.9	-	0.8	0.7	<0.5	0.6	<0.5	1.1	<0.5	0.6	<0.5	-	<0.5	1.2	1.123
AECOM	BH340	7	30/7/10	Area B	333625	6251392	-4.6	<0.5	<0.5	<0.5	1.3	1.3	-	1.1	0.7	<0.5	1.1	<0.5	1.6	<0.5	0.6	<0.5	-	0.5	3.5	1.618

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH340	8	30/7/10	Area B	333625	6251392	-5.6	<0.5	0.6	1.1	1.8	1.9	-	1.6	0.9	0.5	1.5	<0.5	3.8	<0.5	0.8	<0.5	-	2.3	5.1	2.394
AECOM	BH340	9	30/7/10	Area C	333625	6251392	-6.6	0.7	1.9	5.2	7.4	5.8	-	5.4	3.2	3.1	6.8	0.7	14.5	1.7	2.7	0.5	-	17.3	13.1	8.46
AECOM	BH341	0.1	22/7/10	Area B	333627	6251372	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH341	1.5	29/7/10	Area B	333627	6251372	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH341	2.5	29/7/10	Area B	333627	6251372	-0.1	<0.5	<0.5	<0.5	0.9	1.2	-	1.2	<0.5	0.6	1	<0.5	1.7	<0.5	<0.5	<0.5	-	<0.5	4.2	1.48
AECOM	BH341	3.5	29/7/10	Area B	333627	6251372	-1.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH341	4.5	29/7/10	Area B	333627	6251372	-2.1	<0.5	<0.5	<0.5	1.1	1	-	1	<0.5	0.6	0.9	<0.5	2	<0.5	<0.5	<0.5	-	0.7	2.5	1.279
AECOM	BH341	5.5	29/7/10	Area B	333627	6251372	-3.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH341	6.5	29/7/10	Area B	333627	6251372	-4.1	<0.5	<0.5	<0.5	0.6	0.6	-	0.7	0.6	<0.5	0.5	<0.5	1.3	<0.5	<0.5	<0.5	-	0.7	1.3	0.741
AECOM	BH341	7.5	29/7/10	Area B	333627	6251372	-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	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH341	8.5	29/7/10	Area C	333627	6251372	-6.1	1.6	<0.5	7.4	13.2	11.4	-	12.1	7.3	6	11.6	1.2	28.7	2.9	5.2	<0.5	-	23.8	27.7	16.439
AECOM	BH342	0.1	22/7/10	Area B	333633	6251335	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH342	1.0	30/7/10	Area B	333633	6251335	1.4	<0.5	0.6	1.3	2.3	2.5	-	2.7	1.2	1	1.9	<0.5	3.7	<0.5	1	<0.5	-	2.8	5.1	3.231
AECOM	BH342	2	30/7/10	Area B	333633	6251335	0.4	1.7	0.8	6.2	8.6	7.7	-	7.9	2.8	3.8	7.2	0.6	21.7	1.9	2.8	<0.5	-	18.2	22.6	10.71
AECOM	BH342	3	30/7/10	Area B	333633	6251335	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH342	5	30/7/10	Area B	333633	6251335	-2.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH342	6	30/7/10	Area B	333633	6251335	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH342	7	30/7/10	Area B	333633	6251335	-4.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH342	8	30/7/10	Area B	333633	6251335	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH343	0.1	22/7/10	Area B	333632	6251315	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH343	10.5	8/4/10	Area C	333632	6251315	-8.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH343	1	8/4/10	Area B	333632	6251315	1.4	<0.5	1.8	<0.5	8.1	5.4	-	<0.5	<0.5	<0.5	5.9	<0.5	15.2	0.5	<0.5	<0.5	-	<0.5	15.2	6.269
AECOM	BH343	12	8/4/10	Area C	333632	6251315	-9.6	<0.5	<0.5	<0.5	1.3	1.3	-	<0.5	1	<0.5	1	<0.5	3	<0.5	0.7	<0.5	-	<0.5	3.3	1.52
AECOM	BH343	13	8/4/10	Area C	333632	6251315	-10.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH343	2	8/4/10	Area B	333632	6251315	0.4	<0.5	0.7	<0.5	3.3	2.3	-	<0.5	<0.5	<0.5	2.4	<0.5	6.6	0.6	<0.5	<0.5	-	<0.5	6.5	2.654
AECOM	BH343	3	8/4/10	Area B	333632	6251315	-0.6	<0.5	<0.5	<0.5	2.2	2.4	-	<0.5	<0.5	<0.5	1.6	<0.5	3.7	<0.5	<0.5	<0.5	-	<0.5	6.2	2.636
AECOM	BH343	4	8/4/10	Area B	333632	6251315	-1.6	<0.5	<0.5	<0.5	1.2	1.9	-	<0.5	<0.5	<0.5	0.8	<0.5	1.8	<0.5	<0.5	<0.5	-	<0.5	4.4	2.028
AECOM	BH343	5	8/4/10	Area B	333632	6251315	-2.6	3	<0.5	<0.5	2.3	1.6	-	<0.5	<0.5	<0.5	1.7	<0.5	7.5	2.2	<0.5	1.6	-	<0.5	6.9	1.847
AECOM	BH343	6	8/4/10	Area B	333632	6251315	-3.6	<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	1	0
AECOM	BH343	7	8/4/10	Area B	333632	6251315	-4.6	0.7	<0.5	<0.5	2.1	1.4	-	<0.5	<0.5	<0.5	1.9	<0.5	5.5	0.6	<0.5	0.7	-	<0.5	5.7	1.629
AECOM	BH343	8	8/4/10	Area B	333632	6251315	-5.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH344	0.1	22/7/10	Area B	333639	6251280	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH344	0.8	8/2/10	Area B	333639	6251280	1.6	1.4	3.2	16.2	31.6	23.2	-	21.9	6.8	11	27.3	1.9	62.2	3.7	6.8	0.7	-	49.9	68	32.571
AECOM	BH344	1.8	8/2/10	Area B	333639	6251280	0.6	17.4	20.9	86.1	123	97.2	-	95	52.7	46.3	109	11.1	269	40.6	41.5	12.3	-	292	280	140.497
AECOM	BH344	3	8/2/10	Area B	333639	6251280	-0.6	<0.5	0.6	1.1	1	1.2	-	1.3	<0.5	<0.5	0.8	<0.5	3.1	<0.5	<0.5	<0.5	-	2.4	5	1.438
AECOM	BH344	4	8/2/10	Area B	333639	6251280	-1.6	<0.5	1.1	1	2	3.8	-	4.8	1.4	1.5	1.4	<0.5	3	<0.5	1.2	1	-	1.3	7.6	4.778
AECOM	BH344	5.8	8/2/10	Area B	333639	6251280	-3.4	<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	0.9	0
AECOM	BH344	5	8/2/10	Area B	333639	6251280	-2.6	<0.5	<0.5	<0.5	0.7	0.6	-	0.7	<0.5	<0.5	0.6	<0.5	1.5	<0.5	<0.5	<0.5	-	1	1.6	0.746
AECOM	BH344	7	8/2/10	Area B	333639	6251280	-4.6	<0.5	2.8	4.8	8.4	8	-	9.4	2.4	2.9	5.2	0.6	17.8	1.7	2.3	0.6	-	9.6	27	10.976
AECOM	BH344	8	8/2/10	Area B	333639	6251280	-5.6	<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	<0.5	-	<0.5	0.6	0
AECOM	BH344	9	8/2/10	Area C	333639	6251280	-6.6	<0.5	<0.5	<0.5	<0.5	0.9	-	1	<0.5	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	-	<0.5	1.4	1
AECOM	BH345	0.1	21/7/10	Area A	333595	6251485	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH345	1.5	21/7/10	Area A	333595	6251485	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH345	10.5	21/7/10	Area A	333595	6251485	-8.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH345	12	22/7/10	Area A	333595	6251485	-9.6	<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	-	0.6	2	0
AECOM	BH345	13.5	22/7/10	Area A	333595	6251485	-11.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH345	15	22/7/10	Area A	333595	6251485	-12.6	<0.5	<0.5	<0.5	1.6	1.4	-	1.7	1	0.9	1.4	<0.5	3	<0.5	0.7	<0.5	-	0.9	3.3	1.914
AECOM	BH345	16.5	22/7/10	Area A	333595	6251485	-14.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH345	18	22/7/10	Area A	333595	6251485	-15.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH345	3	21/7/10	Area A	333595	6251485	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH345	4.5	21/7/10	Area A	333595	6251485	-2.1	<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	-	0.5	0.8	0
AECOM	BH345	6	21/7/10	Area A	333595	6251485	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH345	7.5	21/7/10	Area A	333595	6251485	-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	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH345	9	21/7/10	Area A	333595	6251485	-6.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH346	0.1	21/7/10	Area A	333597	6251467	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH346	1.5	21/7/10	Area A	333597	6251467	0.9	<0.5	<0.5	<0.5	1.2	1	-	0.9	<0.5	0.5	1.2	<0.5	2.2	<0.5	<0.5	<0.5	-	0.7	2.9	1.272
AECOM	BH346	10.5	22/7/10	Area A	333597	6251467	-8.1	<0.5	<0.5	0.6	2.1	2.1	-	2.9	1.3	1.8	1.7	<0.5	9.4	<0.5	1	<0.5	-	<0.5	11.9	2.91
AECOM	BH346	12	22/7/10	Area A	333597	6251467	-9.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH346	13.5	22/7/10	Area A	333597	6251467	-11.1	<0.5	<0.5	<0.5	0.8	0.8	-	0.8	0.5	0.6	<0.5	<0.5	1.3	<0.5	<0.5	<0.5	-	<0.5	1.8	1.025
AECOM	BH346	15	22/7/10	Area A	333597	6251467	-12.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH346	16.5	22/7/10	Area A	333597	6251467	-14.1	<0.5	2	2.7	5.8	4.6	-	5.7	2.3	2.1	4.3	0.5	12.5	1	2	<0.5	-	7	11.9	6.726
AECOM	BH346	17	22/7/10	Area A	333597	6251467	-14.6	0.7	5.9	7	14.1	10.7	-	14.7	5.8	6.5	11	1.7	29.3	1.8	5.3	1.9	-	14.2	30.7	16.628
AECOM	BH346	3	21/7/10	Area A	333597	6251467	-0.6	<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	-	0.7	0.7	0
AECOM	BH346	6	21/7/10	Area A	333597	6251467	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH346	7.5	21/7/10	Area A	333597	6251467	-5.1	<0.5	1.5	1.4	3.9	2.5	-	2.7	1.3	1.8	2.6	<0.5	8.1	<0.5	1	<0.5	-	1.9	9.3	3.479
AECOM	BH346	9	21/7/10	Area A	333597	6251467	-6.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH347	0.1	21/7/10	Area A	333603	6251446	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH347	1.5	22/7/10	Area A	333603	6251446	0.9	<0.5	2	2.4	10.5	9.5	-	11.7	4.6	4.4	8.8	1	15.6	<0.5	3.7	<0.5	-	3.5	23.2	13.664
AECOM	BH347	10.5	23/7/10	Area A	333603	6251446	-8.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH347	12	23/7/10	Area A	333603	6251446	-9.6	3.3	29.7	52.3	81.3	55.8	-	78.1	28.3	23.4	59.2	8.6	172	11.4	25.6	3.7	-	145	176	86.115
AECOM	BH347	13.5	23/7/10	Area A	333603	6251446	-11.1	<0.5	0.8	1.7	3.5	2.9	-	3.6	1.6	1.6	2.7	<0.5	6.8	0.5	1.4	0.5	-	5.5	7.2	3.953
AECOM	BH347	15.1	23/7/10	Area A	333603	6251446	-12.7	<0.5	1.5	1.4	4.3	4.1	-	5	2.2	2.8	3.2	0.6	6.8	<0.5	2	0.6	-	2.7	7.6	6.164
AECOM	BH347	15	23/7/10	Area A	333603	6251446	-12.6	<0.5	1.1	1.6	4.4	3.9	-	5.1	2.4	2.2	3.4	0.6	7.8	<0.5	2	0.6	-	4.1	8.3	5.928
AECOM	BH347	3	22/7/10	Area A	333603	6251446	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH347	4.5	22/7/10	Area A	333603	6251446	-2.1	<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	0.6	0
AECOM	BH347	6	22/7/10	Area A	333603	6251446	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH347	7.5	22/7/10	Area A	333603	6251446	-5.1	<0.5	<0.5	0.7	0.9	0.7	-	0.8	<0.5	<0.5	0.7	<0.5	2	<0.5	<0.5	<0.5	-	1.7	1.9	0.877
AECOM	BH347	9	22/7/10	Area A	333603	6251446	-6.6	<0.5	<0.5	0.8	2.1	2.1	-	2.3	1.7	1.2	1.7	<0.5	3.5	<0.5	1.3	<0.5	-	2	3.6	2.824
AECOM	BH348	0.1	21/7/10	Area A	333602	6251429	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH348	1.5	23/7/10	Area A	333602	6251429	0.9	<0.5	<0.5	<0.5	<0.5	<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
AECOM	BH348	10.5	23/7/10	Area A	333602	6251429	-8.1	<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	0
AECOM	BH348	12	26/7/10	Area A	333602	6251429	-9.6	<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	<0.5	-	<0.5	0.5	0
AECOM	BH348	14.5	26/7/10	Area A	333602	6251429	-12.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH348	3	23/7/10	Area A	333602	6251429	-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	<0.5	-	<0.5	0.5	0
AECOM	BH348	4.5	23/7/10	Area A	333602	6251429	-2.1	<0.5	0.9	1.4	3	2.5	-	2.6	1	1	2.3	<0.5	6.2	<0.5	1	0.5	-	3.1	6.7	3.293
AECOM	BH348	6	23/7/10	Area A	333602	6251429	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH348	7.5	23/7/10	Area A	333602	6251429	-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	<0.5	<0.5	-	<0.5	0.5	0
AECOM	BH348	9	23/7/10	Area A	333602	6251429	-6.6	<0.5	<0.5	<0.5	1.3	1.1	-	1.3	<0.5	0.8	1	<0.5	2.2	<0.5	<0.5	<0.5	-	<0.5	2.3	1.45

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH349	0.1	21/7/10	Area A	333605	6251410	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH349	1.5	22/7/10	Area A	333605	6251410	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	-	0.6	1	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	-	0.5	0.8	0.07
AECOM	BH349	10.5	23/7/10	Area A	333605	6251410	-8.1	<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	-	<0.5	0.9	0.05
AECOM	BH349	12	26/7/10	Area A	333605	6251410	-9.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH349	13.6	26/7/10	Area A	333605	6251410	-11.2	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH349	3	22/7/10	Area A	333605	6251410	-0.6	<0.5	<0.5	0.6	1.2	1.2	-	1.2	0.6	0.9	1.1	<0.5	2.5	<0.5	0.5	<0.5	-	1.2	2.8	1.597
AECOM	BH349	4.5	22/7/10	Area A	333605	6251410	-2.1	<0.5	0.7	0.8	1.5	2.1	-	2.6	1.4	1	1.3	<0.5	2.6	<0.5	1.2	<0.5	-	1.3	3.4	2.757
AECOM	BH349	6	22/7/10	Area A	333605	6251410	-3.6	<0.5	<0.5	<0.5	0.8	0.6	-	0.7	<0.5	<0.5	0.7	<0.5	1.8	<0.5	<0.5	<0.5	-	2	1.9	0.757
AECOM	BH349	7.5	23/7/10	Area A	333605	6251410	-5.1	<0.5	<0.5	<0.5	1.2	1.3	-	1.9	0.8	0.7	1.1	<0.5	2	<0.5	0.6	<0.5	-	0.8	2.5	1.759
AECOM	BH349	9	23/7/10	Area A	333605	6251410	-6.6	<0.5	1.4	1.9	4.5	3.4	-	4.6	1.7	2.1	3.7	<0.5	8.6	<0.5	1.5	<0.5	-	4.8	9.2	4.724
AECOM	BH35	0.9	22/2/10	Block 4	333706	6251580	1.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH35	4	22/2/10	Block 4	333706	6251580	-1.81	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
AECOM	BH35	6.4	22/2/10	Block 4	333706	6251580	-4.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH35	9.9	22/2/10	Block 4	333706	6251580	-7.71	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
AECOM	BH350	0.1	21/7/10	Area A	333608	6251395	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH350	1.5	30/7/10	Area A	333608	6251395	0.9	<0.5	<0.5	<0.5	<0.5	0.7	-	0.8	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.6	0.786
AECOM	BH350	10	30/7/10	Area A	333608	6251395	-7.6	<0.5	<0.5	1	1.4	1.1	-	1.4	<0.5	0.7	1.1	<0.5	3.9	<0.5	<0.5	<0.5	-	2.8	3.9	1.461
AECOM	BH350	11.5	30/7/10	Area A	333608	6251395	-9.1	<0.5	<0.5	<0.5	1.2	1.4	-	1.7	0.7	0.7	1.2	<0.5	2.7	<0.5	0.6	<0.5	-	<0.5	4.2	1.839
AECOM	BH350	14.5	30/7/10	Area A	333608	6251395	-12.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH350	16	30/7/10	Area A	333608	6251395	-13.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH350	2.5	30/7/10	Area A	333608	6251395	-0.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	0.5	0
AECOM	BH350	4	30/7/10	Area A	333608	6251395	-1.6	<0.5	<0.5	<0.5	0.6	0.6	-	0.9	<0.5	<0.5	0.6	<0.5	1.4	<0.5	<0.5	<0.5	-	1	1.6	0.756
AECOM	BH350	5.5	30/7/10	Area A	333608	6251395	-3.1	<0.5	1.6	2.4	10	5.2	-	7.8	2.5	3.2	8.3	<0.5	2.6	0.6	2	<0.5	-	0.7	31.5	7.608
AECOM	BH350	8.5	30/7/10	Area A	333608	6251395	-6.1	<0.5	0.6	1	2.2	2	-	2.7	1	1.2	1.6	<0.5	3.9	<0.5	0.8	<0.5	-	2.1	4.4	2.716
AECOM	BH351	0.1	23/7/10	Area A	333610	6251371	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH351	1.5	27/7/10	Area A	333610	6251371	0.9	<0.5	0.9	1	2	2.1	-	1.5	2.1	0.6	1.9	<0.5	3.7	<0.5	1.3	<0.5	-	1.8	3.7	2.68
AECOM	BH351	10	27/7/10	Area A	333610	6251371	-7.6	<0.5	<0.5	<0.5	0.9	1.2	-	1.2	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	-	<0.5	2.2	1.41
AECOM	BH351	11.5	27/7/10	Area A	333610	6251371	-9.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH351	14.5	27/7/10	Area A	333610	6251371	-12.1	<0.5	<0.5	0.5	1.3	1.6	-	1.9	0.6	0.8	1.4	<0.5	2.3	<0.5	0.6	<0.5	-	0.9	3.5	2.08
AECOM	BH351	2.5	27/7/10	Area A	333610	6251371	-0.1	<0.5	1.4	2.5	3.3	3.4	-	3.4	3.6	1.2	3	0.6	7.3	<0.5	2.2	<0.5	-	5.8	7.1	5.076
AECOM	BH351	4	27/7/10	Area A	333610	6251371	-1.6	<0.5	0.6	0.8	1.5	2.1	-	2.2	1.4	0.8	1.4	<0.5	1.6	<0.5	1	0.6	-	1.3	3.9	2.678
AECOM	BH351	7	27/7/10	Area A	333610	6251371	-4.6	<0.5	1	1.9	3.6	3.6	-	3.6	2.1	1.4	2.8	<0.5	7.8	<0.5	1.7	<0.5	-	4.2	7.4	4.679
AECOM	BH351	8.5	27/7/10	Area A	333610	6251371	-6.1	<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	-	<0.5	1	0.05
AECOM	BH352	9.5	27/7/10	Area A	333611	6251353	-7.1	<0.5	<0.5	<0.5	0.7	1	-	0.8	<0.5	<0.5	0.5	<0.5	1.3	<0.5	<0.5	<0.5	-	0.8	2.2	1.155
AECOM	BH352	0.1	23/7/10	Area A	333611	6251353	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH352	1.5	27/7/10	Area A	333611	6251353	0.9	<0.5	<0.5	0.5	0.7	<0.5	-	0.5	<0.5	<0.5	0.5	<0.5	1.5	<0.5	<0.5	<0.5	-	1.5	1.3	0.125
AECOM	BH352	10.5	27/7/10	Area A	333611	6251353	-8.1	<0.5	0.5	1	2.4	3.7	-	3.5	1.3	0.9	1.5	<0.5	3.9	<0.5	1.2	<0.5	-	2.5	8.4	4.528
AECOM	BH352	12	27/7/10	Area A	333611	6251353	-9.6	<0.5	<0.5	1.4	2.9	3.6	-	3.6	1.3	0.9	2.2	<0.5	5.6	<0.5	1.2	<0.5	-	2.6	8.9	4.495
AECOM	BH352	13.5	27/7/10	Area A	333611	6251353	-11.1	<0.5	0.8	1.5	3.8	4.9	-	4.2	2	1.9	3.3	<0.5	7.8	0.6	1.8	<0.5	-	3.3	8	6.123
AECOM	BH352	3	27/7/10	Area A	333611	6251353	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH352	4.5	27/7/10	Area A	333611	6251353	-2.1	<0.5	0.7	1.1	3.5	5	-	6	1.8	1.8	2.8	<0.5	6.9	<0.5	1.7	<0.5	-	2	18.3	6.346
AECOM	BH352	6	27/7/10	Area A	333611	6251353	-3.6	<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	<0.5	-	<0.5	0.5	0
AECOM	BH352	7.5	27/7/10	Area A	333611	6251353	-5.1	<0.5	<0.5	<0.5	1.1	2.5	-	2.1	0.9	1	0.8	<0.5	1.7	<0.5	0.8	<0.5	-	0.7	3.8	3.017
AECOM	BH353	0.1	23/7/10	Area A	333613	6251333	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH353	1.5	27/7/10	Area A	333613	6251333	0.9	<0.5	<0.5	1.2	1.6	1.5	-	1.6	<0.5	<0.5	1.4	<0.5	3.5	<0.5	<0.5	<0.5	-	3	3.4	1.834
AECOM	BH353	10.5	28/7/10	Area A	333613	6251333	-8.1	2.6	4.9	10.3	14.6	11.2	-	15.8	6.4	4.2	10.8	1.3	38.4	5.6	4.8	2.1	-	36.8	41.1	16.612
AECOM	BH353	11.7	29/7/10	Area A	333613	6251333	-9.3	<0.5	<0.5	<0.5	0.6	0.6	-	0.7	<0.5	<0.5	<0.5	<0.5	1.1	<0.5	<0.5	<0.5	-	0.9	1.9	0.73
AECOM	BH353	13	29/7/10	Area A	333613	6251333	-10.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH353	3	27/7/10	Area A	333613	6251333	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH353	4	27/7/10	Area A	333613	6251333	-1.6	<0.5	<0.5	<0.5	0.6	0.6	-	0.7	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	<0.5	-	<0.5	1.1	0.73
AECOM	BH353	6	28/7/10	Area A	333613	6251333	-3.6	<0.5	<0.5	<0.5	0.7	1.2	-	1.2	0.6	0.6	0.6	<0.5	2.9	<0.5	<0.5	<0.5	-	0.8	4.5	1.462
AECOM	BH353	7.5	28/7/10	Area A	333613	6251333	-5.1	<0.5	<0.5	<0.5	0.6	0.8	-	0.8	0.5	<0.5	0.5	<0.5	1.1	<0.5	<0.5	<0.5	-	<0.5	2.5	0.95
AECOM	BH354	0.1	23/7/10	Area A	333615	6251314	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH354	1.5	29/7/10	Area A	333615	6251314	0.9	<0.5	0.6	0.5	0.8	0.8	-	0.9	1.3	<0.5	0.8	<0.5	2.3	<0.5	0.6	<0.5	-	0.8	2.2	1.051
AECOM	BH354	10.5	29/7/10	Area A	333615	6251314	-8.1	<0.5	0.8	1.4	4.2	3.9	-	4.9	2.1	1.7	3.7	<0.5	8.8	<0.5	1.7	<0.5	-	2.3	12	5.208
AECOM	BH354	12	29/7/10	Area A	333615	6251314	-9.6	0.8	<0.5	<0.5	0.7	0.6	-	0.6	<0.5	<0.5	0.6	<0.5	2.1	<0.5	<0.5	<0.5	-	0.7	2.6	0.736
AECOM	BH354	13.5	29/7/10	Area A	333615	6251314	-11.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	0.6	<0.5	<0.5	<0.5	<0.5	1.2	<0.5	<0.5	<0.5	-	<0.5	1.1	0.06
AECOM	BH354	3	29/7/10	Area A	333615	6251314	-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	<0.5	-	<0.5	<0.5	0
AECOM	BH354	4.5	29/7/10	Area A	333615	6251314	-2.1	<0.5	<0.5	0.5	1	1.3	-	1.3	0.7	0.5	0.9	<0.5	2.3	<0.5	0.5	0.6	-	0.8	3.8	1.646
AECOM	BH354	6	29/7/10	Area A	333615	6251314	-3.6	0.6	1.8	3.8	6.8	6.9	-	9.3	2.6	3.4	6	0.7	19.9	0.7	2.7	1.4	-	9.3	20.5	9.906
AECOM	BH354	7.5	29/7/10	Area A	333615	6251314	-5.1	0.7	0.8	1.5	3.4	4.1	-	4.7	2.2	1.4	3	<0.5	6.1	0.5	1.7	1.9	-	3.9	8.6	5.272
AECOM	BH355	0	27/7/10	Area A	333617	6251295	2.4	<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	-	<0.5	<0.5	0
AECOM	BH355	1.5	29/7/10	Area A	333617	6251295	0.9	<0.5	<0.5	0.6	2.6	2	-	2.7	1.8	1	2.5	<0.5	5.8	<0.5	1.2	<0.5	-	1.2	6.6	2.793
AECOM	BH355	11.5	29/7/10	Area A	333617	6251295	-9.1	4.5	1.7	6.8	6.7	4.9	-	7.5	2.6	3.2	5.3	<0.5	19.9	3.8	1.9	6.3	-	21.9	18	6.909
AECOM	BH355	13	30/7/10	Area A	333617	6251295	-10.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH355	2.5	29/7/10	Area A	333617	6251295	-0.1	<0.5	1	1.1	2.7	4.6	-	7.9	5.1	2.8	2.6	0.7	3.8	<0.5	3.4	<0.5	-	0.9	6.7	7.057
AECOM	BH355	4	29/7/10	Area A	333617	6251295	-1.6	<0.5	<0.5	<0.5	0.7	1.2	-	1.1	0.7	0.5	<0.5	<0.5	1.3	<0.5	<0.5	<0.5	-	<0.5	3.2	1.437
AECOM	BH355	5.5	29/7/10	Area A	333617	6251295	-3.1	<0.5	<0.5	0.6	1.2	0.9	-	1.1	0.6	0.5	0.9	<0.5	2.4	<0.5	<0.5	<0.5	-	1.8	2.7	1.195
AECOM	BH355	7	29/7/10	Area A	333617	6251295	-4.6	<0.5	<0.5	<0.5	<0.5	0.6	-	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	1	0.67
AECOM	BH355	8.5	29/7/10	Area A	333617	6251295	-6.1	<0.5	1.3	2.3	3.9	2.9	-	4.1	1.8	1.7	3.3	<0.5	7.8	<0.5	1.5	<0.5	-	5.6	7.1	4.071
AECOM	BH356	0.1	27/7/10	Area A	333619	6251279	2.3	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH356	1.3	28/7/10	Area A	333619	6251279	1.1	<0.5	<0.5	0.7	2	2.6	-	3.1	2	1	1.8	<0.5	4.5	<0.5	1.5	<0.5	-	1.4	4.1	3.398
AECOM	BH356	10.5	29/7/10	Area A	333619	6251279	-8.1	<0.5	0.6	1.9	2.8	2.4	-	2.4	1	1.1	2.5	<0.5	6.9	<0.5	0.9	<0.5	-	6.4	7.2	3.155
AECOM	BH356	12	29/7/10	Area A	333619	6251279	-9.6	<0.5	<0.5	<0.5	1.3	1.9	-	1.8	0.7	0.9	1	<0.5	2.4	<0.5	0.6	<0.5	-	0.6	3.3	2.377
AECOM	BH356	13.5	29/7/10	Area A	333619	6251279	-11.1	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH356	3	28/7/10	Area A	333619	6251279	-0.6	<0.5	<0.5	<0.5	0.9	0.9	-	0.9	<0.5	0.6	0.8	<0.5	2.1	<0.5	<0.5	<0.5	-	0.9	2.7	1.148
AECOM	BH356	4	28/7/10	Area A	333619	6251279	-1.6	<0.5	<0.5	0.6	1.1	0.9	-	1	<0.5	<0.5	0.9	<0.5	2.4	<0.5	<0.5	<0.5	-	1.6	2.3	1.119
AECOM	BH356	6	29/7/10	Area A	333619	6251279	-3.6	<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	<0.5	-	<0.5	<0.5	0
AECOM	BH356	7.5	29/7/10	Area A	333619	6251279	-5.1	<0.5	<0.5	0.6	1.3	1	-	1.5	0.6	0.6	1.2	<0.5	2.6	<0.5	0.5	<0.5	-	1.6	2.6	1.408
AECOM	BH356	9	29/7/10	Area A	333619	6251279	-6.6	<0.5	<0.5	<0.5	0.8	0.7	-	0.9	<0.5	<0.5	0.7	<0.5	1.5	<0.5	<0.5	<0.5	-	0.9	1.7	0.877
AECOM	BH36	0.7	19/2/10	Block 3	333684	6251545	1.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH36	1	3/3/10	Block 3	333684	6251545	1.25	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH36	13	3/3/10	Block 3	333684	6251545	-10.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH36	15	3/3/10	Block 3	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	1.7	6.15	1	0.7	0
AECOM	BH36	4	3/3/10	Block 3	333684	6251545	-1.75	<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	<7	<0.5	<0.5	0
AECOM	BH36	8.5	3/3/10	Block 3	333684	6251545	-6.25	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH36	0.7	19/2/10	Area B	333684	6251545	1.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH36	1	3/3/10	Area B	333684	6251545	1.25	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH36	13	3/3/10	Area C	333684	6251545	-10.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<1		<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	1.7	-	1	0.7	0
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<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
AECOM	BH36	8.5	3/3/10	Area C	333684	6251545	-6.25	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	16.1	112	39.9	35	22.8	18		5.5		24.1	2.1	44.6	54.1	4.6	948	-	159	68.2	29.156
AECOM	BH37	0.06	17/2/10	Area B	333655	6251543	2.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH37	15.8	18/2/10	Area C	333655	6251543	-13.57	<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	0.05
AECOM	BH37	2.5	17/2/10	Area B	333655	6251543	-0.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	0.6	3.8	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	0.929
AECOM	BH37	5.5	18/2/10	Area B	333655	6251543	-3.27	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH37	8.3	18/2/10	Area B	333655	6251543	-6.07	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
AECOM	BH38	0.15	18/2/10	Southern Cove	333620	6251544	2.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<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
AECOM	BH38	14.5	19/2/10	Southern Cove	333620	6251544	-12.13	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.4	0.9	0.5	0
AECOM	BH38	2.5	19/2/10	Southern Cove	333620	6251544	-0.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH38	20.5	19/2/10	Southern Cove	333620	6251544	-18.13	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH38	8.5	19/2/10	Southern Cove	333620	6251544	-6.13	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.5	<0.5	0
AECOM	BH39	0.15	18/2/10	Southern Cove	333609	6251568	2.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH39	11.5	24/2/10	Southern Cove	333609	6251568	-9.02	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH39	16	24/2/10	Southern Cove	333609	6251568	-13.52	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH39	2.5	23/2/10	Southern Cove	333609	6251568	-0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<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
AECOM	BH39	4	24/2/10	Southern Cove	333609	6251568	-1.52	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH39	7	24/2/10	Southern Cove	333609	6251568	-4.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH40	1	18/2/10	Southern Cove	333642	6251571	1.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH40	13	18/2/10	Proposed Southern Cove	333642	6251571	-10.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH40	14.5	19/2/10	Southern Cove	333642	6251571	-12.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	2.5	13.1	10	8.4	*6.8*	6	-	2	-	6	0.6	31.8	12.6	2	137	*288.6*	36.6	19.2	8.52
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	<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	2.2	0.8	<0.5	0
AECOM	BH40	19	18/2/10	Southern Cove	333642	6251571	-16.88	<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	36.55	6.6	3.4	1.042
AECOM	BH40	7	18/2/10	Southern Cove	333642	6251571	-4.88	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
AECOM	BH41	0.07	19/2/10	Southern Cove	333661	6251582	2.152	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH41	1	4/3/10	Southern Cove	333661	6251582	1.222	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH41	14.5	8/3/10	Southern Cove	333661	6251582	-12.278	<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	12.2	0.5	3.2	1.526
AECOM	BH41	16	8/3/10	Southern Cove	333661	6251582	-13.778	<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	10.4	3.3	1.7	0.056
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<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	1.3	0.7	<0.5	0
AECOM	BH41	4	4/3/10	Southern Cove	333661	6251582	-1.778	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH41	8.5	4/3/10	Southern Cove	333661	6251582	-6.278	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH42	1	23/2/10	Block 4	333738	6251549	1.51	<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	18.7	1.2	3.2	2.115
AECOM	BH42	20.5	19/2/10	Southern Cove	333738	6251549	-17.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	35	250	217	157	113	136	-	22.9	-	122	7.9	369	243	23.8	926	4065	660	351	140.429
AECOM	BH42	3.5	23/2/10	Block 4	333738	6251549	-0.99	<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	8.9	2.4	0.8	0
AECOM	BH43	8.5	19/2/10	Southern Cove	333761	6251581	-5.92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH44	1.4	23/2/10	Block 4	333733	6251591	0.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH44	1.9	23/2/10	Block 4	333733	6251591	0.45	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	11.3	90	41.9	27.6	15.6	18	-	3.2	-	22.8	<1.2	59.2	54.5	3.4	410	963.3	156	67.2	19.16
AECOM	BH45	0.8	23/2/10	Proposed Southern Cove	333698	6251587	1.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH45	13.2	23/2/10	Proposed Southern Cove	333698	6251587	-11.04	<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	6.55	1.2	1	0
AECOM	BH45	3.2	23/2/10	Proposed Southern Cove	333698	6251587	-1.04	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	4.5	0.5	<0.5	0
AECOM	BH45	7.2	23/2/10	Proposed Southern Cove	333698	6251587	-5.04	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
AECOM	BH46	1	23/2/10	Southern Cove	333627	6251582	1.22	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH46	14.5	23/2/10	Southern Cove	333627	6251582	-12.28	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	385.9	55.9	32.1	15.455
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<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
AECOM	BH46	20.5	23/2/10	Southern Cove	333627	6251582	-18.28	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH46	23.5	23/2/10	Southern Cove	333627	6251582	-21.28	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH46	4	23/2/10	Southern Cove	333627	6251582	-1.78	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH46	7	23/2/10	Southern Cove	333627	6251582	-4.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH47	10	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-7.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH47	1	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	1.38	0.8	<0.5	1.3	2	1.7	2	-	<0.5	1.7	<0.5	4.8	0.6	<0.5	<0.5	24	3.8	5.3	-	6.87
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH47	18.6	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-16.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH47	4	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-1.62	<0.5	<0.5	0.6	2	2	2.5	-	1.4	1	1.6	<0.5	3.3	<0.5	1	<0.5	20.5	1.8	3.3	2.43
AECOM	BH47	8.5	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-6.12	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	146	20.6	27.8	11.959
AECOM	BH48	0.15	19/2/10	Block 4	333652	6251615	2.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH48	1	22/2/10	Block 4	333652	6251615	1.46	<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	9.95	1	1.8	0.887
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	12.9	113	54	39.2	31	39	-	8.5	-	30.8	2.9	124	94.3	8.9	517	1535.5	215	101	39.103
AECOM	BH48	17	23/2/10	Block 4	333652	6251615	-14.54	<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	32.65	5.2	2.4	0.809
AECOM	BH48	8.5	23/2/10	Block 4	333652	6251615	-6.04	<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	7.7	0.9	1.4	0.116
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	12.9	113	54	39.2	31	-	8.5	-		30.8	2.9	124	94.3	8.9	517	1352.5	215	101	39.868
AECOM	BH49	1.5	22/2/10	Block 4	333699	6251517	1.04	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	428.1	61.4	77.9	36.552
AECOM	BH49	10.2	22/2/10	Block 4	333699	6251517	-7.66	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	813.1	191	46.7	17.52
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	16.5	132	59.1	48.4	35.8	45	-	8.7	-	37.8	3.4	161	125	9.8	703	1760.5	283	137	45.485
AECOM	BH49	4.2	22/2/10	Block 4	333699	6251517	-1.66	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	374.2	41.7	53.3	29.264
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	0.8	2.3	1.7	3.1	2.5	3	-	0.6	-	2.4	<0.5	4.4	2.7	0.7	19.5	50.35	5.7	3.7	2.91
AECOM	BH49	8.2	22/2/10	Block 4	333699	6251517	-5.66	11.2	55.1	43.6	30.9	16.4	-	21.4	6.7	12	22.6	2	83.3	62	6	373	946.5	130	70.3	25.723
AECOM	BH50	0.15	24/2/10	Block 4	333741	6251608	2.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH50	1.3	26/2/10	Block 4	333741	6251608	1.21	<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	1.1	<0.5	0.5	0.06
AECOM	BH52	0.15	17/2/10	Block 4	333710	6251631	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH52	1	22/2/10	Block 4	333710	6251631	1.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH52	2.2	22/2/10	Block 4	333710	6251631	0.27	<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	23.3	2.3	3.9	2.288
AECOM	BH52	4.2	22/2/10	Block 4	333710	6251631	-1.73	36.1	85.7	115	140	82.2	-	93.8	43.2	52.9	109	11.6	306	123	37.6	55.8	1994.9	412	291	127.752
AECOM	BH54	0.6	18/2/10	Block 4	333737	6251636	1.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH54	1	23/2/10	Block 4	333737	6251636	1.13	273	1000	1070	912	533	-	824	248	324	549	72.5	2130	1290	231	6370	20626.5	3130	1670	842.57
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	11.1	29.3	32.6	27.5	21.7	28	-	5.8	-	22.5	2.2	66.1	40.2	6.6	227	678.1	131	54.5	27.593
AECOM	BH55	1	25/2/10	Block 4	333725	6251640	1.23	80.7	473	482	425	252	-	300	123	107	282	23.3	1280	460	95	4510	12100	2030	1220	372.05
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	25.3	149	119	107	84	102	-	17.2	-	87	5.4	274	151	17.5	1740	3886.4	463	237	102.892
AECOM	BH55	2.7	25/2/10	Block 4	333725	6251640	-0.47	67.1	386	341	294	160	-	187	65	117	200	14.5	783	440	53.3	4810	10400	1840	677	242.28
AECOM	BH56	11.5	4/3/10	Public Domain Blocks 4&5	333616	6251645	-8.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH56	13	5/3/10	Public Domain Blocks 4&5	333616	6251645	-10.39	<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	7.8	1.8	1.5	0.065
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	2.2	0.9	0.6	0
AECOM	BH56	17.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-14.89	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH56	2.5	4/3/10	Public Domain Blocks 4&5	333616	6251645	0.11	<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	3.6	0.6	1	0.05
AECOM	BH56	20.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-17.89	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH56	21.4	5/3/10	Public Domain Blocks 4&5	333616	6251645	-18.79	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	<0.5	2.7	<0.5	7.5	4.8	3.2	-	4	1.3	4.2	<0.5	19.8	3.4	1.2	4.6	101.7	25.2	18	5.882
AECOM	BH57	11.5	25/2/10	Block 4	333648	6251649	-8.99	<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	1.3	<0.5	0.7	0
AECOM	BH57	16.5	25/2/10	Block 4	333648	6251649	-13.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH57	4	25/2/10	Block 4	333648	6251649	-1.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH57	7	25/2/10	Block 4	333648	6251649	-4.49	<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	*127.1*	20.9	22.7	9.223
AECOM	BH58	0.15	17/2/10	Block 4	333697	6251651	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH58	10.2	22/2/10	Block 4	333697	6251651	-7.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH58	10.8	22/2/10	Block 4	333697	6251651	-8.35	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	40.05	3.6	8.5	3.161
AECOM	BH58	1	22/2/10	Block 4	333697	6251651	1.45	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	205.8	23.4	37.6	19.668
AECOM	BH58	3.2	22/2/10	Block 4	333697	6251651	-0.75	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	51.05	5.9	6.8	2.979
AECOM	BH58	5.2	22/2/10	Block 4	333697	6251651	-2.75	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	45.85	6.2	7.4	3.688
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<0.5	2.1	2.2	5.6	5.3	7	-	1.4	-	4.6	<0.5	7.9	0.7	1.3	1.2	48	4.6	10.6	6.05
AECOM	BH59	0.15	17/2/10	Block 4	333730	6251655	2.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH59	1.9	22/2/10	Block 4	333730	6251655	0.47	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	1264.5	206	104	40.933
AECOM	BH59	1	22/2/10	Block 4	333730	6251655	1.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	104	404	368	271	189	232	-	44.5	-	214	21.7	669	462	52.2	3560	9561.4	1400	603	245.605
AECOM	BH59	4.2	22/2/10	Block 4	333730	6251655	-1.83	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	147.85	23.5	12.6	4.859
AECOM	BH60	0.17	24/2/10	Public Domain Blocks 4&5	333586	6251687	2.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH60	13	1/3/10	Public Domain Blocks 4&5	333586	6251687	-10.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH60	16	1/3/10	Public Domain Blocks 4&5	333586	6251687	-13.31	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	653.8	88.3	45.9	17.093
AECOM	BH60	17.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-14.81	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	322.6	50.7	25.7	9.664
AECOM	BH60	2.5	1/3/10	Public Domain Blocks 4&5	333586	6251687	0.19	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	82.4	12.3	13.7	6.143
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	<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	<1	<0.5	<0.5	0
AECOM	BH60	7	1/3/10	Public Domain Blocks 4&5	333586	6251687	-4.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH62	1	26/2/10	Block 5	333682	6251687	1.23	<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	4.4	0.9	0.9	0.1
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<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	<7	<0.5	<0.5	0
AECOM	BH62	3.4	26/2/10	Block 5	333682	6251687	-1.17	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH62	5.4	26/2/10	Block 5	333682	6251687	-3.17	<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	4.247
AECOM	BH62	8	26/2/10	Block 5	333682	6251687	-5.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH63	11.5	1/3/10	Public Domain Blocks 4&5	333642	6251713	-9.15	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	81.3	13.3	6.6	1.922
AECOM	BH63	13	1/3/10	Public Domain Blocks 4&5	333642	6251713	-10.65	<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	9.2	2	1	0
AECOM	BH63	17.7	1/3/10	Public Domain Blocks 4&5	333642	6251713	-15.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH63	2.5	26/2/10	Public Domain Blocks 4&5	333642	6251713	-0.15	<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	6.2	<0.5	1.9	0.578
AECOM	BH63	20.5	2/3/10	Public Domain Blocks 4&5	333642	6251713	-18.15	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH63	6.5	26/2/10	Public Domain Blocks 4&5	333642	6251713	-4.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH64	0.15	1/3/10	Block 5	333717	6251694	2.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH64	10	1/3/10	Block 5	333717	6251694	-7.63	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	1460	261	259	107.979
AECOM	BH64	1	1/3/10	Block 5	333717	6251694	1.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH64	2.5	1/3/10	Block 5	333717	6251694	-0.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH64	5.5	1/3/10	Block 5	333717	6251694	-3.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH65	0.15	23/2/10	Block 5	333709	6251701	2.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	3.1	24.9	11.7	4.7	2.9	3	-	<0.5	-	4.5	<0.5	10.8	20.8	<0.5	65	217.55	51.5	16.9	3.415
AECOM	BH65	13.4	24/2/10	Block 5	333709	6251701	-10.99	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	114.9	25.1	9.4	2.755
AECOM	BH65	3.4	24/2/10	Block 5	333709	6251701	-0.99	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	532.8	98.8	82.8	41.546
AECOM	BH65	8.2	24/2/10	Block 5	333709	6251701	-5.79	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	115	15.6	18.3	12.071
AECOM	BH66	2.3	24/2/10	Block 5	333731	6251712	-0.02	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	105	9.2	13	16.292
AECOM	BH66	3.2	24/2/10	Block 5	333731	6251712	-0.92	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
AECOM	BH66	7	24/2/10	Block 5	333731	6251712	-4.72	<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	4.9	<0.5	0.7	0
AECOM	BH68	2.5	2/3/10	Block 5	333758	6251752	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH68	4	2/3/10	Block 5	333758	6251752	-1.44	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH68	7	2/3/10	Block 5	333758	6251752	-4.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	1.6	5.9	4.7	3.1	1.4	2	-	<0.5	-	2.8	<0.5	11.3	4.6	<0.5	<0.5	73.2	24.4	12.4	1.738
AECOM	BH69	1	26/2/10	Block 5	333706	6251737	1.4	<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	4.937
AECOM	BH69	4	26/2/10	Block 5	333706	6251737	-1.6	<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	15.3	1.4	2.6	1.941
AECOM	BH70	0.1	3/3/10	Block 5	333712	6251766	2.19	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH70	11.5	8/3/10	Block 5	333712	6251766	-9.21	<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	2.6	<0.5	1	0.006
AECOM	BH70	13	8/3/10	Block 5	333712	6251766	-10.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH70	16	8/3/10	Block 5	333712	6251766	-13.71	62	473	325	256	*194*	-	72.4	-	235	204	17	615	402	62.4	3440	7676.8	1000	554	275.62
AECOM	BH70	2.5	8/3/10	Block 5	333712	6251766	-0.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH70	4	8/3/10	Block 5	333712	6251766	-1.71	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH70	5.5	8/3/10	Block 5	333712	6251766	-3.21	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	*193.8*	21.1	33.1	17.671
AECOM	BH70	8.5	8/3/10	Block 5	333712	6251766	-6.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH71	0.08	3/3/10	Public Domain Blocks 4&5	333677	6251751	2.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	<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	6.7	1.4	1.3	0.706
AECOM	BH71	13	4/3/10	Public Domain Blocks 4&5	333677	6251751	-10.22	<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	44.4	5.5	7.9	3.417
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	<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	<1	<0.5	<0.5	0
AECOM	BH71	19	4/3/10	Public Domain Blocks 4&5	333677	6251751	-16.22	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	<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	<1	<0.5	<0.5	0
AECOM	BH71	23.5	5/3/10	Public Domain Blocks 4&5	333677	6251751	-20.72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH71	7	4/3/10	Public Domain Blocks 4&5	333677	6251751	-4.22	<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	6.3	1	1.3	0.576
AECOM	BH72	0.15	25/2/10	Public Domain Blocks 4&5	333634	6251746	2.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	<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	<1	<0.5	<0.5	0
AECOM	BH72	13	3/3/10	Public Domain Blocks 4&5	333634	6251746	-10.48	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	236.8	28.7	42.1	17.795
AECOM	BH72	16	4/3/10	Public Domain Blocks 4&5	333634	6251746	-13.48	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	195.5	43.9	24.1	9.293
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	<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	<1	<0.5	<0.5	0
AECOM	BH72	2.5	3/3/10	Public Domain Blocks 4&5	333634	6251746	0.02	<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	55.7	6.5	9.1	4.756
AECOM	BH72	20.5	4/3/10	Public Domain Blocks 4&5	333634	6251746	-17.98	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	<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	25.2	5.3	4	2.497
AECOM	BH73	11.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-8.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH73	16	2/3/10	Public Domain Blocks 4&5	333582	6251695	-13.37	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	86.5	11.7	5.8	2.138
AECOM	BH73	17.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-14.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH73	19	2/3/10	Public Domain Blocks 4&5	333582	6251695	-16.37	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
AECOM	BH73	2.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	0.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH73	20.5	2/3/10	Public Domain Blocks 4&5	333582	6251695	-17.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH73	7	2/3/10	Public Domain Blocks 4&5	333582	6251695	-4.37	<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	5.2	0.6	1.3	0.566
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	<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	3.7	1.1	1.4	0
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	<0.5	1.3	3.1	5.4	4.6	2.8	-	4	1	3.7	<0.5	17.1	4.2	1	5.2	91.3	20.3	14.8	5.417
AECOM	BH74	13	3/3/10	Public Domain Blocks 4&5	333626	6251702	-10.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH74	16	3/3/10	Public Domain Blocks 4&5	333626	6251702	-13.67	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH74	5.5	3/3/10	Public Domain Blocks 4&5	333626	6251702	-3.17	<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	35.6	7.1	6.3	2.251
AECOM	BH74	8.5	3/3/10	Public Domain Blocks 4&5	333626	6251702	-6.17	<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	8.6	1.3	3.1	0.787
AECOM	BH75	1	25/2/10	Public Domain Blocks 4&5	333617	6251749	1.34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH75	16	26/2/10	Public Domain Blocks 4&5	333617	6251749	-13.66	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	BH75	4	25/2/10	Public Domain Blocks 4&5	333617	6251749	-1.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
AECOM	BH75	8.5	25/2/10	Public Domain Blocks 4&5	333617	6251749	-6.16	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
AECOM	SV09	0.2	26/2/10	Block 5	333585	6251733	2.21	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	495	69.1	92.2	42.044
AECOM	SV09	1.3	26/2/10	Block 5	333585	6251733	1.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH001	1	1/5/06	Block 5	333728	6251686	1.39	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	699.1	84.4	-	67.03
ERM	BH001	4	2/5/06	Block 5	333728	6251686	-1.61	<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	31.45	2.4	-	3.531
ERM	BH017	0.5	8/5/06	Southern Cove	333724	6251690	1.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH017	1.5	8/5/06	Southern Cove	333724	6251690	0.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH017	21.5	8/5/06	Southern Cove	333724	6251690	-19.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH017	3	8/5/06	Southern Cove	333724	6251690	-0.64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH018	0.3	5/8/06	Area B	333610	6251593	2.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH018	0	5/8/06	Area B	333610	6251593	2.45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH018	3	5/8/06	Area B	333610	6251593	-0.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH019	0.3	8/5/06	Block 4	333689	6251510	1.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH019	1.5	8/5/06	Block 4	333689	6251510	0.68	<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	40.7	4.1	1.1	0
ERM	BH019	2.5	8/5/06	Block 4	333689	6251510	-0.32	24.3	82	79.3	70.3	58.2	-	56.9	22.6	25.5	54.1	6.4	208	110	22.6	700	1994.2	295	179	82.897
ERM	BH019	3	8/5/06	Block 4	333689	6251510	-0.82	31.6	120	114	103	86.3	-	85.3	32.2	37.2	77.6	8.8	295	157	32.9	891	2733.9	407	255	122.038
ERM	BH020	0.3	9/5/06	Block 4	333724	6251628	1.9	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	80.3	7.8	15.2	9.621
ERM	BH020	1.5	9/5/06	Block 4	333724	6251628	0.7	<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	50.25	4.7	8.7	6.351
ERM	BH020	3	9/5/06	Block 4	333724	6251628	-0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH021	0.3	9/5/06	Block 4	333684	6251663	1.99	<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	28.05	2.8	4.8	3.06
ERM	BH021	1.5	9/5/06	Public Domain Blocks 4&5	333684	6251663	0.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH021	16	9/5/06	Public Domain Blocks 4&5	333684	6251663	-13.71	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	150.8	20.8	11.6	4.673
ERM	BH026	0.3	12/5/06	Public Domain Blocks 4&5	333622	6251692	1.91	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH026	1.5	12/5/06	Public Domain Blocks 4&5	333622	6251692	0.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH026	16.5	15/5/06	Public Domain Blocks 4&5	333622	6251692	-14.29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH028	0.3	12/5/06	Block 5	333617	6251775	2.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH028	13	12/5/06	Block 5	333617	6251775	-10.65	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	470.5	76	33.9	12.142
ERM	BH028	3	12/5/06	Block 5	333617	6251775	-0.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH035	0.3	18/5/06	Area B	333694	6251749	2.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH035	1.5	18/5/06	Area B	333694	6251749	1.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH035	4	18/5/06	Area B	333694	6251749	-1.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH042	0.3	23/5/06	Block 5	333654	6251541	1.91	<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	53.5	6.8	8.9	5.687

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
ERM	BH042	1.5	23/5/06	Block 5	333654	6251541	0.71	<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	20.6	0.9	3.5	2.412
ERM	BH042	6	23/5/06	Block 5	333654	6251541	-3.79	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH044	0.3	23/5/06	Block 5	333730	6251756	1.94	<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	*146.2*	12.2	24.3	18.281
ERM	BH044	2.3	23/5/06	Block 5	333730	6251756	-0.06	<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	1.2	<0.5	0.6	0
ERM	BH044	4	23/5/06	Block 5	333730	6251756	-1.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH045	0.3	24/5/06	Block 5	333728	6251774	1.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH045	1.5	24/5/06	Block 5	333728	6251774	0.79	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH045	3	24/5/06	Block 5	333728	6251774	-0.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH046	1.5	24/5/06	Public Domain Blocks 4&5	333656	6251723	0.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH046	3	24/5/06	Public Domain Blocks 4&5	333656	6251723	-0.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH047	0.3	24/5/06	Area B	333641	6251753	2.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH047	1.5	24/5/06	Area B	333641	6251753	1.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH048	1.5	24/5/06	Area B	333635	6251526	0.67	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM	BH048	3	24/5/06	Area B	333635	6251526	-0.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH049	0.3	25/5/06	Area A	333621	6251500	2.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH049	3	25/5/06	Area A	333621	6251500	-0.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH052	1.5	26/5/06	Public Domain Blocks 4&5	333617	6251533	0.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH052	3	26/5/06	Public Domain Blocks 4&5	333617	6251533	-0.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH053	0.3	29/5/06	Public Domain Blocks 4&5	333607	6251758	2.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH053	1.5	29/5/06	Public Domain Blocks 4&5	333607	6251758	0.81	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH053	3	29/5/06	Public Domain Blocks 4&5	333607	6251758	-0.69	<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	2	<0.5	0.9	0
ERM	BH054	1.5	29/5/06	Public Domain Blocks 4&5	333603	6251640	1.26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH054	3	29/5/06	Public Domain Blocks 4&5	333603	6251640	-0.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH055	0.8	30/5/06	Southern Cove	333663	6251601	1.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH055	1.8	30/5/06	Southern Cove	333663	6251601	0.51	<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	9.2	1	1.6	1.176
ERM	BH055	3.3	30/5/06	Southern Cove	333663	6251601	-0.99	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH058	1.5	31/5/06	Block 5	333731	6251736	0.76	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	368.6	39.5	61.7	39.542
ERM	BH058	6	31/5/06	Block 5	333731	6251736	-3.74	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	154.6	28.9	10	2.618
ERM	BH059	1.5	31/5/06	Block 5	333712	6251751	0.79	<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	52.85	6.4	8.5	5.742
ERM	BH059	3	31/5/06	Block 5	333712	6251751	-0.71	<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	28.65	2.6	5	3.224
ERM	BH059	8.5	31/5/06	Block 5	333712	6251751	-6.21	<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	13.15	3	1.2	0
ERM	BH060	1.7	31/5/06	Block 5	333722	6251703	0.73	<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	44.5	3.2	5.5	6.082
ERM	BH060	9.5	31/5/06	Block 5	333722	6251703	-7.07	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.9	0.9	0.5	0
ERM	BH062	1.5	31/5/06	Block 5	333701	6251699	0.85	<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	228.55	17.1	30.6	30.902
ERM	BH062	3	31/5/06	Block 5	333701	6251699	-0.65	<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	47.9	4.9	8.1	6.023
ERM	BH063	1.5	1/6/06	Public Domain Blocks 4&5	333642	6251664	0.79	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	104.9	9.1	18.9	11.691
ERM	BH063	2.8	1/6/06	Public Domain Blocks 4&5	333642	6251664	-0.51	<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	10.8	1.3	2.2	1.165
ERM	BH064	1.5	1/6/06	Public Domain Blocks 4&5	333595	6251569	1.04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH064	3	1/6/06	Public Domain Blocks 4&5	333595	6251569	-0.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH065	0.3	1/6/06	Block 4	333692	6251676	2	<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	36.4	3.6	6.2	4.098
ERM	BH065	1.5	1/6/06	Block 4	333692	6251676	0.8	<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	13.45	1.9	2.3	1.134
ERM	BH065	3	1/6/06	Block 4	333692	6251676	-0.7	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	176.3	34.6	25.8	11.332
ERM	BH066	0.3	1/6/06	Block 5	333655	6251689	1.94	<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	9.4	1	1.7	1.218
ERM	BH066	1.5	1/6/06	Block 5	333655	6251689	0.74	<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	2.9	0.9	1	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
ERM	BH067	1.5	1/6/06	Block 5	333681	6251695	0.8	<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	19.35	2.9	3	1.711
ERM	BH067	3	1/6/06	Block 5	333681	6251695	-0.7	<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	63.6	7.5	11.9	6.064
ERM	BH068	0.3	1/6/06	Block 4	333666	6251663	1.98	<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	13.1	1	2.4	1.487
ERM	BH068	3	1/6/06	Block 4	333666	6251663	-0.72	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH068	9.5	1/6/06	Block 4	333666	6251663	-7.22	<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	2.8	0.7	1	0
ERM	BH070	0.3	2/5/06	Block 4	333683	6251681	1.9	<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	18.45	2.3	3.1	1.828
ERM	BH070	1.5	2/5/06	Block 4	333683	6251681	0.7	<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	31	3.7	5	3.349
ERM	BH071	1.5	2/5/06	Proposed Southern Cove	333666	6251589	0.84	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH071	3	2/5/06	Proposed Southern Cove	333666	6251589	-0.66	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH072	0.3	2/5/06	Proposed Southern Cove	333667	6251571	2.01	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH072	3	2/5/06	Proposed Southern Cove	333667	6251571	-0.69	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH072	9.5	2/5/06	Proposed Southern Cove	333667	6251571	-7.19	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH073	1.5	2/5/06	Block 4	333735	6251645	0.73	20.6	87.8	77.3	107	100	-	99.3	44	33.5	88.7	10.7	252	56.5	41.4	14.8	1451.6	190	228	140.147
ERM	BH073	3	2/5/06	Block 4	333735	6251645	-0.77	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	383.1	58.3	43	21.659
ERM	BH074	1.5	2/5/06	Block 5	333684	6251725	0.85	<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	13.05	1.4	2.2	1.239
ERM	BH074	3	2/5/06	Block 5	333684	6251725	-0.65	<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	46.25	8.6	7.7	3.729
ERM	BH074	9.5	2/5/06	Block 5	333684	6251725	-7.15	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	1222.9	184	96.4	45.766
ERM	BH075	0.3	6/6/06	Block 4	333708	6251660	1.98	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	242.1	25.7	43	27.657
ERM	BH075	3	6/6/06	Block 4	333708	6251660	-0.72	<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	11.05	1	1.9	1.063
ERM	BH076	0.3	6/6/06	Public Domain Blocks 4&5	333586	6251646	2.32	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH076	1.5	6/6/06	Public Domain Blocks 4&5	333586	6251646	1.12	<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	2.9	0.5	0.9	0
ERM	BH077	0.3	6/6/06	Block 5	333670	6251771	2.53	<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	3.2	0.8	1.2	0.56
ERM	BH077	3	6/6/06	Block 5	333670	6251771	-0.17	<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	122.2	1.2	30.7	9.682
ERM	BH078	1.5	6/6/06	Block 5	333694	6251773	1.01	<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	7.7	0.7	1.7	0.836
ERM	BH078	3	6/6/06	Block 5	333694	6251773	-0.49	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH079	0.3	6/6/06	Block 5	333671	6251743	2.44	<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	15.5	2.3	2.6	1.276
ERM	BH079	1.5	6/6/06	Block 5	333671	6251743	1.24	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	28.7	5.7	4.9	2.003
ERM	BH087	1.5	8/6/06	Block 4	333732	6251613	0.79	21.6	177	136	114	78.5	-	83.6	34	35.2	69.5	8.6	325	182	31.2	925	2982.2	496	265	114.535
ERM	BH087	3	8/6/06	Block 4	333732	6251613	-0.71	24.4	158	120	97.4	79.6	-	79.6	34	31.9	70.7	8.6	285	160	30.5	1030	2895.7	439	247	113.187
ERM	BH087	7	8/6/06	Block 4	333732	6251613	-4.71	23.7	135	104	64.5	49	-	45.7	20	19.9	50	5.3	163	125	17.4	1090	2418.5	333	173	69.75
ERM	BH089	0.3	9/6/06	Block 4	333678	6251627	2.38	<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	5.45	0.7	0.7	0
ERM	BH089	1.5	9/6/06	Block 4	333678	6251627	1.18	<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	57.9	8.3	7.4	4.367
ERM	BH089	3	9/6/06	Block 4	333678	6251627	-0.32	<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	77.05	11.5	13	7.99
ERM	BH090	1.5	9/6/06	Block 4	333682	6251647	1.02	<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	7.85	0.8	1.1	0.845
ERM	BH090	3	9/6/06	Block 4	333682	6251647	-0.48	<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	42.6	6.3	7.3	4.337
ERM	BH091	0.3	13/6/06	Area B	333761	6251440	2.13	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM	BH091	3	13/6/06	Area B	333761	6251440	-0.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH093	0.3	13/6/06	Area B	333679	6251281	1.73	<0.5	<0.5	<0.5	0.6	<0.5		<0.5	<0.5	<0.5	0.6	<0.5	1.5	<0.5	<0.5	<0.5	-	1.2	1.5	0.066
ERM	BH093	1.5	13/6/06	Area B	333679	6251281	0.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH093	3	13/6/06	Area B	333679	6251281	-0.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH094	1.5	13/6/06	Area D	333756	6251343	1.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH094	3	13/6/06	Area D	333756	6251343	-0.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH095	1.5	13/6/06	Area B	333663	6251334	0.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH095	3	13/6/06	Area B	333663	6251334	-0.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
ERM	BH096	1.5	13/6/06	Area B	333705	6251326	1.19	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM	BH096	3	13/6/06	Area B	333705	6251326	-0.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH097	0.3	13/6/06	Area B	333731	6251385	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH098	1.7	13/6/06	Area B	333668	6251367	0.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH098	3	13/6/06	Area B	333668	6251367	-0.36	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH099	0.3	15/6/06	Area B	333649	6251404	2.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH100	1.5	15/6/06	Area B	333663	6251466	1.13	<0.5	<0.5	0.5	0.8	0.8	-	0.6	0.6	<0.5	0.8	<0.5	2	<0.5	<0.5	<0.5	-	1.8	2.1	0.954
ERM	BH100	14	15/6/06	Area C	333663	6251466	-11.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH100	3	15/6/06	Area B	333663	6251466	-0.37	<0.5	2.1	<0.5	<0.5	6.2	-	5.7	4.1	4	<0.5	1.2	0.6	<0.5	3.2	<0.5	-	<0.5	18	8.731
ERM	BH101	1.5	15/6/06	Area B	333722	6251441	1.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH101	14	15/6/06	Area C	333722	6251441	-11.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH102	1.5	16/6/06	Area B	333621	6251480	1.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH102	17.8	16/6/06	Area C	333621	6251480	-15.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH102	3	16/6/06	Area B	333621	6251480	-0.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH103	1.5	19/6/06	Area B	333625	6251434	1.05	<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	0.6	0
ERM	BH103	3	19/6/06	Area B	333625	6251434	-0.45	<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	1	0.555
ERM	BH104	0.3	19/6/06	Area B	333642	6251285	2.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH104	3	19/6/06	Area B	333642	6251285	-0.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH108	1.5	26/6/06	Area B	333633	6251360	1.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH108	3	27/6/06	Area B	333633	6251360	-0.45	0.5	<0.5	1.6	2.1	1.8	-	2.6	1.2	0.7	1.8	<0.5	4.5	0.7	0.9	0.6	-	4.1	4.2	2.46
ERM	BH109	0.3	27/6/06	Block 4	333683	6251569	1.81	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH109	3	27/6/06	Block 4	333683	6251569	-0.89	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH109	9.5	27/6/06	Block 4	333683	6251569	-7.39	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH110	0.3	27/6/06	Area B	333671	6251531	2.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH110	1.5	27/6/06	Area B	333671	6251531	0.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH110	23.3	27/6/06	Area C	333671	6251531	-20.99	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH110	3	27/6/06	Area B	333671	6251531	-0.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH111	1.5	27/6/06	Area B	333691	6251530	0.61	<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	0.6	0
ERM	BH111	3	27/6/06	Area B	333691	6251530	-0.89	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM	BH111	9.5	27/6/06	Area C	333691	6251530	-7.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-			0
ERM	BH112	1.5	27/6/06	Area B	333709	6251539	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM	BH112	3	27/6/06	Area B	333709	6251539	-0.8	<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	-	0.7	1	0
ERM	BH112	7	27/6/06	Area B	333709	6251539	-4.8	<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
ERM	BH113	1.5	27/6/06	Block 4	333706	6251570	0.68	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH113	3	27/6/06	Block 4	333706	6251570	-0.82	<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	11.2	1.8	1.8	0.878
ERM	BH114	0.3	28/6/06	Block 4	333718	6251554	1.98	<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	16.5	1	2.5	2.225
ERM	BH114	3	28/6/06	Block 4	333718	6251554	-0.72	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH115	0.8	28/6/06	Block 4	333689	6251605	1.48	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH115	1.5	28/6/06	Block 4	333689	6251605	0.78	<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	9.65	1	1.6	0.877
ERM	BH115	3	28/6/06	Block 4	333689	6251605	-0.72	<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	8.75	0.8	1.4	0.756
ERM	BH116	1.5	28/6/06	Southern Cove	333607	6251595	0.97	<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	2.5	<0.5	0.9	0.07
ERM	BH116	3	28/6/06	Southern Cove	333607	6251595	-0.53	<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	4.7	1	1.1	0.13
ERM	BH117	1.5	29/6/06	Area B	333722	6251516	0.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH117	10	29/6/06	Area B	333722	6251516	-7.65	0.6	3.8	1.9	1.4	0.8	-	0.8	<0.5	<0.5	1.3	<0.5	2.4	2.7	<0.5	19.3	-	6.3	3.7	1.033

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
ERM	BH117	15	29/6/06	Area B	333722	6251516	-12.65	8.3	63.1	25.6	18.9	11.4	-	10	3.8	2.8	15.4	1.1	31.2	36.4	2.8	462	-	86	47.5	16.142
ERM	BH118	1.5	30/6/06	Area B	333675	6251515	0.8	<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
ERM	BH118	3	30/6/06	Area B	333675	6251515	-0.7	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM	BH118	9.5	30/6/06	Area C	333675	6251515	-7.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH119	1.6	30/6/06	Block 4	333670	6251622	0.98	<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	8	0.5	1	0.962
ERM	BH119	7.5	30/6/06	Block 4	333670	6251622	-4.92	53.5	273	236	152	149	-	113	59.9	71.3	121	27.4	550	313	57.2	1620	5173.3	880	497	217.559
ERM	BH119	9.5	30/6/06	Block 4	333670	6251622	-6.92	39.7	240	163	88.9	80	-	55.5	23.5	43.5	69.8	9	289	239	26.4	1210	3325.3	504	244	111.363
ERM	BH128	1.5	3/7/06	Public Domain Blocks 4&5	333572	6251768	0.94	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH128	20	3/7/06	Public Domain Blocks 4&5	333572	6251768	-17.56	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH129	0.4	5/7/06	Public Domain Blocks 4&5	333578	6251713	2.08	<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	7.1	0.6	1.4	0.892
ERM	BH129	12.5	3/7/06	Public Domain Blocks 4&5	333578	6251713	-10.02	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH129	3	3/7/06	Public Domain Blocks 4&5	333578	6251713	-0.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH132	1.5	6/7/06	Proposed Southern Cove	333727	6251560	0.94	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	*189.2*	16.1	27.5	25.386
ERM	BH132	8	6/7/06	Proposed Southern Cove	333727	6251560	-5.56	18.4	148	57	45	*28*	-	27.4	11	11.6	37.5	3	77.6	76.9	8.3	825	*1700.3*	228	97.6	40.715
ERM	BH133	0.3	6/7/06	Block 4	333747	6251595	2.07	<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	26.75	2.7	4	2.803
ERM	BH133	1.5	6/7/06	Block 4	333747	6251595	0.87	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH134	0.4	7/11/06	Area B	333734	6251518	2.2	<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	<0.5	-	<0.5	<0.5	0
ERM	BH134	3	7/11/06	Area B	333734	6251518	-0.4	<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	-	<0.5	<0.5	0
ERM	BH134	9.2	7/11/06	Area B	333734	6251518	-6.6	<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	<0.5	-	<0.5	<0.5	0
ERM	BH135A	0.4	11/7/06	Block 4	333725	6251577	2.06	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH135A	3	11/7/06	Block 4	333725	6251577	-0.54	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH136	3	6/7/06	Block 5	333703	6251780	-0.64	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH136	8	6/7/06	Block 5	333703	6251780	-5.64	<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	<0.5	0.8	0
ERM	BH137	1.5	6/7/06	Block 4	333664	6251636	1.24	<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	<0.5	0.8	0.5
ERM	BH137	12.5	6/7/06	Block 4	333664	6251636	-9.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH137	3	6/7/06	Block 4	333664	6251636	-0.26	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH141	1.5	7/7/06	Block 4	333721	6251645	0.78	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	350.5	38.4	67.9	34.823
ERM	BH141	3	7/7/06	Block 4	333721	6251645	-0.72	127	600	499	429	344	-	359	149	140	328	35.4	1160	725	124	5840	13659.4	1820	980	489.37
ERM	BH142	1.5	10/7/06	Southern Cove	333654	6251577	0.62	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH142	9.5	10/7/06	Southern Cove	333654	6251577	-7.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH143	1.5	10/7/06	Southern Cove	333643	6251590	0.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM	BH143	9	10/7/06	Southern Cove	333643	6251590	-6.87	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH145	0.3	11/7/06	Block 5	333713	6251681	1.89	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	849.7	61.6	149	109.996
ERM	BH145	3	11/7/06	Block 5	333713	6251681	-0.81	<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	4.9	<0.5	0.7	0
ERM	BH146	1.5	11/7/06	Block 4	333736	6251583	0.94	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH146	3	11/7/06	Block 4	333736	6251583	-0.56	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	951.4	26.6	198	99.1
ERM	BH146	4.1	11/7/06	Block 4	333736	6251583	-1.66	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	1274.6	186	105	48.479
ERM	BH156	0.4	14/8/06	Proposed Southern Cove	333726	6251602	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	<0.5	<8	<0.5	<0.5	0
ERM	BH156	0.9	14/8/06	Proposed Southern Cove	333726	6251602	1.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH159		14/8/06	Block 4	333706	6251570	#VALUE!	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH160	0.3	14/8/06	Block 4	333748	6251595	2.1	<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	<8	<0.5	<0.5	0
ERM	BH161	0.3	14/8/06	Block 4	333723	6251577	2.1	<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	<8	<0.5	<0.5	0
ERM	BH190	5.1	26/3/08	Public Domain Blocks 4&5	333612	6251728	-2.865	0.5	0.5	1.1	3.1	2.6	3	-	1.6	1	2.6	<0.5	4.6	0.8	1.1	0.5	32.8	5.1	4.7	3.162
ERM	BH190	15	10/4/08	Public Domain Blocks 4&5	333612	6251728	-12.765	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.8	2.2	0.9	<0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
ERM	BH191	3.7	27/3/08	Public Domain Blocks 4&5	333591	6251690	-1.4	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	228.5	38.4	29.4	17.617
ERM	BH191	5.6	11/4/08	Public Domain Blocks 4&5	333591	6251690	-3.3	<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	4.8	0.8	0.9	0.07
ERM	BH191	16.5	14/4/08	Public Domain Blocks 4&5	333591	6251690	-14.2	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	298	44.7	22.4	10.365
ERM	BH191	18.2	14/4/08	Public Domain Blocks 4&5	333591	6251690	-15.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	0.6	2	0.9	<0.5	0
ERM	BH192	3	19/3/08	Area B	333703	6251485	-0.481	<0.5	<0.5	<0.5	<0.5	<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
ERM	BH192	7.4	19/3/08	Area B	333703	6251485	-4.881	<0.5	<0.5	0.5	1.1	1.1		1.1	0.5	<0.5	0.9	<0.5	2.2	<0.5	<0.5	<0.5	.	1.4	2.3	1.334
ERM	BH192	16.5	20/3/08	Area C	333703	6251485	-13.981	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	.	<0.5	<0.5	0
ERM	BH193	2.5	20/3/08	Area B	333696	6251465	0.245	<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	.	<0.5	0.8	0
ERM	BH193	11.3	20/3/08	Area C	333696	6251465	-8.555	<0.5	<0.5	<0.5	1	1.2		1.2	0.7	0.5	0.9	<0.5	1.9	<0.5	0.6	<0.5	.	0.8	2.2	1.546
ERM	BH193	14.5	17/4/08	Area C	333696	6251465	-11.755	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	.	<0.5	<0.5	0
ERM	BH194	0.5	19/3/08	Area B	333685	6251446	2.417	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	.	<0.5	<0.5	0
ERM	BH194	1.5	20/3/08	Area B	333685	6251446	1.417	<0.5	0.6	0.8	2.3	2.6		2.5	1.5	1.4	2.1	<0.5	5.4	<0.5	1.3	<0.5	.	2.4	5.2	3.386
ERM	BH194	3.6	20/3/08	Area B	333685	6251446	-0.683	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	.	<0.5	<0.5	0
ERM	BH194	10.8	20/3/08	Area C	333685	6251446	-7.883	<0.5	<0.5	<0.5	1	0.9		0.9	<0.5	<0.5	0.8	<0.5	2.1	<0.5	<0.5	<0.5	.	0.8	2.3	1.098
ERM	BH194	13.6	4/7/08	Area C	333685	6251446	-10.683	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	.	<0.5	<0.5	0
ERM	BH195	5.45	25/3/08	Area B	333707	6251426	-2.539	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	.	<0.5	<0.5	0
ERM	BH195	9.9	25/3/08	Area C	333707	6251426	-6.989	<0.5	0.5	1.2	2.1	1.4		1.9	0.9	0.7	1.6	<0.5	4.1	0.6	0.6	<0.5	.	4.4	3.9	1.955
ERM	BH195	10.5	4/9/08	Area C	333707	6251426	-7.589	<0.5	1.4	1.8	6.3	6		6.4	2.9	3.7	4.1	0.6	8.1	0.6	2.4	0.6	.	3	10.3	8.55
ERM	BH195	11.7	4/9/08	Area C	333707	6251426	-8.789	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	.	<0.5	<0.5	0
ERM	BH196	1	19/3/08	Area B	333720	6251359	1.761	2.4	<0.5	1.4	1.6	1.2		1.5	0.6	<0.5	1.3	<0.5	4.6	<0.5	0.6	<0.5	.	3.7	4.2	1.589
ERM	BH196	6.4	19/3/08	Area B	333720	6251359	-3.639	<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	.	1	1.1	0.72
ERM	BH197	0.4	3/3/08	Block 5	333706	6251718	2.077	<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	14.1	2.9	-	0.125
ERM	BH197	5	9/4/08	Block 5	333706	6251718	-2.523	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	546.8	23.6	-	49.087
ERM	BH197	6.5	9/4/08	Block 5	333706	6251718	-4.023	<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	12.25	1.6	-	0.05
ERM	BH197	11.5	9/4/08	Block 5	333706	6251718	-9.023	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	92.3	19.3	-	1.587
ERM	BH197	15.9	10/4/08	Block 5	333706	6251718	-13.423	<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	12.5	2.7	-	0.06
ERM	BH197	18.6	10/4/08	Block 5	333706	6251718	-16.123	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	-	0
ERM	BH198	3	6/3/08	Block 5	333731	6251708	-0.725	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	274.8	21	54.8	37.064
ERM	BH198	4.5	6/3/08	Block 5	333731	6251708	-2.225	<0.5	<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	4.75	<0.5	<0.5	0
ERM	BH198	6.9	6/3/08	Block 5	333731	6251708	-4.625	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH199	2.7	11/3/08	Block 5	333719	6251681	-0.459	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	217.2	25.3	39.4	20.52
ERM	BH199	3.7	11/3/08	Block 5	333719	6251681	-1.459	14.2	47.2	44.7	39.8	27.4	-	29.8	10.3	11.9	28	2.5	122	69	10.4	439	1158.9	164	98.7	39.473
ERM	BH199	5.6	11/3/08	Block 5	333719	6251681	-3.359	<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	26.2	2.9	4.4	1.454
ERM	BH199	6	17/3/08	Block 5	333719	6251681	-3.759	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH200	1	7/4/08	Block 4	333721	6251658	1.298	5.2	54.8	75.7	158	113	-	158	30.4	48.2	128	11.6	320	14.8	34.4	64.4	1781.5	269	296	166.044
ERM	BH200	2.5	7/4/08	Block 4	333721	6251658	-0.202	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	220.1	32.4	33.1	19.759
ERM	BH200	6.53	7/4/08	Block 4	333721	6251658	-4.232	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH201	2.4	4/3/08	Block 5	333699	6251682	-0.167	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH201	10.3	18/3/08	Block 5	333699	6251682	-8.067	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	160.4	16.2	23.6	21.747
ERM	BH201	11	18/3/08	Block 5	333699	6251682	-8.767	<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	7.15	<0.5	1.5	0.72
ERM	BH202	2.3	10/3/08	Block 4	333705	6251646	0.179	<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	67.1	3.4	11.6	9.474
ERM	BH202	4.7	10/3/08	Block 4	333705	6251646	-2.221	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	48.1	4.8	9.8	4.748
ERM	BH202	6.8	10/3/08	Block 4	333705	6251646	-4.321	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH203	1.9	10/3/08	Block 4	333693	6251633	0.781	<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	58.15	5.9	9.1	7.675

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
ERM	BH203	7.3	10/3/08	Block 4	333693	6251633	-4.619	<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	32	3.4	5.6	3.394
ERM	BH204	1	18/3/08	Block 4	333744	6251622	0.952	45.2	194	187	128	78.6	-	68.8	39.8	59	83.5	9.9	373	295	41.3	1180	3702.1	673	246	119.443
ERM	BH204D	1.5	7/4/08	Block 4	333724	6251620	0.664	222	605	1200	823	652	-	587	305	231	631	71.4	1550	1190	247	8410	20934.4	2700	1510	921.56
ERM	BH204D	3	7/4/08	Block 4	333724	6251620	-0.836	85.6	234	283	255	195	-	210	38.2	40.4	184	13.3	655	384	40.8	1970	6223.3	1090	545	265.142
ERM	BH204D	4	7/4/08	Block 4	333724	6251620	-1.836	73.4	336	338	299	224	-	239	42.5	41	212	16.3	777	462	48.3	2930	7972.5	1290	644	305.575
ERM	BH205	7.8	27/3/08	Block 4	333704	6251613	-5.394	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	4.7	0.5	<0.5	0
ERM	BH205	9.3	27/3/08	Block 4	333704	6251613	-6.894	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	738.1	117	50.8	22.484
ERM	BH205	13	1/4/08	Block 4	333704	6251613	-10.594	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	81.75	13.1	6.3	2.566
ERM	BH205	13.8	1/4/08	Block 4	333704	6251613	-11.394	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH205	19.2	2/4/08	Block 4	333704	6251613	-16.794	<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	6.75	1.4	0.7	0
ERM	BH205	22.2	2/4/08	Block 4	333704	6251613	-19.794	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH206	0.5	7/3/08	Block 4	333713	6251599	1.729	<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	98.45	11.8	16.8	11.321
ERM	BH206	1.8	17/4/08	Block 4	333713	6251599	0.429	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.25	<0.5	0.5	0
ERM	BH206	4.6	17/4/08	Block 4	333713	6251599	-2.371	<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	19.7	2.4	3.6	1.658
ERM	BH206	7.1	17/4/08	Block 4	333713	6251599	-4.871	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	110.35	16.9	8.8	2.862
ERM	BH206	10.7	21/4/08	Block 4	333713	6251599	-8.471	<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	22.95	5.1	2.5	0.909
ERM	BH207	7.45	3/4/08	Proposed Southern Cove	333698	6251599	-5.163	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH207	12	3/4/08	Proposed Southern Cove	333698	6251599	-9.713	<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	53.85	4.3	9.5	6.811
ERM	BH207	13.1	3/4/08	Proposed Southern Cove	333698	6251599	-10.813	<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	34.25	6.5	4.3	1.525
ERM	BH207	15	3/4/08	Proposed Southern Cove	333698	6251599	-12.713	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.6	4.35	<0.5	<0.5	0
ERM	BH208	2.25	4/4/08	Block 4	333705	6251588	-0.032	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH208	9.5	4/4/08	Block 4	333705	6251588	-7.282	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH208	13.5	4/4/08	Block 4	333705	6251588	-11.282	<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	110.05	8.4	22.8	13.108
ERM	BH209	2.3	22/4/08	Block 4	333727	6251589	-0.014	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	168	7.6	44.8	23.217
ERM	BH209	4.5	22/4/08	Block 4	333727	6251589	-2.214	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	497	75.5	41.6	16.094
ERM	BH209	6.1	22/4/08	Block 4	333727	6251589	-3.814	6.8	54.9	22.3	15.4	9.1	-	7	3.2	2.9	11	1	24.6	27	2.2	498	814	86.5	42.1	12.992
ERM	BH209	9.4	23/4/08	Block 4	333727	6251589	-7.114	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH210	1.5	18/3/08	Proposed Southern Cove	333685	6251582	0.558	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH210	15.9	27/3/08	Proposed Southern Cove	333685	6251582	-13.842	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH211	14	26/3/08	Block 4	333676	6251561	-11.749	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH211	15.5	26/3/08	Block 4	333676	6251561	-13.249	<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	19.45	3.6	1.8	0.086
ERM	BH211	16.05	26/3/08	Block 4	333676	6251561	-13.799	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM	BH212	3.1	18/3/08	Public Domain Blocks 4&5	333573	6251519	-0.748																			0
ERM	BH212	4.8	25/3/08	Public Domain Blocks 4&5	333573	6251519	-2.448	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH212	12.2	28/3/08	Public Domain Blocks 4&5	333573	6251519	-9.848	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH212	26	31/3/08	Public Domain Blocks 4&5	333573	6251519	-23.648	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH213	3.6	14/4/08	Public Domain Blocks 4&5	333559	6251750	-1.263	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH213	10.5	14/4/08	Public Domain Blocks 4&5	333559	6251750	-8.163	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0
ERM	BH213	18.5	17/4/08	Public Domain Blocks 4&5	333559	6251750	-16.163	<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	13.7	1	2.7	1.436
ERM 2007	BH021	0.3-0.5	ERM 2007	Barangaroo Central	333621.97	6251691.71	2.21	0.9	<0.5	0.9	2.2	2.3	-	2.8	1.2	1.1	1.8	<0.5	4.5	<0.5	1.2	0.8	28.8	2.8	4.8	3.06
ERM 2007	BH021	1.5-1.95	ERM 2007	Barangaroo Central	333621.97	6251691.71	2.21	8.9	1.5	7.3	5.1	3.8	-	4.5	1.4	1.8	3.9	<0.5	13.8	8.9	1.3	56.2	151.3	20.8	11.6	5.123
ERM 2007	BH021	16.0-16.5	ERM 2007	Barangaroo Central	333621.97	6251691.71	2.21	<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
ERM 2007	BH022	0.3-0.5	ERM 2007	Barangaroo Central	333644.6	6251851.63	2.81	<0.5	<0.5	<0.5	0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0.05
ERM 2007	BH022	1.5-1.95	ERM 2007	Barangaroo Central	333644.6	6251851.63	2.81	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
ERM 2007	BH022	11.0-11.5	ERM 2007	Barangaroo Central	333644.6	6251851.63	2.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH023	0.3-0.5	ERM 2007	Barangaroo Central	333682.71	6251864.66	2.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH023	1.5-1.95	ERM 2007	Barangaroo Central	333682.71	6251864.66	2.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH023	13.5-13.8	ERM 2007	Barangaroo Central	333682.71	6251864.66	2.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH024	0.3-0.5	ERM 2007	Barangaroo Central	333707.06	6251850.27	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH024	3.0-3.45	ERM 2007	Barangaroo Central	333707.06	6251850.27	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH024	10.0-10.5	ERM 2007	Barangaroo Central	333707.06	6251850.27	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH025	0.3-0.5	ERM 2007	Barangaroo Central	333713.78	6251794.82	2.22	<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	12.9	0.7	1.7	1.017
ERM 2007	BH025	3.0-3.65	ERM 2007	Barangaroo Central	333713.78	6251794.82	2.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH025	8.5-9.0	ERM 2007	Barangaroo Central	333713.78	6251794.82	2.22	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2007	BH026	0.3-0.5	ERM 2007	Barangaroo Central	333617.2	6251774.86	2.35	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2007	BH026	1.5-1.95	ERM 2007	Barangaroo Central	333617.2	6251774.86	2.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH026	16.5-16.95	ERM 2007	Barangaroo Central	333617.2	6251774.86	2.35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH027	0.3-0.5	ERM 2007	Barangaroo Central	333650.91	6251793.26	2.84	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2007	BH027	3.0-3.45	ERM 2007	Barangaroo Central	333650.91	6251793.26	2.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH027	14.0-14.5	ERM 2007	Barangaroo Central	333650.91	6251793.26	2.84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH029	0.3-0.5	ERM 2007	Barangaroo Central	333709.24	6251985.27	2.553	<0.5	<0.5	<0.5	0.9	1	-	0.8	0.7	0.8	0.9	<0.5	1.5	<0.5	0.6	0.5	11.5	0.8	<0.5	1.326
ERM 2007	BH029	3.0-3.45	ERM 2007	Barangaroo Central	333709.24	6251985.27	2.553	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH029	9.0-9.5	ERM 2007	Barangaroo Central	333709.24	6251985.27	2.553	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2007	BH032	0.3-0.5	ERM 2007	Barangaroo Central	333654.69	6251923.5	2.44	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2007	BH032	1.5-1.95	ERM 2007	Barangaroo Central	333654.69	6251923.5	2.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH032	3.0-3.34	ERM 2007	Barangaroo Central	333654.69	6251923.5	2.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH040	0.3-0.5	ERM 2007	Barangaroo Central	333609.17	6251893.69	2.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH040	1.5-1.95	ERM 2007	Barangaroo Central	333609.17	6251893.69	2.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH040	26.5-27.0	ERM 2007	Barangaroo Central	333609.17	6251893.69	2.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH045	0.3-0.5	ERM 2007	Barangaroo Central	333655.53	6251722.86	2.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH045	1.5-1.95	ERM 2007	Barangaroo Central	333655.53	6251722.86	2.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH045	3.0-3.45	ERM 2007	Barangaroo Central	333655.53	6251722.86	2.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH046	1.5-1.95	ERM 2007	Barangaroo Central	333641.38	6251752.7	2.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH046	3.0-3.45	ERM 2007	Barangaroo Central	333641.38	6251752.7	2.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH050	0.3-0.5	ERM 2007	Barangaroo Central	333618.89	6251819.47	2.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH050	1.5-1.8	ERM 2007	Barangaroo Central	333618.89	6251819.47	2.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH050	3.0-3.5	ERM 2007	Barangaroo Central	333618.89	6251819.47	2.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH051	0.3-0.5	ERM 2007	Barangaroo Central	333600.24	6251794.48	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH051	1.5-1.7	ERM 2007	Barangaroo Central	333600.24	6251794.48	2.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH052	1.5-1.95	ERM 2007	Barangaroo Central	333606.71	6251757.95	2.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH052	3.0-3.45	ERM 2007	Barangaroo Central	333606.71	6251757.95	2.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH056	0.3-0.5	ERM 2007	Barangaroo Central	333688.86	6251817.14	2.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH056	1.5-1.95	ERM 2007	Barangaroo Central	333688.86	6251817.14	2.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH056	13.0-13.5	ERM 2007	Barangaroo Central	333688.86	6251817.14	2.53	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH057	1.5-1.7	ERM 2007	Barangaroo Central	333564.03	6251834.68	2.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH057	3.0-3.45	ERM 2007	Barangaroo Central	333564.03	6251834.68	2.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH057	16.5-17.0	ERM 2007	Barangaroo Central	333564.03	6251834.68	2.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH061	1.5-1.95	ERM 2007	Barangaroo Central	333567.17	6251808.1	2.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH061	3.0-3.45	ERM 2007	Barangaroo Central	333567.17	6251808.1	2.31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH066	0.3-0.5	ERM 2007	Barangaroo Central	333654.96	6251689.34	2.24	<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	12.9	1	1.7	1.275

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
ERM 2007	BH066	1.5-1.95	ERM 2007	Barangaroo Central	333654.96	6251689.34	2.24	<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	9.4	0.9	1	0.05
ERM 2007	BH080	0.3-0.5	ERM 2007	Barangaroo Central	333669.21	6251935.85	2.543	<0.5	<0.5	<0.5	1.1	1.1	-	0.9	0.8	0.9	1.1	<0.5	2.4	<0.5	0.6	<0.5	15.8	1.2	2.7	1.469
ERM 2007	BH080	1.5-1.95	ERM 2007	Barangaroo Central	333669.21	6251935.85	2.543	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH080	19.0-19.5	ERM 2007	Barangaroo Central	333669.21	6251935.85	2.543	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2007	BH107	1.5-1.95	ERM 2007	Barangaroo Central	333594.08	6251850.09	2.32	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2007	BH107	3.0-3.45	ERM 2007	Barangaroo Central	333594.08	6251850.09	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH107	13.5-14.0	ERM 2007	Barangaroo Central	333594.08	6251850.09	2.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH128	1.5-1.7	ERM 2007	Barangaroo Central	333571.82	6251767.73	2.44	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2007	BH128	20-20.5	ERM 2007	Barangaroo Central	333571.82	6251767.73	2.44	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2007	BH129	0.4-0.6	ERM 2007	Barangaroo Central	333577.76	6251713.33	2.4	<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	11.1	0.6	1.4	0.982
ERM 2007	BH129	3.0-3.45	ERM 2007	Barangaroo Central	333577.76	6251713.33	2.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH129	12.5-13	ERM 2007	Barangaroo Central	333577.76	6251713.33	2.4	<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	-	<0.5	<0.5	0
ERM 2007	BH140	1.5-1.95	ERM 2007	Barangaroo Central	333721.59	6251809.19	2.34	<0.5	<0.5	<0.5	0.6	0.6	-	0.7	<0.5	<0.5	0.6	<0.5	1.2	<0.5	<0.5	<0.5	10.1	0.7	1.2	0.736
ERM 2007	BH140	6.0-6.5	ERM 2007	Barangaroo Central	333721.59	6251809.19	2.34	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2007	BH147	1.6-2.05	ERM 2007	Barangaroo Central	333712.32	6251933.44	2.65	<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	8.7	<0.5	0.8	0.06
ERM 2007	BH147	3.0-3.45	ERM 2007	Barangaroo Central	333712.32	6251933.44	2.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2007	BH147	8.9-9.2	ERM 2007	Barangaroo Central	333712.32	6251933.44	2.65	<0.5	<0.5	0.7	1	0.8	-	0.9	<0.5	<0.5	0.8	<0.5	2.6	<0.5	<0.5	<0.5	14.8	1.7	2.3	0.998
ERM 2007	BH155	0.4-0.5	ERM 2007	Barangaroo Central	333712.78	6251933.5	2.646	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2007	BH155	0.9-1.0	ERM 2007	Barangaroo Central	333712.78	6251933.5	2.646	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH179	1.5-2.0	ERM 2008	Barangaroo Central	333708.26	6251901.9	2.458	<0.5	<0.5	<0.5	1.8	1.6	-	1.6	1	1.1	1.3	<0.5	3.5	<0.5	0.8	<0.5	19.5	1.4	3.4	2.153
ERM 2008	BH179	7	ERM 2008	Barangaroo Central	333708.26	6251901.9	2.458	2	8.2	8	30	28.3	-	32.8	16.6	18.6	26.7	3.6	53.6	4.4	13.9	3.5	315.6	21.2	56.4	41.863
ERM 2008	BH179	11	ERM 2008	Barangaroo Central	333708.26	6251901.9	2.458	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH180	4.7	ERM 2008	Barangaroo Central	333670.09	6251872.95	2.691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2008	BH180	8.7	ERM 2008	Barangaroo Central	333670.09	6251872.95	2.691	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
ERM 2008	BH180	14.3	ERM 2008	Barangaroo Central	333670.09	6251872.95	2.691	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH183	2.2	ERM 2008	Barangaroo Central	333554.97	6251884.78	2.451	9.4	3.2	12.1	56.2	38.9	-	61.8	30.8	16.5	47.1	6.9	150	1.1	26.1	<0.5	593.25	14.9	118	62.639
ERM 2008	BH183	8	ERM 2008	Barangaroo Central	333554.97	6251884.78	2.451	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH183	30.3	ERM 2008	Barangaroo Central	333554.97	6251884.78	2.451	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH183	31.6	ERM 2008	Barangaroo Central	333554.97	6251884.78	2.451	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<8	<0.5	<0.5	0
ERM 2008	BH184	4.8	ERM 2008	Barangaroo Central	333604.52	6251922.67	2.411	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH184	9.6	ERM 2008	Barangaroo Central	333604.52	6251922.67	2.411	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH184	23.3	ERM 2008	Barangaroo Central	333604.52	6251922.67	2.411	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH186	3.6	ERM 2008	Barangaroo Central	333579.03	6251907.93	2.398	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH186	11	ERM 2008	Barangaroo Central	333579.03	6251907.93	2.398	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH186	13.5	ERM 2008	Barangaroo Central	333579.03	6251907.93	2.398	<0.5	1	1.1	3.3	3.4	-	4.1	2.2	1.5	2.4	<0.5	5	<0.5	1.7	<0.5	35	2.4	5.9	4.506
ERM 2008	BH187	3.6	ERM 2008	Barangaroo Central	333588.75	6251879.22	2.243	<0.5	<0.5	<0.5	0.6	0.5	-	0.6	<0.5	<0.5	0.5	<0.5	1.2	<0.5	<0.5	<0.5	7.55	0.7	1.2	0.625
ERM 2008	BH187	10	ERM 2008	Barangaroo Central	333588.75	6251879.22	2.243	<0.5	<0.5	0.7	1.8	1.8	-	2	1.1	1	1.4	<0.5	3.8	<0.5	0.8	<0.5	21.65	1.6	4.4	2.385
ERM 2008	BH187	25	ERM 2008	Barangaroo Central	333588.75	6251879.22	2.243	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH188	2.9	ERM 2008	Barangaroo Central	333636.01	6251875.72	2.689	0.5	<0.5	1.4	3.6	2.9	-	3.5	1.8	1.2	2.7	<0.5	6.5	0.6	1.4	0.7	38.4	4.6	6.5	3.915
ERM 2008	BH188	11.5	ERM 2008	Barangaroo Central	333636.01	6251875.72	2.689	1.3	1.3	3.6	6.9	6.6	-	7.5	3.8	3.1	5.1	0.8	13.1	1.4	3	1	87.7	9.2	20	9.539
ERM 2008	BH188	15.1	ERM 2008	Barangaroo Central	333636.01	6251875.72	2.689	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH189	16	ERM 2008	Barangaroo Central	333661.69	6251831.66	2.831	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH189	3.7	ERM 2008	Barangaroo Central	333661.69	6251831.66	2.831	<0.5	<0.5	<0.5	0.6	<0.5	-	0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5	0.9	7.2	0.9	0.9	0.11
ERM 2008	BH189	7.2	ERM 2008	Barangaroo Central	333661.69	6251831.66	2.831	<0.5	0.6	1.1	2.3	2	-	2.3	1.1	1	1.7	<0.5	4.5	<0.5	0.9	<0.5	27	3	5.5	2.678
ERM 2008	BH213	3.6	ERM 2008	Barangaroo Central	333558.56	6251749.96	2.337	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH213	10.5	ERM 2008	Barangaroo Central	333558.56	6251749.96	2.337	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH213	18.5	ERM 2008	Barangaroo Central	333558.56	6251749.96	2.337	<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	14.95	1	2.7	1.546

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	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	PAHs (Sum of total)	Phenanthrene	Pyrene	TEF
ERM 2008	BH214	6.3	ERM 2008	Barangaroo Central	333547.71	6251850.17	2.103	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0
ERM 2008	BH214	15	ERM 2008	Barangaroo Central	333547.71	6251850.17	2.103	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.25	<0.5	0.5	0
ERM 2008	BH214	16	ERM 2008	Barangaroo Central	333547.71	6251850.17	2.103	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	0

Table 5: Phenols

All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	Phenol	2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,6-dichlorophenol	2-chlorophenol	Pentachlorophenol
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH04	22	12/10/09	Area C	333662	6251527	-19.84	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH05	1.7	12/2/09	Area B	333692	6251518	0.39	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH11	1.4	2/5/10	Area B	333757	6251517	1.6	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH11	3.2	2/5/10	Area B	333757	6251517	-0.2	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH13	1	2/5/10	Area B	333692	6251488	1.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH13	7.2	2/5/10	Area B	333692	6251488	-4.7	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH14	13	2/10/10	Area C	333648	6251482	-10.44	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH14	2.5	2/10/10	Area B	333648	6251482	0.06	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH15	2	2/9/10	Area B	333758	6251459	0.71	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH17	10	2/10/10	Area B	333732	6251416	-7.45	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH17	4	2/9/10	Area B	333732	6251416	-1.45	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH18	2.5	2/10/10	Area B	333753	6251380	-0.21	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH20	1	2/11/10	Area B	333733	6251328	1.76	0.9	0.9	<0.5	2	<0.5	1	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH20	4	2/11/10	Area B	333733	6251328	-1.24	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH21	4	2/11/10	Area B	333718	6251310	-1.44	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH22	4	2/10/10	Area B	333639	6251295	-1.8	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH23	4.7	2/5/10	Area B	333640	6251297	-2.26	<2	<2	<2	<4	<2	<2	<2	<2	<2	<2	<2	<4
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH25	1	19/2/10	Area B	333697	6251356	1.87	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH26	10	2/11/10	Area C	333666	6251372	-7.41	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH26	11.4	2/11/10	Area C	333666	6251372	-8.81	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH26	4	2/11/10	Area B	333666	6251372	-1.41	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH27	10	15/2/10	Area C	333630	6251405	-7.59	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH28	13	15/2/10	Area C	333683	6251424	-10.85	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH30	13	16/2/10	Area C	333639	6251452	-10.58	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH31	2.5	16/2/10	Area B	333646	6251473	-0.05	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH32	14.5	2/12/10	Area C	333692	6251462	-11.68	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	Phenol	2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,6-dichlorophenol	2-chlorophenol	Pentachlorophenol
AECOM	BH33	5	12/2/10	Block 3	333699	6251546	-2.7	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH34	1.8	25/2/10	Block 4	333689	6251576	0.24	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH34	11	25/2/10	Block 4	333689	6251576	-8.96	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH34	6	25/2/10	Block 4	333689	6251576	-3.96	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH35	4	22/2/10	Block 4	333706	6251580	-1.81	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH35	9.9	22/2/10	Block 4	333706	6251580	-7.71	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH36	1	3/3/10	Block 3	333684	6251545	1.25	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH36	15	3/3/10	Block 3	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH36	4	3/3/10	Block 3	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH36	8.5	3/3/10	Block 3	333684	6251545	-6.25	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH36	1	3/3/10	Area B	333684	6251545	1.25	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH36	8.5	3/3/10	Area C	333684	6251545	-6.25	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	<0.6	<0.6	<0.6	<1.2	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	<1
AECOM	BH37	15.8	18/2/10	Area C	333655	6251543	-13.57	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1
AECOM	BH37	5.5	18/2/10	Area B	333655	6251543	-3.27	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH37	8.3	18/2/10	Area B	333655	6251543	-6.07	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH38	14.5	19/2/10	Southern Cove	333620	6251544	-12.13	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH38	20.5	19/2/10	Southern Cove	333620	6251544	-18.13	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH38	8.5	19/2/10	Southern Cove	333620	6251544	-6.13	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH39	11.5	24/2/10	Southern Cove	333609	6251568	-9.02	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH39	16	24/2/10	Southern Cove	333609	6251568	-13.52	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH39	4	24/2/10	Southern Cove	333609	6251568	-1.52	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	5.9	<0.5	<0.5	3	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	1	<0.5	<0.5	0.6	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH40	19	18/2/10	Southern Cove	333642	6251571	-16.88	3.1	1.3	<0.5	2.7	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH40	7	18/2/10	Southern Cove	333642	6251571	-4.88	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH41	1	4/3/10	Southern Cove	333661	6251582	1.222	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH41	14.5	8/3/10	Southern Cove	333661	6251582	-12.278	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH41	16	8/3/10	Southern Cove	333661	6251582	-13.778	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5						
AECOM	BH41	4	4/3/10	Southern Cove	333661	6251582	-1.778	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH41	8.5	4/3/10	Southern Cove	333661	6251582	-6.278	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH42	1	23/2/10	Block 4	333738	6251549	1.51	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	<1.2	3.2	<1.2	<2.5	<1.2	<1.2	-	-	-	-	-	-
AECOM	BH42	3.5	23/2/10	Block 4	333738	6251549	-0.99	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH44	1.9	23/2/10	Block 4	333733	6251591	0.45	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	<1.2	<1.2	<1.2	<2.5	<1.2	<1.2	-	-	-	-	-	-
AECOM	BH45	13.2	23/2/10	Proposed Southern Cove	333698	6251587	-11.04	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH45	3.2	23/2/10	Proposed Southern Cove	333698	6251587	-1.04	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	Phenol	2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,6-dichlorophenol	2-chlorophenol	Pentachlorophenol
AECOM	BH45	7.2	23/2/10	Proposed Southern Cove	333698	6251587	-5.04	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH46	1	23/2/10	Southern Cove	333627	6251582	1.22	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH46	14.5	23/2/10	Southern Cove	333627	6251582	-12.28	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	2.2	0.8	<0.5	1.4	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH46	20.5	23/2/10	Southern Cove	333627	6251582	-18.28	0.7	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH46	23.5	23/2/10	Southern Cove	333627	6251582	-21.28	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH46	7	23/2/10	Southern Cove	333627	6251582	-4.78	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH47	4	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-1.62	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH47	8.5	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-6.12	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH48	1	22/2/10	Block 4	333652	6251615	1.46	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	97.6	30.2	<1.2	57.1	<1.2	9.4	-	-	-	-	-	-
AECOM	BH48	17	23/2/10	Block 4	333652	6251615	-14.54	6.4	4.8	<0.5	10.8	<0.5	2.1	<0.5	<0.5	<0.5	<0.5	<0.5	-
AECOM	BH48	8.5	23/2/10	Block 4	333652	6251615	-6.04	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
AECOM	BH48	14.5	23/2/10		333652	6251615	-12.04	97.6	30.2	<1.2	57.1	<1.2	9.4	-	-	-	-	-	-
AECOM	BH49	1.5	22/2/10	Block 4	333699	6251517	1.04	0.8	0.8	<0.5	2.1	<0.5	1.9	-	-	-	-	-	-
AECOM	BH49	10.2	22/2/10	Block 4	333699	6251517	-7.66	9	7.8	<0.5	9.5	<0.5	1.6	-	-	-	-	-	-
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	57.6	14.4	<1.2	25.5	<1.2	2.8	-	-	-	-	-	-
AECOM	BH49	4.2	22/2/10	Block 4	333699	6251517	-1.66	5.1	6.4	<0.5	13.9	<0.5	15.8	-	-	-	-	-	-
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	1.4	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH49	8.2	22/2/10	Block 4	333699	6251517	-5.66	4.5	4.1	<0.5	1.2	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH50	1.3	26/2/10	Block 4	333741	6251608	1.21	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH52	2.2	22/2/10	Block 4	333710	6251631	0.27	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH52	4.2	22/2/10	Block 4	333710	6251631	-1.73	5.7	5.1	<0.5	11.7	<0.5	7.4	-	-	-	-	-	-
AECOM	BH54	1	23/2/10	Block 4	333737	6251636	1.13	22.8	7	<4	<8	<4	5	-	-	-	-	-	-
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	<1.2	<1.2	<1.2	<2.5	<1.2	<1.2	-	-	-	-	-	-
AECOM	BH55	1	25/2/10	Block 4	333725	6251640	1.23	41.3	28.3	<4	33.2	<4	23.5	-	-	-	-	-	-
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	4.2	<1.2	<1.2	<2.5	<1.2	<1.2	-	-	-	-	-	-
AECOM	BH55	2.7	25/2/10	Block 4	333725	6251640	-0.47	8.4	<4	<4	<8	<4	<4	-	-	-	-	-	-
AECOM	BH56	13	5/3/10	Public Domain Blocks 4&5	333616	6251645	-10.39	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH56	17.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-14.89	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH56	2.5	4/3/10	Public Domain Blocks 4&5	333616	6251645	0.11	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH56	20.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-17.89	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH56	21.4	5/3/10	Public Domain Blocks 4&5	333616	6251645	-18.79	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	0.9	<0.5	<0.5	1.5	<0.5	0.8	-	-	-	-	-	-
AECOM	BH57	11.5	25/2/10	Block 4	333648	6251649	-8.99	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
AECOM	BH57	7	25/2/10	Block 4	333648	6251649	-4.49	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
AECOM	BH58	10.8	22/2/10	Block 4	333697	6251651	-8.35	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH58	1	22/2/10	Block 4	333697	6251651	1.45	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH58	3.2	22/2/10	Block 4	333697	6251651	-0.75	0.6	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH58	5.2	22/2/10	Block 4	333697	6251651	-2.75	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH59	1.9	22/2/10	Block 4	333730	6251655	0.47	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	Phenol	2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,6-dichlorophenol	2-chlorophenol	Pentachlorophenol
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	42.5	8.2	<1.2	7	1.3	1.8	-	-	-	-	-	-
AECOM	BH59	4.2	22/2/10	Block 4	333730	6251655	-1.83	8.1	5	<0.5	7.2	<0.5	1.6	-	-	-	-	-	-
AECOM	BH60	16	1/3/10	Public Domain Blocks 4&5	333586	6251687	-13.31	4.2	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH60	17.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-14.81	0.6	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH60	2.5	1/3/10	Public Domain Blocks 4&5	333586	6251687	0.19	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH62	1	26/2/10	Block 5	333682	6251687	1.23	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH62	3.4	26/2/10	Block 5	333682	6251687	-1.17	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH62	5.4	26/2/10	Block 5	333682	6251687	-3.17	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH63	11.5	1/3/10	Public Domain Blocks 4&5	333642	6251713	-9.15	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH63	13	1/3/10	Public Domain Blocks 4&5	333642	6251713	-10.65	1.2	0.7	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH63	2.5	26/2/10	Public Domain Blocks 4&5	333642	6251713	-0.15	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH63	20.5	2/3/10	Public Domain Blocks 4&5	333642	6251713	-18.15	4	5.3	<0.5	12.7	<0.5	6	-	-	-	-	-	-
AECOM	BH64	1	1/3/10	Block 5	333717	6251694	1.37	2.4	1.9	<0.5	5.3	<0.5	3.8	-	-	-	-	-	-
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH65	13.4	24/2/10	Block 5	333709	6251701	-10.99	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH65	3.4	24/2/10	Block 5	333709	6251701	-0.99	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH65	8.2	24/2/10	Block 5	333709	6251701	-5.79	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH66	2.3	24/2/10	Block 5	333731	6251712	-0.02	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH66	7	24/2/10	Block 5	333731	6251712	-4.72	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH68	4	2/3/10	Block 5	333758	6251752	-1.44	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH69	1	26/2/10	Block 5	333706	6251737	1.4	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
AECOM	BH69	4	26/2/10	Block 5	333706	6251737	-1.6	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
AECOM	BH70	0.1	3/3/10	Block 5	333712	6251766	2.19	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
AECOM	BH70	11.5	8/3/10	Block 5	333712	6251766	-9.21	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
AECOM	BH70	16	8/3/10	Block 5	333712	6251766	-13.71	250	40.1	<2.5	67.2	<2.5	3.3	-	-	-	-	-	-
AECOM	BH70	4	8/3/10	Block 5	333712	6251766	-1.71	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
AECOM	BH70	5.5	8/3/10	Block 5	333712	6251766	-3.21	<0.8	<0.8	<0.8	<1.6	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	-
AECOM	BH71	0.08	3/3/10	Public Domain Blocks 4&5	333677	6251751	2.7	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH71	13	4/3/10	Public Domain Blocks 4&5	333677	6251751	-10.22	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH71	19	4/3/10	Public Domain Blocks 4&5	333677	6251751	-16.22	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH71	7	4/3/10	Public Domain Blocks 4&5	333677	6251751	-4.22	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH72	13	3/3/10	Public Domain Blocks 4&5	333634	6251746	-10.48	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH72	16	4/3/10	Public Domain Blocks 4&5	333634	6251746	-13.48	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH72	2.5	3/3/10	Public Domain Blocks 4&5	333634	6251746	0.02	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH72	20.5	4/3/10	Public Domain Blocks 4&5	333634	6251746	-17.98	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	Phenol	2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,6-dichlorophenol	2-chlorophenol	Pentachlorophenol
AECOM	BH73	16	2/3/10	Public Domain Blocks 4&5	333582	6251695	-13.37	2.7	1.8	<0.5	3.2	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH73	19	2/3/10	Public Domain Blocks 4&5	333582	6251695	-16.37	3.2	3.9	<0.5	8.1	<0.5	3.1	-	-	-	-	-	-
AECOM	BH73	7	2/3/10	Public Domain Blocks 4&5	333582	6251695	-4.37	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH74	16	3/3/10	Public Domain Blocks 4&5	333626	6251702	-13.67	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH74	5.5	3/3/10	Public Domain Blocks 4&5	333626	6251702	-3.17	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH74	8.5	3/3/10	Public Domain Blocks 4&5	333626	6251702	-6.17	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH75	16	26/2/10	Public Domain Blocks 4&5	333617	6251749	-13.66	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	BH75	8.5	25/2/10	Public Domain Blocks 4&5	333617	6251749	-6.16	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
AECOM	SV09	0.2	26/2/10	Block 5	333585	6251733	2.21	<0.5	<0.5	<0.5	1.4	<0.5	<0.5	-	-	-	-	-	-
ERM	BH116	1.5	28/6/06	Southern Cove	333607	6251595	0.97	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH118	1.5	30/6/06	Area B	333675	6251515	0.8	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
ERM	BH156	0.9	14/8/06	Proposed Southern Cove	333726	6251602	1.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	<2
ERM	BH160	0.3	14/8/06	Block 4	333748	6251595	2.1	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH190	5.1	26/3/08	Public Domain Blocks 4&5	333612	6251728	-2.865	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH190	15	10/4/08	Public Domain Blocks 4&5	333612	6251728	-12.765	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH191	3.7	27/3/08	Public Domain Blocks 4&5	333591	6251690	-1.4	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH191	5.6	11/4/08	Public Domain Blocks 4&5	333591	6251690	-3.3	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH191	16.5	14/4/08	Public Domain Blocks 4&5	333591	6251690	-14.2	1.1	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH191	18.2	14/4/08	Public Domain Blocks 4&5	333591	6251690	-15.9	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH192	3	19/3/08	Area B	333703	6251485	-0.481	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH192	7.4	19/3/08	Area B	333703	6251485	-4.881	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH192	16.5	20/3/08	Area C	333703	6251485	-13.981	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH193	2.5	20/3/08	Area B	333696	6251465	0.245	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH193	11.3	20/3/08	Area C	333696	6251465	-8.555	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH193	14.5	17/4/08	Area C	333696	6251465	-11.755	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH194	0.5	19/3/08	Area B	333685	6251446	2.417	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH194	1.5	20/3/08	Area B	333685	6251446	1.417	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH194	3.6	20/3/08	Area B	333685	6251446	-0.683	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH194	10.8	20/3/08	Area C	333685	6251446	-7.883	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH194	13.6	4/7/08	Area C	333685	6251446	-10.683	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH195	5.45	25/3/08	Area B	333707	6251426	-2.539	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH195	9.9	25/3/08	Area C	333707	6251426	-6.989	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH195	10.5	4/9/08	Area C	333707	6251426	-7.589	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH195	11.7	4/9/08	Area C	333707	6251426	-8.789	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH196	1	19/3/08	Area B	333720	6251359	1.761	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH196	6.4	19/3/08	Area B	333720	6251359	-3.639	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM	BH197	0.4	3/3/08	Block 5	333706	6251718	2.077	-	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH197	5	9/4/08	Block 5	333706	6251718	-2.523	-	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH197	6.5	9/4/08	Block 5	333706	6251718	-4.023	-	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH197	11.5	9/4/08	Block 5	333706	6251718	-9.023	-	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH197	15.9	10/4/08	Block 5	333706	6251718	-13.423	-	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH197	18.6	10/4/08	Block 5	333706	6251718	-16.123	-	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	Phenol	2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,6-dichlorophenol	2-chlorophenol	Pentachlorophenol
ERM	BH198	3	6/3/08	Block 5	333731	6251708	-0.725	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH198	4.5	6/3/08	Block 5	333731	6251708	-2.225	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH198	6.9	6/3/08	Block 5	333731	6251708	-4.625	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH199	2.7	11/3/08	Block 5	333719	6251681	-0.459	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH199	3.7	11/3/08	Block 5	333719	6251681	-1.459	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH199	5.6	11/3/08	Block 5	333719	6251681	-3.359	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH199	6	17/3/08	Block 5	333719	6251681	-3.759	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH200	1	7/4/08	Block 4	333721	6251658	1.298	<0.5	3.8	<0.5	8.5	<0.5	6.7	-	-	-	-	-	-
ERM	BH200	2.5	7/4/08	Block 4	333721	6251658	-0.202	<0.5	<0.5	<0.5	1.3	<0.5	<0.5	-	-	-	-	-	-
ERM	BH200	6.53	7/4/08	Block 4	333721	6251658	-4.232	1.1	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH201	2.4	4/3/08	Block 5	333699	6251682	-0.167	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH201	10.3	18/3/08	Block 5	333699	6251682	-8.067	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH201	11	18/3/08	Block 5	333699	6251682	-8.767	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH202	2.3	10/3/08	Block 4	333705	6251646	0.179	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH202	4.7	10/3/08	Block 4	333705	6251646	-2.221	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH202	6.8	10/3/08	Block 4	333705	6251646	-4.321	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH203	1.9	10/3/08	Block 4	333693	6251633	0.781	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH203	7.3	10/3/08	Block 4	333693	6251633	-4.619	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH204	1	18/3/08	Block 4	333744	6251622	0.952	1.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH204D	1.5	7/4/08	Block 4	333724	6251620	0.664	754	1160	<8	2290	<8	1720	-	-	-	-	-	-
ERM	BH204D	3	7/4/08	Block 4	333724	6251620	-0.836	<0.5	38.4	<0.5	63.4	<0.5	55.8	-	-	-	-	-	-
ERM	BH204D	4	7/4/08	Block 4	333724	6251620	-1.836	<0.5	80	<0.5	100	<0.5	84.2	-	-	-	-	-	-
ERM	BH205	7.8	27/3/08	Block 4	333704	6251613	-5.394	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH205	9.3	27/3/08	Block 4	333704	6251613	-6.894	9.5	2.1	<0.5	2.6	<0.5	<0.5	-	-	-	-	-	-
ERM	BH205	13	1/4/08	Block 4	333704	6251613	-10.594	5.2	<0.5	<0.5	5	<0.5	<0.5	-	-	-	-	-	-
ERM	BH205	13.8	1/4/08	Block 4	333704	6251613	-11.394	1.3	<0.5	<0.5	1.2	<0.5	<0.5	-	-	-	-	-	-
ERM	BH205	19.2	2/4/08	Block 4	333704	6251613	-16.794	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH205	22.2	2/4/08	Block 4	333704	6251613	-19.794	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH206	0.5	7/3/08	Block 4	333713	6251599	1.729	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH206	1.8	17/4/08	Block 4	333713	6251599	0.429	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH206	4.6	17/4/08	Block 4	333713	6251599	-2.371	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH206	7.1	17/4/08	Block 4	333713	6251599	-4.871	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH206	10.7	21/4/08	Block 4	333713	6251599	-8.471	0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH207	7.45	3/4/08	Proposed Southern Cove	333698	6251599	-5.163	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH207	12	3/4/08	Proposed Southern Cove	333698	6251599	-9.713	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH207	13.1	3/4/08	Proposed Southern Cove	333698	6251599	-10.813	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH207	15	3/4/08	Proposed Southern Cove	333698	6251599	-12.713	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH208	2.25	4/4/08	Block 4	333705	6251588	-0.032	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH208	9.5	4/4/08	Block 4	333705	6251588	-7.282	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH208	13.5	4/4/08	Block 4	333705	6251588	-11.282	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH209	2.3	22/4/08	Block 4	333727	6251589	-0.014	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH209	4.5	22/4/08	Block 4	333727	6251589	-2.214	1	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH209	6.1	22/4/08	Block 4	333727	6251589	-3.814	14	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH209	9.4	23/4/08	Block 4	333727	6251589	-7.114	1.6	3.5	<0.5	6	<0.5	10	-	-	-	-	-	-

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	2,4-dimethylphenol	2-methylphenol	2-nitrophenol	3-&4-methylphenol	4-chloro-3-methylphenol	Phenol	2,4,5-trichlorophenol	2,4,6-trichlorophenol	2,4-dichlorophenol	2,6-dichlorophenol	2-chlorophenol	Pentachlorophenol
ERM	BH210	1.5	18/3/08	Proposed Southern Cove	333685	6251582	0.558	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH210	15.9	27/3/08	Proposed Southern Cove	333685	6251582	-13.842	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH211	14	26/3/08	Block 4	333676	6251561	-11.749	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH211	15.5	26/3/08	Block 4	333676	6251561	-13.249	0.6	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH211	16.05	26/3/08	Block 4	333676	6251561	-13.799	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH212	4.8	25/3/08	Public Domain Blocks 4&5	333573	6251519	-2.448	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH212	12.2	28/3/08	Public Domain Blocks 4&5	333573	6251519	-9.848	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH212	26	31/3/08	Public Domain Blocks 4&5	333573	6251519	-23.648	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH213	3.6	14/4/08	Public Domain Blocks 4&5	333559	6251750	-1.263	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH213	10.5	14/4/08	Public Domain Blocks 4&5	333559	6251750	-8.163	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM	BH213	18.5	17/4/08	Public Domain Blocks 4&5	333559	6251750	-16.163	<0.5	<0.5	<0.5	<1	<0.5	<0.5	-	-	-	-	-	-
ERM 2007	BH147	1.6-2.05	ERM 2007	Barangaroo Central	333712.32	6251933.44	2.65	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
ERM 2007	BH147	8.9-9.2	ERM 2007	Barangaroo Central	333712.32	6251933.44	2.65	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-
ERM 2008	BH179	1.5-2.0	ERM 2008	Barangaroo Central	333708.26	6251901.896	2.458	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH179	7	ERM 2008	Barangaroo Central	333708.26	6251901.896	2.458	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH179	11	ERM 2008	Barangaroo Central	333708.26	6251901.896	2.458	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH180	4.7	ERM 2008	Barangaroo Central	333670.087	6251872.951	2.691	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH180	8.7	ERM 2008	Barangaroo Central	333670.087	6251872.951	2.691	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH180	14.3	ERM 2008	Barangaroo Central	333670.087	6251872.951	2.691	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH183	2.2	ERM 2008	Barangaroo Central	333554.971	6251884.783	2.451	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH183	8	ERM 2008	Barangaroo Central	333554.971	6251884.783	2.451	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH183	30.3	ERM 2008	Barangaroo Central	333554.971	6251884.783	2.451	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH183	31.6	ERM 2008	Barangaroo Central	333554.971	6251884.783	2.451	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH184	4.8	ERM 2008	Barangaroo Central	333604.524	6251922.673	2.411	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH184	9.6	ERM 2008	Barangaroo Central	333604.524	6251922.673	2.411	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH184	23.3	ERM 2008	Barangaroo Central	333604.524	6251922.673	2.411	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH186	3.6	ERM 2008	Barangaroo Central	333579.031	6251907.925	2.398	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH186	11	ERM 2008	Barangaroo Central	333579.031	6251907.925	2.398	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH186	13.5	ERM 2008	Barangaroo Central	333579.031	6251907.925	2.398	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH187	3.6	ERM 2008	Barangaroo Central	333588.75	6251879.223	2.243	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH187	10	ERM 2008	Barangaroo Central	333588.75	6251879.223	2.243	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH187	25	ERM 2008	Barangaroo Central	333588.75	6251879.223	2.243	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH188	2.9	ERM 2008	Barangaroo Central	333636.006	6251875.724	2.689	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH188	11.5	ERM 2008	Barangaroo Central	333636.006	6251875.724	2.689	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH188	15.1	ERM 2008	Barangaroo Central	333636.006	6251875.724	2.689	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH189	16	ERM 2008	Barangaroo Central	333661.693	6251831.66	2.831	-	-	<0.5	-	<0.5	-	-	<0.5	-	<0.5	-	<2
ERM 2008	BH213	3.6	ERM 2008	Barangaroo Central	333558.557	6251749.964	2.337	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH213	10.5	ERM 2008	Barangaroo Central	333558.557	6251749.964	2.337	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH213	18.5	ERM 2008	Barangaroo Central	333558.557	6251749.964	2.337	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH214	6.3	ERM 2008	Barangaroo Central	333547.714	6251850.172	2.103	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH214	15	ERM 2008	Barangaroo Central	333547.714	6251850.172	2.103	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2
ERM 2008	BH214	16	ERM 2008	Barangaroo Central	333547.714	6251850.172	2.103	<0.5	<0.5	<0.5	<1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	<2

Table 6: sVOCs
All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	N-Nitrosodiphenyl & Diphenylamine	Pronamide	N-nitrosodiethylamine	N-nitrosodi-n-butylamine	N-nitrosodi-n-propylamine	N-Nitrosomethylethylamine	1-naphthylamine	2-nitroaniline	3-nitroaniline
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	-	-	<0.6	<0.6	<0.6	<0.6	<0.6	<1	<1
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	1.4	<1.2	<1.2
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1

Table 6: sVOCs
All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	4-chloroaniline	4-nitroaniline	2-methyl-5-nitroaniline	Aniline	Hexachlorobutadiene	Hexachlorocyclopentadiene	Hexachloroethane	1,3,5-Trinitrobenzene	2,4-Dinitrotoluene
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<0.5
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<1
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	<0.6	<0.6	<0.6	<0.6	-	-	-	<0.6	<1
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<0.5
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	<1.2	<1.2	<1.2	<1.2	<1.2	<2.5	<1.2	<1.2	<1.2
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	<1.2	<1.2	<1.2	<1.2	<1.2	<2.5	<1.2	<1.2	<1.2
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	<1.2	<1.2	<1.2	<1.2	<1.2	<2.5	<1.2	<1.2	<1.2
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	<1.2	<1.2	<1.2	<1.2	<1.2	<2.5	<1.2	<1.2	<1.2
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	<1.2	<1.2	<1.2	<1.2	<1.2	<2.5	<1.2	<1.2	<1.2
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	<1.2	<1.2	<1.2	<1.2	<1.2	<2.5	<1.2	<1.2	<1.2
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<1
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	<1

Table 6: sVOCs
All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	2,6-dinitrotoluene	1,2,4,5-tetrachlorobenzene	1,2,4-trichlorobenzene	1,2-dichlorobenzene	1,3,5-Trichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene	Hexachlorobenzene	Pentachlorobenzene
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	<0.5	-	-	-	-	-	-	-	-
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	<0.5	-	-	-	-	-	-	-	<0.5
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	<0.5	-	-	-	-	-	-	-	<0.5
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	<1	<0.5	-	-	<0.5	-	-	-	-
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	<1	<0.5	-	-	<0.5	-	-	-	-
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	<1	<0.5	-	-	<0.5	-	-	-	-
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	<1	<0.5	-	-	<0.5	-	-	-	-
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	<1	<0.5	-	-	<0.5	-	-	-	-
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	<1	<0.5	-	-	<0.5	-	-	-	-
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	<1	<1.2	-	-	<0.6	-	-	-	-
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	<0.5	-	-	-	-	-	-	-	-
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	<1.2	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	<1.2	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	<1.2	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	<1.2	-	<1.2	<1.2	-	<1.2	<1.2	<1.2	<1.2
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	<1.2	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	<1.2	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	<1.2	<2.5	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	<1	<0.5	-	-	<0.5	-	-	-	<0.5
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	<1	<0.5	-	-	<0.5	-	-	-	<0.5

Table 6: sVOCs
All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Diallate	Ethyl methanesulfonate	Isosafrole (cis)	Isosafrole (trans)	Methyl methanesulfonate	Safrole	Chlorobenzilate	Bis(2-ethylhexyl) phthalate	Butyl benzyl phthalate
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	-	-	-	-	-	-	-	<0.5	<0.5
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	-	-	-	-	-	-	-	<0.5	<0.5
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	-	-	-	-	-	-	-	<0.5	<0.5
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	<0.5	-	-	-	-	-	-	<5	<0.5
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	<0.5	-	-	-	-	-	-	<5	<0.5
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	<0.5	-	-	-	-	-	-	<5	<0.5
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	<0.5	-	-	-	-	-	-	<5	<0.5
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	<0.5	-	-	-	-	-	-	<5	<0.5
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	-	-	-	-	-	-	-	<5	<0.6
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	-	-	-	-	-	-	-	<0.5	<0.5
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<5	<1.2
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<5	<1.2
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<5	<1.2
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	-	-	-	-	-	-	<1.2	<1.2	<1.2
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<5	<1.2
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<5	<1.2
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	1.6	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<5	<1.2
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5	<0.5
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	-	-	-	-	-	-	-	<5	<0.5
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	-	-	-	-	-	-	-	<5	<0.5

Table 6: sVOCs
All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Diethylphthalate	Dimethyl phthalate	Di-n-butyl phthalate	Di-n-octyl phthalate	Isophorone	2-(acetylamino) fluorene	2-Picoline	3,3-Dichlorobenzidine	4-(dimethylamino) azobenzene
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	<0.6	<0.6	<0.6	<0.6	-	-	<0.6	<0.6	<0.6
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	<0.5	<0.5	<0.5	<0.5	-	-	<0.5	<0.5	<0.5
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	1.6	<1.2
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	<0.5	<0.5
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	1.3
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5

Table 6: sVOCs
All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	4-aminobiphenyl	4-bromophenyl phenyl ether	4-chlorophenyl phenyl ether	4-Nitroquinoline-N-oxide	Acetophenone	Azobenzene	Bis(2-chloroethoxy) methane	Bis(2-chloroisopropyl) ether	Carbazole
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	0.8
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	1.9
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	<0.6	<0.6	<0.6	<0.6	<0.6	<1	<0.6	<0.6	6.8
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	5.3
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	<1.2	<1.2	<1.2	<1.2	<1.2	1	<1.2	<1.2	69.7
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	<1.2	<1.2	<1.2	<1.2	<1.2	<1	<1.2	<1.2	11.1
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	<0.5	<0.5	<0.5	<0.5		<1	<0.5	<0.5	<0.5
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	<1.2	<1.2	<1.2	<1.2	<1.2	<1	<1.2	<1.2	32.8
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	<1.2	<1.2	<1.2	<1.2	<1.2	<1	<1.2	<1.2	32.3
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	2
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	<1.2	<1.2	<1.2	<1.2	<1.2	<1	<1.2	<1.2	20
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	1.2	<1.2	<1.2	<1.2	<1.2	<1	<1.2	<1.2	67.6
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	<1.2	<1.2	<1.2	<1.2	<1.2	<1	<1.2	<1.2	186
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	0.5
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	<0.5	<0.5	<0.5	<0.5	-	<1	<0.5	<0.5	<0.5

Table 6: sVOCs
All measurements in mg/kg unless otherwise specified

Consultant	Sample Loc.	Sample Depth	Date	Location	X	Y	Z	Dibenzofuran	Hexachloropropene	Methapyrilene	N-nitrosomorpholine	N-nitrosopiperidine	N-nitrosopyrrolidine	Pentachloronitrobenzene	Phenacetin
AECOM	BH04	21	12/10/09	Area C	333662	6251527	-18.84	1.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH08	13	12/8/09	Area B	333717	6251528	-10.78	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH08	14	12/8/09	Area B	333717	6251528	-11.78	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH14	7	2/10/10	Area B	333648	6251482	-4.44	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH20	11	2/11/10	Area C	333733	6251328	-8.24	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH21	12	2/11/10	Area C	333718	6251310	-9.44	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH22	8	2/10/10	Area B	333639	6251295	-5.8	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH24	10	2/12/10	Area C	333655	6251338	-7.69	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH27	7	15/2/10	Area B	333630	6251405	-4.59	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH28	11.5	15/2/10	Area C	333683	6251424	-9.35	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH30	1	15/2/10	Area B	333639	6251452	1.42	0.8	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH31	7	16/2/10	Area B	333646	6251473	-4.55	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH31	14.5	17/2/10	Area C	333646	6251473	-12.05	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH32	11.5	2/12/10	Area C	333692	6251462	-8.68	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH36	15	3/3/10	Area C	333684	6251545	-12.75	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH36	4	3/3/10	Area B	333684	6251545	-1.75	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH37	22	18/2/10	Area C	333655	6251543	-19.77	16.8	<0.6	<0.6	<0.6	<0.6	<1	<0.6	<0.6
AECOM	BH37	20.4	18/2/10	Area C	333655	6251543	-18.17	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
AECOM	BH38	11.5	19/2/10	Southern Cove	333620	6251544	-9.13	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH39	20.5	24/2/10	Southern Cove	333609	6251568	-18.02	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH40	16.5	18/2/10	Proposed Southern Cove	333642	6251571	-14.38	8.9	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH40	17.8	18/2/10	Proposed Southern Cove	333642	6251571	-15.68	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH41	17.5	8/3/10	Southern Cove	333661	6251582	-15.278	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH42	3.2	23/2/10	Block 4	333738	6251549	-0.69	103	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH44	4.9	23/2/10	Block 4	333733	6251591	-2.55	21.7	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH46	19	23/2/10	Southern Cove	333627	6251582	-16.78	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH47	13	22/2/10	Public Domain Blocks 4&5	333614.3	6251616	-10.62	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH48	14.5	23/2/10	Block 4	333652	6251615	-12.04	49.4	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH49	12.5	22/2/10	Block 4	333699	6251517	-9.96	60.8	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH49	6.2	22/2/10	Block 4	333699	6251517	-3.66	2.1	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH54	2.8	23/2/10	Block 4	333737	6251636	-0.67	31	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH55	2.2	25/2/10	Block 4	333725	6251640	0.03	124	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH56	14.5	5/3/10	Public Domain Blocks 4&5	333616	6251645	-11.89	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH56	7	4/3/10	Public Domain Blocks 4&5	333616	6251645	-4.39	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH58	8.6	22/2/10	Block 4	333697	6251651	-6.15	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH59	3.4	22/2/10	Block 4	333730	6251655	-1.03	327	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
AECOM	BH60	20.5	2/3/10	Public Domain Blocks 4&5	333586	6251687	-17.81	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH62	11.8	26/2/10	Block 5	333682	6251687	-9.57	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH65	11.5	24/2/10	Block 5	333709	6251701	-9.09	1.9	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH69	10	26/2/10	Block 5	333706	6251737	-7.6	0.8	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH71	10	4/3/10	Public Domain Blocks 4&5	333677	6251751	-7.22	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH71	15	4/3/10	Public Domain Blocks 4&5	333677	6251751	-12.22	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH71	2.5	4/3/10	Public Domain Blocks 4&5	333677	6251751	0.28	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH72	1	3/3/10	Public Domain Blocks 4&5	333634	6251746	1.52	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH72	18	4/3/10	Public Domain Blocks 4&5	333634	6251746	-15.48	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH72	5	3/3/10	Public Domain Blocks 4&5	333634	6251746	-2.48	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH74	10	3/3/10	Public Domain Blocks 4&5	333626	6251702	-7.67	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5
AECOM	BH74	1	3/3/10	Public Domain Blocks 4&5	333626	6251702	1.33	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5

Appendix B

RISC Modelling Equations

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Appendix A

Vadose Zone Model

A.1 MODEL DESCRIPTION

The Vadose Zone model in RISC simulates contaminant transport through unsaturated soil. The transport equations are solved using the analytical solutions of the one-dimensional advective-dispersive solute transport equation (van Genuchten and Alves, 1982). The model considers the following fate and transport processes: (i) a well-mixed finite-mass source zone, (ii) pseudo steady-state volatilization and diffusive vapor transport from the source to ground surface, (iii) leaching from the source zone, (iv) advective dissolved-phase transport, (v) dissolved-phase dispersion, (vi) adsorption, and vii) first-order decay in the leachate.

This model is similar to the vadose zone model presented by Unlü et al. (1992) with the exception of several significant differences that are discussed. The most significant change is that the Vadose Zone transport model in RISC allows for the presence of a second soil layer located between the source zone and the ground surface; this layer may have soil properties different from the rest of the vadose zone which can dramatically affect vapor emissions to the surface.

The purpose of the Vadose Zone model is to predict (1) loading to groundwater and (2) volatilization losses. The groundwater loading term may be used as a source input to the saturated zone model (Appendix B). The volatilization losses may be used as a source for the box air model to calculate concentrations in outdoor air (Appendix F). Figure A-1 shows the processes simulated by the Vadose Zone model.

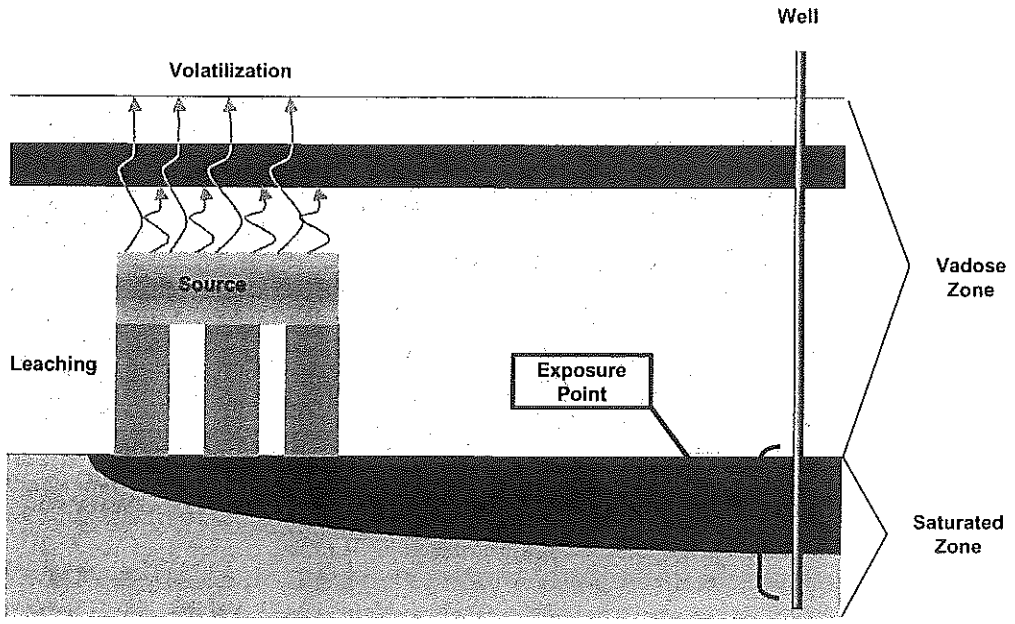


FIGURE A-1. Schematic of the Vadose Zone Model.

This appendix describes the equations used to predict volatile losses from a vadose zone source, leaching/mass loading rates from the source to groundwater and concentration distributions in the vadose zone. Appendix B describes the model used for the saturated zone (including groundwater transport).

A.2 APPLICATIONS OF THIS MODEL

This is a partial list of the main applications and limitations of the model:

- This model estimates the mass loading to groundwater from a vadose zone source. The model accounts for source depletion due to volatilization and leaching. The volatilization flux is only used to estimate losses from the source; it is not linked with an indoor or outdoor air model.
- This model does not simulate the movement of NAPL (free phase product). It is a dissolved phase-only model. Volatilization losses from the source are accounted for, however, the vapor phase concentrations with depth are not estimated. The volatile losses are assumed to be instantaneous and irreversible.

- Degradation is considered in the dissolved phase for the region between the source and the water table.
- The vadose zone model is automatically linked with the dissolved phase model in RISC so that concentrations in groundwater may be estimated.
- The model accounts for the presence of NAPL by limiting the dissolved phase concentration in the source region to the chemicals' effective solubility limit. This is important for two reasons:
    1. Otherwise the leachate and groundwater concentrations may be greatly over-estimated.
    2. Limiting the leachate concentrations to effective solubility limits may cause the source to deplete at a slower rate, thereby increasing the length of time for loading to groundwater. Depending on the problem being simulated, this approach may be more conservative than ignoring solubility limitations because it increases the exposure duration and hence the estimate of long-term cancer risk.

- The source is assumed to be located in the vadose zone. The region in the vadose zone below the source and the groundwater aquifer itself is assumed to be "clean" at the start of the simulation. This means that the vertical extent of the contamination in the vadose zone must be known. If the groundwater is already contaminated there are several ways to model the situation. Here are two ideas:
    1. Assume that the start of the simulation coincides with the date that the spill occurred ("back it up in time"). Run the model through the present day using the current site information to calibrate the model (e.g. make the model predict the current distribution of contaminants in the soil and groundwater).
    2. Skip the vadose zone portion and model the site with one of the groundwater models. If there is still a large amount of contamination in the vadose zone but the system appears to be at steady-state (i.e. the groundwater concentrations are not increasing with time) then use the dissolved phase model with a constant source.

- It is important to choose the source concentration and size of the source carefully. The best approach is to estimate (roughly) the amount of mass thought to be in the vadose zone. The average concentration multiplied by the source size should not exceed the estimated mass. This seems obvious, however, it is very easy to use an unreasonably large source mass especially if maximum concentrations and the maximum extent of detection are used simultaneously.

- The size of the source in the vadose zone is "mapped" onto the water table and becomes the footprint of the groundwater source size. If the receptor well is close to the source region, it may be more conservative to use a smaller source size and a larger source concentration than to average the concentrations across a large source region. More concentrated (but smaller) sources in the groundwater yield higher concentrations along the centerline of the plume when the receptor point is close to the source region.

A.3 FATE AND TRANSPORT PROCESSES

RISC's vadose zone transport model uses a "compartmental" approach; in other words, different models are used to describe the source zone, the vadose zone above the source, and the vadose zone between the source and groundwater.

The source zone is described as being a well-mixed finite source that depletes with time, while the vadose zone above the source is treated as being one-dimensional and at pseudo-steady state.

Beneath the source zone, solute transport of leachate occurs via advection and dispersion, and mass loss may occur through a first-order degradation reaction. The one-dimensional transport equation (including adsorption) in this zone is given by:

$$R\frac{\partial C_w}{\partial t} = D_x\frac{\partial^2 C_w}{\partial x^2} - \bar{v}\frac{\partial C_w}{\partial x} - \mu C_w \qquad \text{(A-1)}$$

where

C_w = dissolved phase concentration of chemical [mg/L]

D_x = dispersion coefficient in the unsaturated zone [cm^2/d]

$\bar{v}$ = seepage velocity (or interstitial velocity) [cm/d]

μ = first-order decay coefficient for chemical [1/d]

x = distance below the source (measured positively downward) [cm]

t = time [d]

R = retardation factor (defined in Equation A-31) [-]

The x-axis is assumed to be aligned with the direction of fluid flow; in the vadose zone that direction is vertically downward. The model considers dispersion in the downward direction only (longitudinal dispersion). The advection-dispersion equation is used to solve for aqueous-phase concentration with depth below the source. This concentration at the water table will be used with the infiltration rate to estimate mass loading to groundwater.

A note on nomenclature: In this appendix the variable, C (C_w, C_v, *or* C_T), will always refer to the concentration of the individual chemical being modeled (not the TPH mixture). If the concentration of TPH is being referenced, the variable C_{TPH} will be used. The same applies to all chemical properties. For example, D_{eff} refers to the chemical-specific diffusion coefficient, MW refers to the chemical-specific molecular weight, and MW_{TPH} refers to the molecular weight of the TPH mixture.

A.3.1 Initial and Boundary Conditions

Below the source it is assumed that concentrations are zero at time = 0:

$$C_w(x, 0) = 0 \qquad \textbf{(A-2)}$$

The leachate concentration leaving the source zone is assumed to decay exponentially with time

$$C_w(0, t) = C_{w_0} e^{-\beta t} \qquad \textbf{(A-3)}$$

where

C_{wo} = dissolved phase concentration of chemical in the source at the beginning of the simulation [mg/L]

β, = source depletion term [-]

The source depletion term, β, is described in equations A-19 and A-23. At a "long distance" below the source the concentration gradient is always zero.

$$\frac{\partial C_w}{\partial x}(\infty, t) = 0 \tag{A-4}$$

The solution for the advection-dispersion equation (A-1) with the above boundary conditions is given by van Genuchten and Alves (1982)

$$C_w(x,t) = C_0 e^{-\beta t} B(x,t) \tag{A-5}$$

where

$$B(x,t) = \frac{1}{2}\exp\left[\frac{(\bar{v} - w)x}{2D_x}\right] erfc\left[\frac{Rx - wt}{2\sqrt{D_x Rt}}\right] + \frac{1}{2}\exp\left[\frac{(\bar{v} + w)x}{2D_x}\right] erfc\left[\frac{Rx + wt}{2\sqrt{D_x Rt}}\right] \tag{A-6}$$

and

$$w = \bar{v}\sqrt{1 + \frac{4D_x}{\bar{v}^2}[\mu - R\beta]} \tag{A-7}$$

where

$C_w(x,t)$ = dissolved phase concentration of chemical at distance x (in cm) below the source and time (in days) [mg/L]

β = source zone depletion coefficient (loss term) defined in equations A-19 and A-23 [-]

In order to solve the above set of equations, the first-order source decay rate must be determined.

A.4 SOURCE TERM

Depletion of the source is assumed to occur due to volatilization and leaching losses. Note that the source is not assumed to undergo microbial decay, or biodegradation, on the assumption that high soil concentrations are toxic to the microorganisms. In terms of a molar balance this can be written as

$$\frac{dm}{dt} = -\frac{J_w}{MW} - \frac{J_v}{MW} \qquad \text{(A-8)}$$

where

m = number of moles of chemical per unit area in the hydrocarbon source [moles/cm^2]

MW = molecular weight of chemical [g/mol]

J_w = rate of mass depletion per area due to percolating water [g/cm^2/d]

J_v = rate of mass depletion per area due to volatilization [g/cm^2/d]

t = time [d]

A.4.1 Aqueous Losses

The leaching loss is assumed to be purely advective (due to water percolating through the source)

$$J_w = qC_{ws}\left(\frac{L}{1000cm^3}\right)\cdot\left(\frac{g}{1000mg}\right) \qquad \text{(A-9)}$$

where

J_w = rate of mass depletion per area due to percolating water [g/cm^2/d]

q = net recharge or infiltration rate [cm/d]

C_{ws} = dissolved phase concentration in the source [mg/L]

In the RISC model, the dissolved phase concentration, C_{ws}, is checked for solubility limitations and therefore is calculated differently depending on whether or not residual phase hydrocarbon (NAPL) is present (see Sections A.4.5 through A.4.7). (Unlü et al., 1992, assumes that the source always contains immiscible phase hydrocarbons.)

A.4.2 Volatilization Losses (Incorporating Lens)

The diffusive vapor loss is estimated using Fick's Law, assuming a linear concentration drop from the source area to the soil surface. Source zone volatilization losses are calculated using a pseudo-steady state vapor flux model based on Fick's Law. In this approach, the steady-state solution for vapor transport is coupled with a source zone concentration that is changing with time. It is assumed that vapor transport reaches steady conditions much faster than the rate at which the source zone concentration changes with time. It is also assumed that vapor concentrations at ground surface are much less than those at the source zone. The mass depletion rate of the source due to volatilization (the volatile losses) is calculated from:

$$J_v = D_{eff} \frac{C_{vs}}{L_d} \left(\frac{86400s}{d} \right) \qquad \textbf{(A-10)}$$

where

J_v = rate of mass depletion per area due to volatilization [g/cm^2/d]

D_{eff} = effective diffusion coefficient in soil [cm^2/s]

C_{vs} = vapor-phase concentration of chemical in the source area [g chemical/cm^3 vapor]

L_d = diffusion path length [cm]

Equation A-10 is Fick's Law applied to the concentration gradient from the source to the ground surface. The concentration of chemical in vapor at the soil surface is assumed to be equal to zero (or very small compared to the source vapor phase concentration). The diffusion path length is assumed to be equal to the distance from the soil surface to the center of the source.

The vapor concentration in the source zone is calculated from Henry's Law:

$$C_{vs} = K_H C_{ws} \left(\frac{L}{1000cm^3} \right) \left(\frac{g}{1000mg} \right) \qquad \textbf{(A-11)}$$

where

K_H = Henry's Law Constant for chemical [(mg/l vapor)/(mg/l water)]

A.4.3 Effective Diffusion Coefficients

The effective diffusion coefficient in vadose zone soil and the lens soil is estimated using the Millington-Quirk relationships:

$$D_{eff\,v} = D_{air} \left(\frac{\theta_{a_v}^{10/3}}{\theta_{T_v}^{2}} \right) + D_{water} \frac{1}{K_H} \left(\frac{\theta_{W_v}^{10/3}}{\theta_{T_v}^{2}} \right) \qquad \textbf{(A-12a)}$$

$$D_{eff\,lens} = D_{air} \left(\frac{\theta_{a\,lens}^{10/3}}{\theta_{T\,lens}^{2}} \right) + D_{water} \frac{1}{K_H} \left(\frac{\theta_{W\,lens}^{10/3}}{\theta_{T\,lens}^{2}} \right) \qquad \textbf{(A-12b)}$$

where

$D_{eff\,v}$ = effective diffusion coefficient for the vadose zone above the source (not including the lens) [cm^2/s]

$D_{eff\,lens}$ = effective diffusion coefficient for the lens [cm^2/s]

D_{air} = molecular diffusion coefficient for chemical in air [cm^2/s]

D_{water} = molecular diffusion coefficient for chemical in water [cm^2/s]

θ_{a_v} = air-filled porosity in the vadose zone [cm^3 air/cm^3 soil]

θ_{w_v} = water-filled porosity in the vadose zone [cm^3 water/cm^3 soil]

θ_{T_v} = total porosity in the vadose zone [cm^3 pores/cm^3 soil]

$\theta_{a\,lens}$ = air-filled porosity in the lens [cm^3 air/cm^3 soil]

$\theta_{w lens}$ = water-filled porosity in the lens [cm^3 water/cm^3 soil]

$\theta_{T lens}$ = total porosity in the lens [cm^3 pores/cm^3 soil]

K_H = Henry's Law Constant for chemical [(mg/l vapor)/(mg/l water)]

Note, the above porosity terms used by the diffusion equations should be total porosity rather than effective porosity. The total effective diffusion coefficient for the vadose zone and lens combined is estimated as the depth-weighted average (Johnson and Ettinger, 1995):

$$D_{eff} = \frac{(h_v + h_{lens})}{\frac{h_{lens}}{D_{eff\ lens}} + \frac{h_v}{D_{eff\ v}}} \quad \textbf{(A-13)}$$

where

D_{eff} = depth-weighted average effective diffusion coefficient for the vadose zone in between the source and the soil surface [cm^2/s]

h_v = thickness of the vadose zone above the source (minus the lens thickness) [cm]

h_{lens} = thickness of the lens [cm]

As a consequence of the modeling assumptions, one can actually account for more than one lens above the source zone, as long as each lens has the same material properties (total porosity, moisture content, etc.). If this is the case, then the user simply sets h_{lens} equal to the combined thickness of all the lenses and h_v is the remaining thickness of the vadose zone.

A.4.4 Overall Source Depletion Rate

Combining equations A-8 through A-11 yields:

$$\frac{dm}{dt} = -\beta m = -\left[\bar{v}\theta_w + \frac{K_H D_{eff}}{L_d}\right] C_w \quad \textbf{(A-14)}$$

where β is a loss term accounting for both dissolution and volatile losses. The loss term is calculated differently depending on whether or not residual phase is present.

A.4.5 Calculating Whether or Not Residual Phase Hydrocarbon is Present

To determine if residual phase hydrocarbon is present, the following condition for multiple chemicals must be met:

$$1 > \sum_{i=1}^{N} \frac{C_{T_i}\rho_b}{S_i\left(\rho_b K_{oc_i} F_{oc} + \theta_w + \theta_a K_{H_i}\right)} \qquad \textbf{(A-15)}$$

where

N	=	total number of chemicals in mixture
$C_{T\,i}$	=	total concentration of chemical i in soil [mg/kg]
S_i	=	liquid phase solubility for chemical i [mg/l or kg/m^3]
ρ_b	=	soil bulk density of the source area [g/cm^3]
F_{oc}	=	fraction organic carbon in soil [g oc/g soil]
$K_{oc\,i}$	=	organic carbon partition coefficient for chemical i [ml/g]
$K_{H\,i}$	=	Henry's Law Constant for chemical i [(mg/l vapor)/(mg/l water)]

This partitioning equation assumes that the total soil concentration for each chemical, $C_{T\,i}$, can be accounted for by summing the mass in the solid, liquid, and vapor phases (i.e. no residual is present). However, equation A-15 requires that all of the chemicals in the mixture are accounted for in the sum. In risk assessments, more often the number of chemicals of concern (and characterized with respect to their concentration) is a small subset of the total number of chemicals present in the mixture. The vadose zone model checks the following equation for each chemical used in the model

$$C_w = \frac{C_T\rho_b}{\rho_b K_{oc} F_{oc} + \theta_w + \theta_a K_H} \qquad \textbf{(A-16)}$$

Again, it is assumed that C_T can be accounted for by summing the mass in the solid, liquid, and vapor phases (i.e. no residual is present). If the liquid phase concentration, C_W, calculated with equation A-15a exceeds the effective solubility of the compound, then it is assumed that residual phase is present (and equation A-15a does not apply).

A.4.6 Source -- When Residual Phase Hydrocarbon is Present

If there is residual phase hydrocarbon present in the source, the aqueous concentration, C_w, will be calculated from

$$C_w = xS \tag{A-17}$$

where

S = aqueous solubility of pure component [mg/l or kg/m^3]

x = mole fraction of component in the hydrocarbon mixture [mol/mol]

The mole fraction is calculated from

$$x = \frac{m}{m_{TPH}} \tag{A-18}$$

$$x = \frac{F_i MW_{TPH}}{MW_i F_{TPH}} \tag{A-19}$$

where

m = total moles of component [mol] $(\frac{\rho_b L_w F_i}{MW_i} A)$

m_{TPH} = total moles of hydrocarbon mixture [mol] $(\frac{\rho_b L_w F_{TPH}}{MW_{TPH}} A)$

L_w = thickness of the source area [cm]

A = area (plan view) of the source [cm^2]

MW_{TPH} = average molecular weight of hydrocarbon [g/mol]

MWi = average molecular weight of component i [g/mol]

F_{TPH} = mass fraction (concentration) of hydrocarbon mixture in the soil source [TPH concentration) [g/g]

F_i = mass fraction (concentration) of component *i* in the soil source [component concentration) [g/g]

As long as there is immiscible phase present, the aqueous phase concentration is given by Equation A-16. Once immiscible phase has been depleted, then the remaining amount of each compound is depleted from the source according with the decay rate given in Equation A-22. In the RISC model, however, it is assumed that if immiscible phase is present initially, then it is present for all time, Thus the approximation developed below is for the case of a more soluble compound leaching from a less soluble mixture, (e.g., benzene from a petroleum fuel mixture).

The source zone depletion coefficient (loss term), β, for the residual case is given by

$$\beta = \frac{qMW_{TPH}S}{\rho_b L_w F_{TPH} MW} + \frac{D_{eff} K_H MW_{TPH} S}{\rho_b L_d L_w F_{TPH} MW} = \beta_w + \beta_v \qquad \textbf{(A-20)}$$

The source zone depletion coefficient is the sum of the leachate losses (β_w) and the vapor losses (β_v). If it is assumed that F_{TPH} is constant (this assumption is only approximate since the source does deplete slowly over time) equation A-8 may be solved analytically to obtain

$$m = m_0 \exp(-\beta t) \qquad \textbf{(A-21)}$$

where

m_0 = initial moles of chemical per area [mol/cm^2]

The aqueous concentration decreases similarly

$$C_w = C_{w0} \exp(-\beta t) \qquad \textbf{(A-22)}$$

where

C_{w0} = initial aqueous concentration of species defined in equation A-16 [mg/l]

Unlü et al. (1992) assumes there is always residual phase hydrocarbon present and uses equation A-19 to estimate losses from the source. This approach is realistic for the types of waste zones that Unlü et al. equations were developed for -- waste sludge pits with high levels of hydrocarbons. However, RISC also allows the user to estimate the behavior of sources for which immiscible phase is not initially present (e.g., equation A-15a is satisfied).

A.4.7 Source -- When Residual Phase Hydrocarbon is Not Present

When an immiscible phase is not present it is assumed that the concentrations of the chemical in each phase are in equilibrium. The equilibrium partitioning equation is:

$$C_{ws} = \frac{C_T \rho_b}{(\rho_b K_{oc} F_{oc} + \theta_w + \theta_a K_H)} \quad \text{(A-23)}$$

which when inserted into Equation A-14 yields:

$$\beta = \frac{q}{(\rho_b K_{oc} F_{oc} + \theta_w + \theta_a K_H) L_w} + \frac{D_{eff} K_H}{(\rho_b K_{oc} F_{oc} + \theta_w + \theta_a K_H) L_d L_w} = \beta_w + \beta_v \quad \text{(A-24)}$$

where all the variables are as defined previously.

A.5 LEACHING AND PERCOLATION RATE

Following Unlü et al. (1992), the RISC Vadose Zone model uses a unit hydraulic gradient approximation, estimating the unsaturated hydraulic conductivity with the Brooks and Corey (1964) model. The unit gradient approach assumes that the pressure (suction) head in the soil profile is constant, as is the moisture content. This is a major simplification of the real processes that control flow in the unsaturated zone. However, the goal in modeling the concentration is to estimate average conditions over long time periods (for purposes of risk assessment: 7 to 30 years). For

this objective, the unit gradient approach has been shown to work reasonably well (Unlü et al., 1992).

A.5.1 Unit Gradient Approach

For more information on this subject the reader is referred to the two papers mentioned above as well as Carsel and Parrish (1988). Briefly, Darcy's equation for the unit gradient case may be written as:

$$q = k_r K_{su} \qquad \text{(A-25)}$$

where

q = infiltration rate or net recharge rate [cm/d]

k_r = relative permeability [unitless]

K_{su} = hydraulic conductivity of the unsaturated zone if it were fully saturated [cm/d]

When using RISC, the user is asked to input the infiltration rate, q, and the unsaturated zone's hydraulic conductivity (K_{su}). This term, K_{su}, is the hydraulic conductivity of the unsaturated zone if it were assumed to be fully saturated, i.e. no air-filled porosity. In many applications of RISC, K_{su} is assumed equal to the hydraulic conductivity of the soil below the water table. If the value entered for the infiltration rate exceeds K_{su}, then q is set to K_{su} assuming that the excess flow will be diverted as runoff.

Having values for q and K_{su}, Equation A-25 is used to solve for the relative permeability, k_r:

$$k_r = \frac{K_{su}}{q} \qquad \text{(A-26)}$$

where the terms are as defined for Equation A-24.

A.5.2 Estimating the Unsaturated Zone Hydraulic Conductivity

In the unsaturated zone, the hydraulic conductivity varies as a function of the moisture content. It is assumed that this relationship can be described by the Brooks and Corey (1964) model

$$k_r = \left[\frac{\theta_w - \theta_r}{\theta_T - \theta_r}\right]^{\gamma} \qquad \text{(A-27)}$$

where

θ_T = total porosity in unsaturated zone [-]

θ_w = volumetric water content or water-filled porosity [cm^3 water/cm^3 soil]

θ_r = irreducible water content [cm^3 water/cm^3 soil]

γ = pore size distribution parameter [-]

The pore size distribution parameter is estimated from the van Genuchten *"n"* parameter using the following relationship (Lenhard et al., 1989)

$$\gamma = 3 + \frac{2}{(n-1)(1-0.5^{\frac{n}{(n-1)}})} \qquad \text{(A-28)}$$

The model requires the user to enter n. Carsel and Parrish (1988) have a large database of van Genuchten's *"n"* for various soil types. This database is also available in the RISC software.

A.5.3 Estimating Moisture Content and Seepage Velocity

The water-filled porosity, θ_w, is calculated using Equation A-26 since values of all the other terms are either specified or previously derived. The calculated water-filled porosity is then used to estimate the seepage velocity, $\bar{v}$:

$$\bar{v} = \frac{q}{\theta_w} \qquad \text{(A-29)}$$

where

$\bar{v}$ = seepage velocity (actual water flowrate through vadose zone) [cm/d]

q = infiltration rate (recharge rate to groundwater) [cm/d]

θ_w = volumetric water content or water-filled porosity [cm^3 water/cm^3 soil]

The seepage velocity, $\bar{v}$, is the average rate of flow that the model uses for the water percolating through the vadose zone.

The water content for the lens may differ from the vadose zone and is also calculated from the same equations as presented above using the lens properties. The values of the estimated moisture contents are presented in the RISC model output. The moisture content is not calculated by the volatilization models (Appendices D, E, J and K) since it is assumed that for soils under a house or building, the infiltration rate is close to zero. In these models the user is requested to specify the average moisture content in the vadose zone. If the vadose zone is subject to infiltration, the above algorithm may be run using the vadose zone model to estimate likely ranges of moisture content. The moisture content can then be entered in the air models.

A.6 UNSATURATED ZONE TRANSPORT

Equations A-5 through A-7 are used to calculate the dissolved phase concentrations in the unsaturated zone from the bottom of the source zone to the groundwater aquifer.

A.6.1 Mass Loading To Groundwater

The mass flux of contaminant at the water table is calculated using Equation A-5 solved at the water table multiplied by the infiltration rate:

$$Q(L_u, t) = q\ C(L_u, t) \cdot \left(\frac{L}{1000cm^2} \right) \qquad \text{(A-30)}$$

where

$Q(L_u,t)$ = mass flux at the water table as a function of time [g/cm^2/d]

$C(L_u,t)$ = dissolved phase concentration of contaminant at the water table as a function of time [mg/L]

L_u = the distance from the source to the water table [cm]

q = net infiltration rate [cm/d]

The mass flux, Q, is used as the time-varying source for the saturated zone model described in Appendix B.

A.6.2 Retardation

The retardation factor for the unsaturated zone, R, is estimated using

$$R = 1 + \frac{\rho_b F_{oc} K_{oc}}{\theta_w} \qquad \text{(A-31)}$$

where

F_{oc} = fraction organic carbon in dry soil [g/g]

K_{oc} = organic carbon normalized partition coefficient [ml/g]

This retardation equation is assumed to be valid when $F_{oc} > 0.001$. [Below values of 0.001 the retardation is estimated to be equal to 1 -- essentially non-retarded.)

A.6.3 Degradation

Degradation is assumed to be a first-order reaction occurring only in the aqueous phase as the leachate is carried from the source to the water table.

A.6.4 Dispersion

The dispersion coefficient is assumed to be a linear function of the seepage velocity, $\bar{v}$, (defined in Equation A-27)

$$D = \alpha_L \left(\bar{v} \cdot \frac{m}{100cm} \right) \qquad \textbf{(A-32)}$$

where

α_L = longitudinal dispersivity [m]

The longitudinal dispersivity is calculated using data from Gelhar et al. (1985) as a function of the vertical distance from the source:

$$\ln \alpha_L = -4.933 + 3.811 \ln x_m \quad x_m \leq 2m \qquad \textbf{(A-33a)}$$

$$\ln \alpha_L = -2.727 + 0.584 \ln x_m \quad x_m \geq 2m \qquad \textbf{(A-33b)}$$

where

x_m = distance from the source to the observation location [m]

A.7 DATA REQUIREMENTS

The data required to run the Vadose Zone model are shown in Table A-1.

Table A-1. Data Requirements for the Vadose Zone Model

		Typical Range of Values	
	Units	**Minimum**	**Maximum**
MEDIA-SPECIFIC PARAMETERS			
Porosity	cm^3/cm^3	0.01	0.5
Irreducible Water Content	cm^3/cm^3	0	porosity
Fraction Organic Carbon	g oc/g soil	0.001	0.05
Hydraulic Conductivity	m/day	1.00E-07	100
Soil Bulk Density	fraction	1.4	2.2
van Genuchten Parameter	dimensionless	~1	~3
Unsaturated Zone Thickness	m	site-specific	site-specific
SOURCE PARAMETERS			
Length of Source (x-direction)	m	site-specific	site-specific
Width of Source (y-direction)	m	site-specific	site-specific
Thickness of Source (z-direction)	m	site-specific	site-specific
TPH DATA			
Molecular Weight of TPH	g/mol	80	120
Concentration of TPH	mg/kg	site-specific	site-specific
CHEMICAL SPECIFIC DATA (individual chemical component)			
Molecular Weight	g/mol	chem-specific	chem-specific
Source Concentration	mg/kg	site-specific	site-specific
Solubility	mg/l	chem-specific	chem-specific
Diffusion Coefficient in Air	cm^2/s	chem-specific	chem-specific
Diffusion Coefficient in Water	cm^2/s	chem-specific	chem-specific
K_{oc}	ml/g	chem-specific	chem-specific
Degradation Rate	1/d	site-specific	site-specific
Henry's Law Constant	(mg/l)/(mg/l)	chem-specific	chem-specific

A.8 ASSUMPTIONS AND LIMITATIONS OF THE VADOSE ZONE MODEL

1. The Vadose Zone model simulates the transport of dissolved phase contaminants downward, and vapor phase contaminants upward. It does not simulate the movement of non-aqueous phase liquids (NAPLs).

2. The Vadose Zone model is a one-dimensional model (from the source to the water table) and accounts for volatile and leachability losses from the source.

3. The vadose zone is considered to be homogeneous and uniform below the source (a lens may be modeled above the source). The hydraulic conductivity is calculated as a function of moisture content, however, this derived moisture content is assumed to be constant for the entire depth of the soil column.

4. The contaminant source has a uniform concentration across the user-specified source volume.

5. Water table fluctuations are not considered. The depth to the aquifer is considered fixed.

A.9 REFERENCES

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Appendix D

Vapor Transport From Soil Into Buildings Without Biodegradation

D.1 MODEL DESCRIPTION

The vapor transport model for soil estimates emissions into a building from a soil source located either below or laterally adjacent to the building. This model is based on the paper entitled "Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings" by Johnson and Ettinger (1991). This vapor transport model combines a model for both diffusive and advective transport through the soil with a simple model of transport through a building foundation.

Figure D-1 illustrates the problem geometry. Advection is caused by a slightly reduced pressure (versus atmospheric pressure) inside a building due to temperature differences, wind, barometric pressure fluctuations or a slight vacuum created by a basement heating system during operation. The pressure gradient is entered as an input parameter.

This is the basically the same model as the one used in the Tier 1 spreadsheet to calculate risk-based screening levels in soil that are protective of indoor inhalation. The enhancements made by the RISC software are twofold: (1) multiple soil horizons may be considered by using the lens and (2) the model calculates the effective solubility and limits the soil gas concentration at the source if residual levels are exceeded. This second option is an important consideration for chemicals that are part of mixtures such as petroleum hydrocarbons in fuel. The example equations presented in the ASTM RBCA guidance are identical to the Johnson and Ettinger model if the building under-pressurization is equal to zero (no advection).

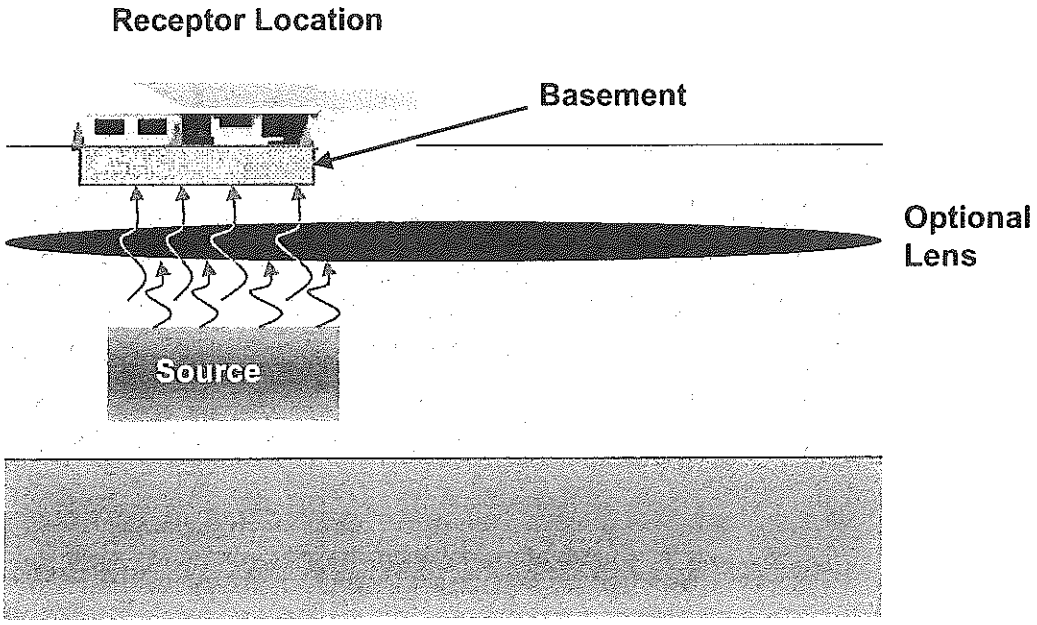


Figure D-1. Schematic of the Vapor Transport Model (from Soil into Buildings).

D.2 APPLICATIONS OF THIS MODEL

This is a partial list of the main applications of the model:

- This is a steady-state model. The source concentration is constant and the size does not deplete with time (i.e. an infinite source). This assumption is valid if the source is large compared to the mass flux rate into the building.
- This model is not linked with any other fate and transport model in RISC. The soil leaching to groundwater model is assumed to have a separate (depleting) source.
- Biodegradation of the chemical vapors is not considered. This is appropriate for chemicals that do not degrade readily, for very short diffusion distances, and/or for screening level calculations. BTEX constituents can have very high degradation rates (higher than in groundwater) under certain conditions. In this case it may be appropriate to use one of the other two vapor transport models in RISC that incorporate degradation.
- The source is located in the vadose zone. For sources located in the saturated zone the volatilization from groundwater model would be more appropriate.
- The likelihood of the building under-pressurization affecting the vapor transport should be evaluated. Often, the reason that advective transport

becomes important is the case where part of the building is sub-grade (e.g. basement) and the path of least resistance from the source is in the direction of the basement. This situation can occur for a laterally offset source if the preferential vapor flow pathways are horizontal (e.g. there are lower permeability units between the source and the ground surface). If the building is not large and does not have a sub-grade basement it is unlikely that the building under-pressurization is affecting the advection processes from an offset soil vapor source. The path of least resistance may be directly out through the ground surface.

- A building on a slab foundation can have advective effects if under-pressurization is present, the source is directly below and close to the foundation, and no partial low permeability lens is available to direct the vapors laterally away from the foundation. But a pier and beam house (where a crawl space is located under the house) would not be subject to advection (and may in fact have only limited diffusion as well if it is vented).

Appendix K.1.2 discusses vertical soil gas profile types and the applicability of the models in RISC to model different soil gas profiles.

D.3 TRANSPORT EQUATIONS AND PROCESSES

The Johnson-Ettinger model assumes that away from the structure, (i.e. out of the influence of pressure-driven flow), the contaminant transport is diffusive only and can be described using Fick's Law:

$$E = \frac{A_B \left(C_{vs} - C_{vf}\right) D_{eff}}{L_T} \qquad \text{(D-1)}$$

where

E = mass transport rate toward the structure [g/s]

D_{eff} = "overall" effective diffusion coefficient [cm^2/s]

C_{vs} = vapor concentration at the source [g/cm^3]

C_{vf} = vapor concentration in the soil just outside the building foundation [g/cm^3]

L_T = distance from source to basement [cm]

A_B = cross-sectional area of foundation available for vapor flux [cm^2]

Note, the effective diffusion coefficient is calculated using the Millington-Quirk relationship (Millington and Quirk, 1961, and described in Appendix A) which accounts for the amount of air vs. water-filled porosity in the soil. Furthermore, a lens can be incorporated in the vapor model so the "overall" effective diffusion coefficient can consider a different soil unit between the source and the house. A clay lens with a high water content can dramatically reduce the overall diffusion coefficient and can result in much lower vapor concentrations inside the house.

Adjacent to the foundation, the transport of contaminants is assumed to occur by a combination of advective and diffusive transport mechanisms through cracks in the foundation slab. The steady-state, one-dimensional solution to the advection-dispersion equation for vapor transport through a crack (just another type of porous media) is given by:

$$E = Q_{soil} C_{vf} - \frac{Q_{soil}\left(C_{vf} - C_{indoor}\right)}{\left[1 - \exp\left(\frac{Q_{soil} L_{crack}}{D_{crack} A_{crack}}\right)\right]} \qquad \text{(D-2)}$$

where

E = entry rate of contaminant into the building [g/s]

Q_{soil} = volumetric flow rate of soil gas into the building [cm^3/s]

C_{indoor} = indoor air concentration in the building [g/cm^3]

C_{vf} = vapor concentration in the soil just outside the building foundation [g/cm^3]

D_{crack} = effective diffusion coefficient in foundation cracks [cm^2/s]

L_{crack} = thickness of the foundation [cm]

A_{crack} = area of cracks or openings through which vapors enter building [cm^2]

The above two equations are assumed to be equal at steady state allowing the contaminant concentration in the soil just outside the foundation to be calculated. Setting Equations D-1 and D-2 equal to each other and rearranging to solve for C_{vf}:

$$C_{vf} = \frac{\left[C_{vs}\left[\frac{D_{eff}A_B}{Q_{soil}L_T}\right]\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)-1\right]+C_{indoor}\right]}{\left[\left[\frac{D_{eff}A_B}{Q_{soil}L_T}\right]\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)-1\right]+\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)\right]} \qquad \textbf{(D-3)}$$

Substituting D-3 into equation D-2 yields:

$$E = \frac{\left[\left[\frac{D_t^{eff}A_BC_{vs}}{L_T}\right]\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)-\left[\frac{C_{indoor}}{C_{vs}}\right]\right]\right]}{\left[\left[\frac{D_T^{eff}A_B}{Q_{soil}L_T}\right]\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)-1\right]+\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)\right]} \qquad \textbf{(D-4)}$$

In equation D-3, the only unknown variable (not entered by the user) is the concentration in the building, C_{indoor}. This concentration can be estimated from a mass balance equation assuming no other contaminant sources or sinks in the building (sorption to walls or furniture). Assuming a well-mixed building this mass balance equation can be written as:

$$Q_B C_{indoor} = E \qquad \textbf{(D-5)}$$

where

Q_B = building ventilation rate (calculated from the number of air exchanges per day and the volume of the building) [m^3/s]

where all the variables have been defined previously. Note, the emission rate, E, is calculated from equation D-4; the building ventilation rate, Q_B, is calculated from user input variables. Substituting Equation D-5 into Equation D-4 yields

$$C_{indoor} = \frac{C^*_{indoor}\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)\right]}{\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)+\left[\frac{D_{eff}A_B}{Q_B L_T}\right]+\left[\frac{D_{eff}A_B}{Q_{soil}L_T}\right]\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)-1\right]\right]} \qquad \textbf{(D-6)}$$

where

$$C^*_{indoor} = \frac{D_{eff}A_B C_{vs}}{Q_B L_T} \qquad \textbf{(D-7)}$$

C^*_{indoor} represents the indoor vapor concentration corresponding to the case where vapors diffuse from the source through a bare soil foundation.

The volumetric soil gas flow rate into the basement, Q_{soil}, may be specified by the user or it is calculated from the area of cracks, A_{crack}, soil type and stratigraphy, pressure difference between atmospheric and building pressure, and basement geometry. If Q_{soil} is specified in RISC to be equal to zero, the vapor transport model will calculate it from (Johnson and Ettinger, 1991):

$$Q_{soil} = \frac{2\pi(\Delta P)k_v X_{crack}}{\mu \ln[2Z_{crack}/r_{crack}]} \qquad \frac{r_{crack}}{Z_{crack}} << 1 \qquad \textbf{(D-8)}$$

This equation is based on flow through a cylinder of length X_{crack} and radius r_{crack} located a depth Z_{crack} below ground surface. The rest of the variables used in D-8 are:

ΔP = pressure gradient between building and outside [g/cm-s^2]
Z_{crack} = depth below ground surface to foundation cracks [cm]
k_v = permeability of the soil to vapor flow [cm^2]
μ = viscosity of vapor [g/cm-s]

The crack length, X_{crack} , is an input parameter and can be conservatively assumed to be the total floor/wall seam perimeter distance. r_{crack} is defined as:

$$r_{crack} = \frac{\eta A_B}{X_{crack}} \qquad \textbf{(D-9)}$$

where

η = the ratio: A_{crack}/A_B so that $0 =< \eta =< 1$

For intrinsic permeabilities of vapor flow, k_v, of less than 1E-8 cm^2 (fine sand soils), the soil gas flow rate through the cracks becomes so low that diffusion is the dominant transport mechanism and the solution is independent of k_v. For "larger" values of k_v, (greater than 1E-8 cm^2) the solution is dominated by the advective contribution. In the model output, the contribution from diffusion is estimated by setting k_v to a very low value.

D.4 SOURCE TERM

The source may be specified by entering total soil concentrations or by entering soil vapor concentrations. Using measured soil vapor concentrations has the following advantages:

- It eliminates the uncertainty in the model of estimating the source vapor concentrations from the equilibrium partitioning equation. This can be significant because of the complexities of partitioning when the chemicals are part of a mixture and because the soil properties like soil moisture and porosity are rarely known.
- The soil vapor concentration may be measured in the vadose zone between the source and the building. This approach can directly account for attenuation processes such as degradation and diffusion through different soil horizons (whose soil properties are not known) that the model may under-estimate. This can be very significant and many US State risk-based corrective action programs are developing protocols for starting with soil vapor concentrations rather than total soil concentrations.

Note that if the location of the soil vapor measurement is not close to the source, it is important to evaluate whether or not the soil vapor concentration has yet reached equilibrium. For example, if a recent subsurface chemical spill occurred in a silty clay and the soil vapor measurement point were 3 meters away, the vapor concentrations may not have yet reached their maximum values.

If there is no residual phase hydrocarbon present, the source vapor concentration is calculated from the total soil concentration using the following equation presented by Jury (1983, 1984, and 1990):

$$C_{vs} = \frac{C_T \rho_b K_H}{\theta_a K_H + \theta_w + \rho_b F_{oc} K_{oc}} \left(\frac{kg}{1E6mg} \right) \qquad \textbf{(D-10)}$$

where

C_{vs} = vapor concentration at the source [g/cm^3]

C_T = total soil concentration of chemical *i* [mg/kg]

ρ_b = soil bulk density of the source area [g/cm^3]

F_{oc} = fraction organic carbon in soil [g oc/g soil]

K_{oc} = chemical-specific organic carbon partition coefficient [ml/g m^3/kg]

K_H = Henry's law constant [(mg/l)/(mg/l)]

θ_a = air-filled porosity of vadose zone [cm^3 of air/cm^3 total soil volume]

θ_w = water-filled porosity of vadose zone [cm^3 of water/cm^3 total soil volume]

If residual phase hydrocarbon (NAPL) is present, Raoult's Law is used with the component mole fraction

$$C_{vs} = \frac{x_i P_v^{\,i} MW_i}{RT} \qquad \textbf{(D-11)}$$

where

x_i = mole fraction of component i in the hydrocarbon [mol/mol]

P_i^v = pure component vapor pressure of component i [atm]

MW_i = molecular weight of component i [g/mol]

R = the universal gas constant (82.1) [cm^3-atm/mol-K]

T = absolute temperature [K]

The model checks to see if residual-phase hydrocarbon is present and then calculates the source term accordingly. (The method for determining the residual limit is discussed in more detail in Appendix A, starting with Equation A-15.)

The mole fraction, x_i, is calculated from

$$x_i = \left(\frac{C_T}{C_{TPH}}\right)\left(\frac{MW_{TPH}}{MW}\right) \qquad \textbf{(D-12)}$$

where

C_T = total soil concentration of chemical i [mg/kg]

C_{TPH} = total soil concentration of TPH mixture [mg/kg]

MW_{TPH} = molecular weight of the mixture [g/mol]

MW_i = average molecular weight of component i [g/mol]

If the molecular weights of the component, i, and the mixture are similar, this roughly translates to the concentration of the component, i, over the concentration of total petroleum hydrocarbons (TPH) in the source.

D.5 DATA REQUIREMENTS OF THE SOIL VAPOR MODEL

The input data requirements for this model are presented in Table D-1.

Table D-1. Data Requirements for the Soil Vapor Model for Indoor Air
(Page 1 of 2)

	Units	Typical Range of Values	
		Minimum	Maximum
UNSATURATED ZONE			
Porosity	cm^3/cm^3	0.01	0.5
Water content in diffusion zone	cm^3/cm^3	0	porosity
Hydraulic conductivity of the soil surrounding the foundation (used to estimate soil vapor flow)	m/day	1.0E-07	100
Soil Bulk Density	fraction	1.4	2.2
LENS (Optional)			
Porosity	cm^3/cm^3	0.01	0.5
Water content of lens	cm^3/cm^3	0	porosity
Lens thickness	m	site-specific	site-specific
TPH DATA (Optional)			
Molecular weight of TPH	g/mol	80	120
Concentration of TPH	mg/kg	site-specific	site-specific
FOUNDATION PARAMETERS			
Distance to foundation	m	site-specific	site-specific
Cross-sectional area of foundation perpendicular to vapor flow	m^2	site-specific	site-specific
Volume of house	m^3	site-specific	site-specific
Number of air exchanges per day	d^{-1}	residential: 12 industrial: 20	location/site-specific
Thickness of foundation	m	0	site-specific
Fraction of cracks in foundation	cm^3/cm^3	0	1

Table D-1. Data Requirements for the Soil Vapor Model for Indoor Air
(Page 2 of 2)

	Units	Typical Range of Values	
		Minimum	Maximum
PARAMETERS USED TO CALCULATE PRESSURE-DRIVEN FLOW			
Soil Gas Flow Rate Into Building (Q_{soil}) (**or** next three parameters)	cm^3/s	*>0*	*location/site-specific*
Length of Foundation Perimeter (not needed if Q_{soil} specified)	m	0	site-specific
Depth Below Ground Surface of Foundation (not needed if Q_{soil} specified)	m	0	site-specific
Pressure Difference From Indoors to Outdoors (not needed if Q_{soil} specified)	g/cm^2-s	0	site-specific
CHEMICAL SPECIFIC DATA (individual chemical component)			
Molecular Weight	g/mol	chem-specific	chem-specific
Source Concentration: Soil Vapor Concentration, or Total Soil Concentration	mg/m^3 mg/kg	site-specific	site-specific
Solubility	mg/l	chem-specific	chem-specific
Diffusion Coefficient in Air	cm^2/s	chem-specific	chem-specific
Diffusion Coefficient in Water	cm^2/s	chem-specific	chem-specific
Henry's Law coefficient	(mg/l)/(mg/l)	chem-specific	chem-specific

D.6 LIMITATIONS OF THE SOIL VAPOR MODEL

1. This is a steady-state, constant and one-dimensional model. The source does not deplete due to vapor losses so mass is not conserved. This assumption has only a minor impact on the risk due to non-carcinogens (unless the source is

very small) since the highest seven-year running average intake is compared to the reference dose. It can have a more significant impact however on carcinogens (such as benzene) since the cumulative exposure over a long exposure duration (up to 30 years) forms the basis for the risk calculation.

2. There is no biodegradation of the vapors as they migrate through the soil.

D.7 REFERENCES

Johnson, P.C., and Ettinger, R.A., 1991. Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings, *Environmental Science and Technology*, 25, 1445-1452.

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Vapour Emissions from Pooled Water in Car Park

The equations used to estimate vapour concentrations above pooled water in the car park have been estimated from those described for impoundments and wastewater treatment tanks in US EPA (1994) 'Air Emissions Models for Waste and Wastewater' as attached.

Mass transfer of volatile chemicals from open liquid surface to air

$E = KAC_L$

Where, E – air emissions from the liquid surface (g/s);

K – overall mass transfer coefficient (m/s);

A – liquid surface area (m^2)

C_L – concentration of constituent in liquid phase (g/m^3)

The 'overall mass transfer coefficient' (K) is estimated from a two-phase resistance model that is based on the liquid-phase mass transfer coefficient (k_L, m/s), the gas phase mass transfer coefficient (k_G, m/s), and Henry's law constant in the form of a partition coefficient (Keq). The two resistances act in series and the overall resistance is expressed as:

$1/K = 1/k_L + 1/(k_G.Keq)$

Where: K – overall mass transfer coefficient (m/s);

k_L – liquid-phase mass transfer coefficient (m/s);

k_G – gas-phase mass transfer coefficient (m/s); and

Keq – equilibrium constant or partition coefficient, concentration in gas phase / concentration in liquid phase where both concentrations are in the same units.

Henry's law constant in units of '$atm.m^3/g.mol$' is reported to be estimated for the constituents of interest by dividing the constituents vapour pressure (in atmospheres) by its solubility in water (in $g\ mol/m^3$). This has been undertaken by using the unitless Henry's Law constants in **Table 8.14** in the following relationship.

Henrys Law ($atm.m^3/g.mol$) = (T / 12186) * HL (unitless)

Where: 12186 is a conversion factor to adjust untiless Henry's Law to ($atm.m^3/g.mol$);

T – Temperature of water (degrees kelvin), assumed to be 20°C / 293 K;

HL – unitless Henry's Law constant

Values used are summarised in **Table B1** following.

Table C1: Summary of Parameters to Estimate Henry's Law Constant ($atm.m^3/g.mol$)

COPC	Henry's Law Constant (unitless)	Henry's Law Constant ($atm.m^3/g.mol$)	Comments
Ammonia	$6.58*10^{-4}$	$1.58*10^{-5}$	
Arsenic	-	-	
Chromium	-	-	
Lead	-	-	
Cyanide	$5.44*10^{-3}$	$1.31*10^{-4}$	
Benzene	0.227	$5.46*10^{-3}$	
Toluene	0.271	$6.52*10^{-3}$	
Ethylbenzene	0.322	$7.74*10^{-3}$	
Xylenes	0.212	$5.10*10^{-3}$	
1,2,4-trimethylbenzene	0.252	$6.06*10^{-3}$	
TPH C_6-C_8 (ali)	-		Not assessed as unable to accurately characterise

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COPC	Henry's Law Constant (unitless)	Henry's Law Constant ($atm.m^3/g.mol$)	Comments
			leachability
TPH C_8-C_{16} (ali)	-		Not assessed as unable to accurately characterise leachability
TPH C_8-C_{16} (aro)	-		Not assessed as unable to accurately characterise leachability
TPH $C_{>16}$ (ali)	-		Not assessed as unable to accurately characterise leachability
TPH $C_{>16}$ (aro)	-		Not assessed as unable to accurately characterise leachability
Acenaphthene	$7.52*10^{-3}$	$1.81*10^{-4}$	
Acenaphthylene	$4.66*10^{-3}$	$1.12*10^{-4}$	
Anthracene	$2.27*10^{-3}$	$5.46*10^{-5}$	
Benzo(a)pyrene	-	-	Non volatile, not assessed.
Fluoranthene	-	-	Non volatile, not assessed.
Fluorene	$3.93*10^{-3}$	$9.45*10^{-5}$	
2-methylnaphthalene	$2.12*10^{-3}$	$5.10*10^{-5}$	
Naphthalene	$1.80*10^{-2}$	$4.33*10^{-4}$	
Phenanthrene	$1.73*10^{-3}$	$4.16*10^{-5}$	
Pyrene	$4.87*10^{-4}$	$1.17*10^{-5}$	
Phenol	$1.36*10^{-5}$	$3.27*10^{-7}$	
2,4-dimethylphenol	-		Non volatile, not assessed.
Cresols	-		Non volatile, not assessed.
Dibenzofuran	$8.71*10^{-3}$	$2.09*10^{-4}$	

The equilibrium constant Keq is estimated by:

$Keq = H/RT$

Where: H – Henry's Law constant ($atm.m^3/g.mol$);

R – universal gas constant, $8.21 * 10^{-5}$ ($atm.m^3/g.mol.K$); and

T – temperature (K).

The units associated with Keq are the ratio of the gas-phase to liquid-phase concentrations, and requires that both be expressed in the same units of mass/volume.

The equation for calculation the individual mass transfer coefficient for volatilization of organic solutes from quiescent surface impoundments is provided following for liquid phase and gas phase. A choice of equations are provided for the range of potential wind speeds above the surface. The wind speed within the car park has been estimated using the rate of ventilation of the Car Park as equal to 3.5 volume changes per hour. Using a ceiling height of 3m, this equates to a typical air velocity of 0.003m/s in any area of the car park, assuming uniform mixing of air velocity.

Liquid phase

$K_L = 2.78 *10^{-6}.(D_w / D_{ether})^{2/3}$

Where: D_w – diffusivity of constituent in water (cm^2/s);

D_{ether} – diffusivity of ether in water = $9.36*10^{-6}$ (cm^2/s) as per US Department of Energy Risk Assessment Information System as accessed on 12th August 2011.

Is only valid where the wind speed at 10m above the liquid surface is below 3.25m/s. The estimated wind speed for the car park is more than likely well below this, based on the rate of ventilation required.

Gas Phase

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$K_G = 4.82*10^{-3}.U^{0.78}.Sc_G^{-0.67}.d_e^{-0.11}$

Where: U – wind speed (m/s);

Sc_G – Schmidt number on gas side

d_e – effective diameter of impoundment (m^2)

The Schmidt number (Sc_G) is estimated by the following:

$Sc_G = \mu_G / (\rho_G.D_a)$

Where: μ_G – viscosity of air = $1.86*10^{-4}$ (g/cm.s);

ρ_G – density of air = $1.29*10^{-3}$ g/cm^3; and

D_a – diffusivity of constituent in air (cm^2/s).

The effective diameter of the impoundment (d_e) is defined as:

$d_e = (4A / 3.14592)^{0.5}$

where: A – area of impoundment / pooled water (m^2)

Values used for D_a and D_w are summarised in **Table B2** following.

Table B2: Diffusivity estimates for Constituents

COPC	Diffusivity in air	Diffusivity in water
	D_a (cm^2/s)	D_w (cm^2/s)
Ammonia	0.1	$1*10^{-5}$
Cyanide	0.211	$2.46*10^{-5}$
Benzene	$8.95*10^{-2}$	$1.03*10^{-5}$
Toluene	$7.78*10^{-2}$	$9.2*10^{-6}$
Ethylbenzene	$6.85*10^{-2}$	$8.46*10^{-6}$
Xylenes	$8.74*10^{-2}$	$9.90*10^{-6}$
1,2,4-trimethylbenzene	$6.07*10^{-2}$	$7.92*10^{-6}$
Styrene	$7.11*10^{-2}$	$8.78*10^{-6}$
Acenaphthene	$5.06*10^{-2}$	$8.33*10^{-6}$
Acenaphthylene	$4.50*10^{-2}$	$6.98*10^{-6}$
Anthracene	$3.90*10^{-2}$	$7.85*10^{-6}$
Benzo(a)pyrene	$4.3*10^{-2}$	$9.0*10^{-6}$
Fluoranthene	$3.0*10^{-2}$	$6.4*10^{-6}$
Fluorene	$4.40*10^{-2}$	$7.89*10^{-6}$
2-methylnaphthalene	$5.24*10^{-2}$	$7.78*10^{-6}$
Naphthalene	$6.05*10^{-2}$	$8.38*10^{-6}$
Phenanthrene	$3.45*10^{-2}$	$6.69*10^{-6}$
Pyrene	$2.87*10^{-2}$	$7.25*10^{-6}$
Dibenzofuran	$4.1*10^{-2}$	$7.38*10^{-6}$
Phenol	$8.34*10^{-2}$	$1.03*10^{-5}$

The flow model assumed for quiescent compounds and tanks with no biodegradation is that the contents of the system are well mixed and that the bulk concentration (driving force) in the system is equal to the effluent concentration (C_L). A material balance around the system yields:

$C_L = (Q.C_i) / (KA + Q)$

Where: C_L – equilibrium or bulk concentration in the impoundment (g/m^3);

Q – volumetric flow rate (m^3/s);

C_i – initial concentration in the waste / pooled water (g/m^3); and

K – overall mass transfer coefficient (m/s);

A – liquid surface area (m^2)

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For the purposes of the calculations here and consistent with the back calculation objectives of the overall risk assessment, C_L has been set as a unit concentration for each constituent, equal to 1mg/L (g/m^3).

Area of Puddles

By review of the site plans, the basement wall at the north and the west will potentially adjoining imported fill materials. This length of the basement wall along the northern and western extents is estimated as being 300m. It has been assumed that the complete length of these walls have puddles of infiltrating seepage water present. The width of the puddles has been assumed to be equal to 100mm, typical of the width of the base of a spoon drain. This is equal to an area of $30m^2$.

Estimating Airborne Concentration

Emission rates are estimated for the whole of the Car Park by this procedure. The actual concentration of constituents in the Car park will be a function of the emission rates and the ventilation (i.e. wind speed) of the Car Park. The airborne concentration of constituents in the car park has been estimated using a box model. The following equation is provided for estimation using a box model to RISC v.4 Users Manual.

$A_c = (F * L) / (U * H)$

Where: A_c – airborne concentration of constituent (g/m^3);

F – flux of constituent ($g/s.m^2$). Assumed to be E divided by the car park area;

L – length of box (m), assumed to be the square root of the area of the car park ($240m * 60m = 14\ 400m^2$) = 77.5m;

U – wind speed (m/s); and

H – height of box, equal to 3m (height of car park).

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Appendix C

Risk Modelling Spreadsheets and Summary

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	Toxicology		Estimates of Airborne Concent						
			Zone 1		Zone 2		Zone		
								Seepage water Volatilisa	
Constituent	Risk / HI	UR/ RfC	Outdoor	Excavation	Outdoor	Excavation	Car Park - Soil	1mg/L	Leach factor
Acenaphthene	HI	0.21	1.02E-05	1.02E-05	2.05E-06	1.02E-05	9.98E-05	4.14E-03	3.00E-03
Acenaphthylene	HI	0.21	5.64E-06	5.64E-06	1.13E-06	5.64E-06	6.14E-05	2.42E-03	1.70E-03
Ammonia	HI	0.07	6.20E-05	6.20E-05	1.24E-05	6.20E-05	3.15E-04	6.03E-04	13
Anthracene	HI	1.1	7.32E-07	7.32E-07	1.46E-07	7.32E-07	9.08E-06	1.10E-03	5.90E-04
Arsenic	HI	1.50E-05							5.00E-04
Benzo(a)pyrene	Risk	8.70E+01							5.68E-04
Benzene	Risk	6.00E-03	1.61E-02	1.61E-02	3.22E-03	1.61E-02	9.11E-02	5.78E-02	1.95
Benzene	HI	1.00E-02	1.61E-02	1.61E-02	3.22E-03	1.61E-02	1.15E-04	5.78E-02	1.95
Chromium	HI	5.00E-03							2.50E-04
Copper	HI	1.75							1.90E-04
Cyanide	HI	0.042	4.70E-05	4.70E-05	9.40E-06	4.70E-05	3.70E-05	7.84E-03	1.00E-02
Dibenzofuran	HI	0.0035	5.28E-07	5.28E-07	1.06E-07	5.28E-07	4.59E-02	4.15E-03	3.63E-02
2,4-dimethylphenol	HI	0.07							0.66
Ethylbenzene	HI	0.27	6.26E-03	6.26E-03	1.25E-03	6.26E-03	4.59E-02	5.50E-02	0.7
Fluoranthene	HI	0.14							1.70E-04
Fluorene	HI	0.14	2.56E-06	2.56E-06	5.11E-07	2.56E-06	2.84E-05	2.03E-03	2.60E-03
Lead	HI	5.00E-04							9.50E-05
2-methylnaphthalene	HI	1.40E-02	6.05E-06	6.05E-06	1.21E-06	6.05E-06	5.71E-05	1.25E-03	0.13
Cresols	HI	0.35							1.05
Naphthalene	HI	3.50E-03	9.52E-05	9.52E-05	1.90E-05	9.52E-05	7.84E-04	1.02E-02	8.70E-03
Phenanthrene	HI	1.1	4.84E-07	4.84E-07	9.69E-08	4.84E-07	6.73E-06	7.73E-04	1.00E-03
Phenol	HI	0.2	7.95E-07	7.95E-07	1.59E-07	7.95E-07	4.72E-06	1.11E-05	0.65
Pyrene	HI	0.1	3.38E-08	3.38E-08	6.77E-09	3.38E-08	5.70E-07	1.94E-04	1.50E-04
Toluene	HI	5	1.09E-02	1.09E-02	2.18E-03	1.09E-02	7.07E-02	5.61E-02	1.24
TPH C_6-C_8 (ali)	HI	18.4	9.46E-02	9.46E-02	1.89E-02	9.46E-02	0.482		
TPH C_8-C_{16} (ali)	HI	1	6.82E-03	6.82E-03	1.36E-03	6.82E-03	3.47E-02		
TPH $C_{>16}$ (ali)	HI	1							
TPH C_8-C_{16} (aro)	HI	0.2	7.53E-04	7.53E-04	1.51E-04	7.53E-04	3.84E-03		
TPH $C_{>16}$ (aro)	HI	0.2							
Trimethylbenzene	HI	0.22	2.79E-03	2.79E-03	5.57E-04	2.79E-03	2.29E-02	4.88E-02	0.52
Xylenes	HI	0.87	5.98E-03	5.98E-03	1.20E-03	5.98E-03	3.57E-02	5.53E-02	0.82

	trations (based on 1 mg/kg)								
	3			Zone 4		Zone 5	Zone 6	Zone 1	
Constituent	ation - CP per 1mg/kg	Seepage Water Vol - Building	Residential building - soil	Car Park - Soil	Residential building - soil	Soil	Soil	Recreational	Sub-Surface Maintenance
Acenaphthene	1.24E-05	1.09E-05	8.73E-05	1.38E-05	1.20E-05	4.99E-04	6.88E-05	0.0605	0.0137
Acenaphthylene	4.11E-06	3.60E-06	5.37E-05	7.69E-06	6.73E-06	3.07E-04	3.84E-05	0.0605	0.0137
Ammonia	7.84E-03	6.87E-03	2.76E-04	7.39E-05	6.47E-05	1.58E-03	3.70E-04	0.0605	0.0137
Anthracene	6.49E-07	5.68E-07	7.95E-06	1.01E-06	8.86E-07	4.54E-05	5.07E-06	0.0605	0.0137
Arsenic								0.0605	0.0137
Benzo(a)pyrene								0.0605	0.00196
Benzene	1.13E-01	9.86E-02	7.97E-02	1.97E-02	1.72E-02	0.456	9.83E-02	0.0605	0.00196
Benzene	1.13E-01	7.81E+01	7.97E-02	1.97E-02	1.72E-02	0.456	9.83E-02	0.0605	0.0137
Chromium								0.0605	0.0137
Copper								0.0605	0.0137
Cyanide	7.84E-05	2.14E-04	1.01E-04	4.48E-05	3.92E-05	5.77E-04	2.24E-04	0.0605	0.0137
Dibenzofuran	1.51E-04	1.06E-07	3.24E-05	8.05E-07	7.05E-07	1.85E-04	4.03E-06	0.0605	0.0137
2,4-dimethylphenol								0.0605	0.0137
Ethylbenzene	3.85E-02	3.36E-02	4.01E-02	8.05E-03	7.04E-03	0.229	4.02E-02	0.0605	0.0137
Fluoranthene								0.0605	0.0137
Fluorene	5.28E-06	4.61E-06	2.48E-05	3.49E-06	3.06E-06	1.42E-04	1.75E-05	0.0605	0.0137
Lead								0.0605	0.0137
2-methylnaphthalene	1.63E-04	1.42E-04	4.99E-05	8.09E-06	7.08E-06	2.85E-04	4.05E-05	0.0605	0.0137
Cresols								0.0605	0.0137
Naphthalene	8.87E-05	7.76E-05	6.86E-04	1.25E-04	1.09E-04	3.92E-03	6.24E-04	0.0605	0.0137
Phenanthrene	7.73E-07	6.77E-07	5.89E-06	6.79E-07	5.94E-07	3.36E-05	3.39E-06	0.0605	0.0137
Phenol	7.22E-06	6.31E-06	4.13E-06	9.82E-07	8.59E-07	2.36E-05	4.91E-06	0.0605	0.0137
Pyrene	2.91E-08	2.55E-08	4.99E-07	4.83E-08	4.22E-08	2.85E-06	2.41E-07	0.0605	0.0137
Toluene	6.96E-02	6.09E-02	6.19E-02	1.37E-02	1.02E-02	0.354	6.85E-02	0.0605	0.0137
TPH C_6-C_8 (ali)			0.422	0.113	9.88E-02	2.41	0.565	0.0605	0.0137
TPH C_8-C_{16} (ali)			3.04E-02	8.14E-03	7.12E-03	0.174	4.07E-02	0.0605	0.0137
TPH $C_{>16}$ (ali)								0.0605	0.0137
TPH C_8-C_{16} (aro)			3.36E-03	8.99E-04	7.87E-04	1.92E-02	4.50E-03	0.0605	0.0137
TPH $C_{>16}$ (aro)								0.0605	0.0137
Trimethylbenzene	2.54E-02	2.22E-02	2.00E-02	3.65E-03	3.19E-03	0.114	1.82E-02	0.0605	0.0137
Xylenes	4.53E-02	3.98E-02	3.13E-02	7.39E-03	6.47E-03	0.179	3.69E-02	0.0605	0.0137

	Inhalation Adjustment Factors							
		Zone 2			Zone 3			
Constituent	Com/Ind	Recreational	Sub-Surface Maintenance	Com/Ind	Res (adult) - Car Park	Res (child) - Car Park	Res (build)	Com/Ind
Acenaphthene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Acenaphthylene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Ammonia	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Anthracene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Arsenic	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Benzo(a)pyrene	0.0934	0.0605	0.00196	0.0934	0.0321	0.00476	0.833	0.0934
Benzene	0.0934	0.0605	0.00196	0.0934	0.0321	0.00476	0.833	0.0934
Benzene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Chromium	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Copper	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Cyanide	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Dibenzofuran	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
2,4-dimethylphenol	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Ethylbenzene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Fluoranthene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Fluorene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Lead	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
2-methylnaphthalene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Cresols	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Naphthalene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Phenanthrene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Phenol	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Pyrene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Toluene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
TPH C_6-C_8 (ali)	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
TPH C_8-C_{16} (ali)	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
TPH $C_{>16}$ (ali)	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
TPH C_8-C_{16} (aro)	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
TPH $C_{>16}$ (aro)	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Trimethylbenzene	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219
Xylenes	0.219	0.0605	0.0137	0.219	0.0417	0.0208	0.833	0.219

	Zone 4				Zone 5		Zone 6		
Constituent	Res (adult) - Car Park	Res (child) - Car Park	Res (build)	Com/Ind	Recreational	Com/Ind	Recreational	Com/Ind	Inhalation
Acenaphthene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	2.939E-06
Acenaphthylene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	1.62E-06
Ammonia	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	5.36E-05
Anthracene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	4.03E-08
Arsenic	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	
Benzo(a)pyrene	0.0321	0.00476	0.833	0.0934	0.0833	0.0934	0.0833	0.0934	
Benzene	0.0321	0.00476	0.833	0.0934	0.0833	0.0934	0.0833	0.0934	5.84E-06
Benzene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	9.74E-02
Chromium	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	
Copper	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	
Cyanide	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	6.77E-05
Dibenzofuran	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	9.13E-06
2,4-dimethylphenol	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	
Ethylbenzene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	1.40E-03
Fluoranthene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	
Fluorene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	1.11E-06
Lead	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	
2-methylnaphthalene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	2.61E-05
Cresols	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	
Naphthalene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	1.65E-03
Phenanthrene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	2.66E-08
Phenol	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	2.40E-07
Pyrene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	2.04E-08
Toluene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	1.32E-04
TPH C_6-C_8 (ali)	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	3.11E-04
TPH C_8-C_{16} (ali)	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	4.13E-04
TPH $C_{>16}$ (ali)	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	
TPH C_8-C_{16} (aro)	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	2.28E-04
TPH $C_{>16}$ (aro)	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	
Trimethylbenzene	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	7.67E-04
Xylenes	0.0417	0.0208	0.833	0.219	0.0833	0.219	0.0833	0.219	4.16E-04

	Zone 1								
	Recreational		Sub-Surface Maintenance			Com/Ind			
Constituent	Oral + Dermal-Child	Oral + Dermal-Adult	Inhalation-Vap	Inhalation-Dust	Oral + Dermal	Inhalation-Vap	Inhalation-Dust	Oral + Dermal	Risk / HI
Acenaphthene	2.20E-04	6.10E-05	6.65429E-07	5.87143E-09	1.10E-05	1.06371E-05	9.38571E-08	5.20E-05	0.00022
Acenaphthylene	2.20E-04	6.10E-05	3.67943E-07	5.87143E-09	1.10E-05	5.88171E-06	9.38571E-08	5.20E-05	0.00022
Ammonia			1.21343E-05			0.000193971			0.00019
Anthracene	4.40E-05	1.20E-05	9.11673E-09	1.12091E-09	2.10E-06	1.45735E-07	1.79182E-08	1.00E-05	4.4E-05
Arsenic	3.60E-03	6.20E-04		0.0000822	1.50E-04		0.001314	4.50E-04	0.0036
Benzo(a)pyrene									
Benzene	3.80E-07	6.70E-07	1.89E-07	1.06E-12	1.40E-08	9.02E-06	5.04E-11	3.30E-07	9.4E-06
Benzene	0.13	5.00E-02	0.022057	1.233E-07	7.20E-03	0.35259	0.000001971	4.50E-02	0.39759
Chromium	1.60E-03	6.50E-04		2.466E-07	9.10E-05		0.000003942	5.90E-04	0.0016
Copper	1.30E-04	5.00E-05		7.04571E-10	7.20E-06		1.12629E-08	4.50E-05	0.00013
Cyanide	3.20E-03	1.20E-03	1.5331E-05	2.93571E-08	1.80E-04	0.000245071	4.69286E-07	1.10E-03	0.00327
Dibenzofuran	2.20E-04	6.10E-05	2.06674E-06	3.52286E-07	1.10E-05	3.30377E-05	5.63143E-06	5.20E-05	0.00023
2,4-dimethylphenol	5.70E-04	1.50E-04		1.76143E-08	2.70E-05		2.81571E-07	1.20E-04	0.00057
Ethylbenzene	6.70E-04	2.60E-04	0.000317637	4.56667E-09	3.70E-05	0.005077556	0.000000073	2.30E-04	0.00531
Fluoranthene	3.30E-04	9.20E-05		8.80714E-09	1.60E-05		1.40786E-07	7.80E-05	0.00033
Fluorene	3.30E-04	9.20E-05	2.50514E-07	8.80714E-09	1.60E-05	4.00457E-06	1.40786E-07	7.80E-05	0.00033
Lead	3.30E-03	8.40E-04		0.000002466	1.50E-04		0.00003942	7.00E-04	0.0033
2-methylnaphthalene	3.30E-03	9.20E-04	5.92036E-06	8.80714E-08	1.60E-04	9.46393E-05	1.40786E-06	7.80E-04	0.00333
Cresols	2.30E-04	5.90E-05		3.52286E-09	1.10E-05		5.63143E-08	4.90E-05	0.00023
Naphthalene	6.60E-04	1.80E-04	0.00037264	3.52286E-07	3.20E-05	0.0059568	5.63143E-06	1.60E-04	0.00612
Phenanthrene	4.40E-05	1.20E-05	6.028E-09	1.12091E-09	2.10E-06	9.636E-08	1.79182E-08	1.00E-05	4.4E-05
Phenol	3.80E-05	9.90E-06	5.44575E-08	6.165E-09	1.80E-06	8.70525E-07	9.855E-08	8.10E-06	3.8E-05
Pyrene	4.40E-04	1.20E-04	4.6306E-09	1.233E-08	2.10E-05	7.4022E-08	1.971E-07	1.00E-04	0.00044
Toluene	2.90E-04	1.10E-04	0.000029866	2.466E-10	1.60E-05	0.00047742	3.942E-09	1.00E-04	0.00058
TPH C_6-C_8 (ali)	1.30E-05	5.00E-06	7.04359E-05	6.70109E-11	7.20E-07	0.001125946	1.0712E-09	4.50E-06	0.00113
TPH C_8-C_{16} (ali)	1.10E-04	3.00E-05	0.000093434	1.233E-09	5.30E-06	0.00149358	1.971E-08	2.40E-05	0.00152
TPH $C_{>16}$ (ali)	5.70E-06	1.50E-06		1.233E-09	2.70E-07		1.971E-08	1.20E-06	5.7E-06
TPH C_8-C_{16} (aro)	2.90E-04	7.40E-05	5.15805E-05	6.165E-09	1.30E-05	0.000824535	9.855E-08	6.10E-05	0.00089
TPH $C_{>16}$ (aro)	3.80E-04	9.90E-05		6.165E-09	1.80E-05		9.855E-08	8.10E-05	0.00038
Trimethylbenzene	3.20E-02	1.20E-02	0.000173741	5.60455E-09	1.80E-03	0.002777318	8.95909E-08	1.10E-02	0.03277
Xylenes	3.60E-04	1.40E-04	9.41678E-05	1.41724E-09	2.00E-05	0.00150531	2.26552E-08	1.20E-04	0.00163

	Zone 2				Ri			
	Recreational	Sub-Surface Maintenance	Com/Ind					
					Inhalation-Car Park Soil			Inhalation Car P
Constituent	Inhalation	Inhalation	Inhalation	Risk / HI	Adult	Child	Building-Soil	Adult
Acenaphthene	5.90595E-07	6.65429E-07	2.138E-06	2.138E-06	1.98174E-05	9.88495E-06	0.00034629	2.46626E-06
Acenaphthylene	3.25548E-07	3.67943E-07	1.178E-06	1.178E-06	1.21923E-05	6.08152E-06	0.00021301	8.16923E-07
Ammonia	1.07171E-05	1.21343E-05	3.879E-05	3.879E-05	0.00018765	0.0000936	0.0032844	0.004669804
Anthracene	8.03E-09	9.11673E-09	2.907E-08	2.907E-08	3.44215E-07	1.71695E-07	6.02032E-06	2.4603E-08
Arsenic								
Benzo(a)pyrene								
Benzene	1.17E-06	1.89E-07	1.80E-06	1.804E-06	1.75E-05	2.60E-06	3.98E-04	2.17E-05
Benzene	0.019481	0.022057	0.070518	0.070518	0.00047955	0.0002392	6.63901	0.4700007
Chromium								
Copper								
Cyanide	1.35405E-05	1.5331E-05	4.901E-05	4.901E-05	3.67357E-05	1.83238E-05	0.002003167	0.00007784
Dibenzofuran	1.83229E-06	2.06674E-06	6.633E-06	6.633E-06	0.546865714	0.272777143	0.0077112	0.001794828
2,4-dimethylphenol								
Ethylbenzene	0.000280093	0.000317637	0.0010139	0.0010139	0.007089	0.003536	0.123715926	0.005946111
Fluoranthene								
Fluorene	2.20825E-07	2.50514E-07	7.994E-07	7.994E-07	8.45914E-06	4.21943E-06	0.00014756	1.57209E-06
Lead								
2-methylnaphthalene	5.22893E-06	5.92036E-06	1.893E-05	1.893E-05	0.000170076	8.48343E-05	0.00296905	0.000484018
Cresols								
Naphthalene	0.000328429	0.00037264	0.0011889	0.0011889	0.0093408	0.0046592	0.163268	0.001057274
Phenanthrene	5.3295E-09	6.028E-09	1.929E-08	1.929E-08	2.55128E-07	1.27258E-07	4.46034E-06	2.93037E-08
Phenol	4.80975E-08	5.44575E-08	1.741E-07	1.741E-07	9.8412E-07	4.9088E-07	1.72015E-05	1.50433E-06
Pyrene	4.09585E-09	4.6306E-09	1.483E-08	1.483E-08	2.3769E-07	1.1856E-07	4.15667E-06	1.21347E-08
Toluene	0.000026378	0.000029866	9.548E-05	9.548E-05	0.000589638	0.000294112	0.01031254	0.000580164
TPH C_6-C_8 (ali)	6.2144E-05	7.04359E-05	0.000225	0.000225	0.001092359	0.00054487	0.019104674	
TPH C_8-C_{16} (ali)	0.00008228	0.000093434	0.0002978	0.0002978	0.00144699	0.00072176	0.0253232	
TPH $C_{>16}$ (ali)								
TPH C_8-C_{16} (aro)	4.56775E-05	5.15805E-05	0.0001653	0.0001653	0.00080064	0.00039936	0.0139944	
TPH $C_{>16}$ (aro)								
Trimethylbenzene	0.000153175	0.000173741	0.0005545	0.0005545	0.004340591	0.002165091	0.075727273	0.004809905
Xylenes	8.34483E-05	9.41678E-05	0.0003021	0.0003021	0.001711138	0.000853517	0.029968851	0.002173481

	sk / Hazard Estimates								
	Zone 3								
	Resident						Com / Ind		
	ark - Seepage		Dermal - Car Park Seepage						
Constituent	Child	Building - Seepage	Adult (1 mg/L)	Adult (1 mg/kg)	Child (1 mg/L)	Child (1mg/kg)	Inh - soil	Inh - seepage	Risk / HI
Acenaphthene	1.23017E-06	4.30954E-05	1.25E-03	3.75E-06	1.12E-03	3.35E-06	0.0001	1.29523E-05	3.70E-04
Acenaphthylene	4.07482E-07	1.42724E-05	1.32E-03	2.24E-06	1.18E-03	2.01E-06	6.4E-05	4.29031E-06	2.27E-04
Ammonia	0.002329303	0.08173464					0.00099	0.024524871	8.64E-02
Anthracene	1.2272E-08	4.30307E-07	4.01E-04	2.37E-07	3.68E-04	2.17E-07	1.8E-06	1.2921E-07	6.60E-06
Arsenic			4.27E-04	2.14E-07	3.88E-04	1.94E-07			2.14E-07
Benzo(a)pyrene			2.30E-04	1.31E-07	5.50E-05	3.12E-08			1.62E-07
Benzene	3.22E-06	4.93E-04	3.42E-07	6.67E-07	8.00E-08	1.56E-07	5.11E-05	6.32E-05	5.19E-04
Benzene	0.2344368	6506.807105	2.50E-02	4.87E-02	2.30E-02	4.49E-02	0.00252	2.468349	6.51E+03
Chromium			6.80E-02	1.70E-05	6.20E-02	1.55E-05			1.70E-05
Copper			1.71E-06	3.25E-10	1.58E-06	3.00E-10			3.25E-10
Cyanide	3.88267E-05	0.004244548	3.16E-05	3.16E-07	2.89E-05	2.89E-07	0.00019	0.0004088	4.32E-03
Dibenzofuran	0.000895262	2.53084E-05	1.38E-03	5.01E-05	1.25E-03	4.54E-05	2.87203	0.009426073	2.87E+00
2,4-dimethylphenol			4.60E-04	3.04E-04	4.27E-04	2.82E-04			3.04E-04
Ethylbenzene	0.002965926	0.103770439	4.34E-04	3.04E-04	3.95E-04	2.76E-04	0.03723	0.031227778	1.31E-01
Fluoranthene			6.51E-03	1.11E-06	5.98E-03	1.02E-06			1.11E-06
Fluorene	7.8416E-07	2.74233E-05	2.37E-03	6.15E-06	2.17E-03	5.64E-06	4.4E-05	8.2563E-06	1.62E-04
Lead			2.43E-05	2.31E-09	2.24E-05	2.12E-09			2.31E-09
2-methylnaphthalene	0.000241429	0.008449573	2.50E-02	3.25E-03	1.78E-02	2.31E-03	0.00089	0.002541964	1.22E-02
Cresols			1.32E-04	1.38E-04	1.18E-04	1.24E-04			1.38E-04
Naphthalene	0.000527369	0.018480105	1.97E-03	1.72E-05	1.84E-03	1.60E-05	0.04906	0.005552589	1.73E-01
Phenanthrene	1.46167E-08	5.12309E-07	4.08E-04	4.08E-07	3.75E-04	3.75E-07	1.3E-06	1.53897E-07	5.12E-06
Phenol	7.5036E-07	2.62942E-05	1.25E-05	8.12E-06	1.12E-05	7.27E-06	5.2E-06	7.90043E-06	3.59E-05
Pyrene	6.0528E-09	2.12209E-07	5.72E-03	8.58E-07	5.19E-03	7.79E-07	1.2E-06	6.3729E-08	5.25E-06
Toluene	0.000289386	0.010146839	1.18E-04	1.47E-04	1.12E-04	1.39E-04	0.0031	0.003046903	1.10E-02
TPH C_6-C_8 (ali)			1.25E-04		1.18E-04		0.00574		2.02E-02
TPH C_8-C_{16} (ali)			1.64E-02		1.51E-02		0.0076		2.68E-02
TPH $C_{>16}$ (ali)			1.25E-04		1.18E-04				0.00E+00
TPH C_8-C_{16} (aro)			1.84E-03		1.71E-03		0.0042		1.48E-02
TPH $C_{>16}$ (aro)			8.55E-03		7.89E-03				0.00E+00
Trimethylbenzene	0.002399185	0.083915077	3.62E-02	1.88E-02	3.35E-02	1.74E-02	0.0228	0.025260655	1.08E-01
Xylenes	0.001084134	0.038066316	2.24E-04	1.83E-04	2.04E-04	1.67E-04	0.00899	0.011414683	4.04E-02

	Zone 4					Zone 5			Zone 6	
	Resident			Com / Ind		Recreational	Com / Ind		Recreational	Com / Ind
	Inhalation-Car Park Soil									
Constituent	Adult	Child	Building-Soil	Inh - soil	Risk / HI	Inhalation	Inhalation	Risk / HI	Inhalation	Inhalation
Acenaphthene	2.7403E-06	1.3669E-06	0.0000476	1.43914E-05	5.03403E-05	0.000197937	0.0005204	0.0005204	2.72907E-05	7.175E-05
Acenaphthylene	1.527E-06	7.6168E-07	2.66957E-05	8.01957E-06	2.82227E-05	0.000121777	0.0003202	0.0003202	0.000015232	4.005E-05
Ammonia	4.4023E-05	2.1959E-05	0.00076993	0.000231201	0.000813953	0.0018802	0.0049431	0.0049431	0.0004403	0.0011576
Anthracene	3.8288E-08	1.9098E-08	6.70944E-07	2.01082E-07	7.09232E-07	3.43802E-06	9.039E-06	9.039E-06	3.83937E-07	1.009E-06
Arsenic										
Benzo(a)pyrene										
Benzene	3.79E-06	5.63E-07	8.60E-05	1.10E-05	9.03E-05	2.28E-04	2.56E-04	0.0002555	4.91E-05	5.51E-05
Benzene	0.082149	0.040976	1.43276	0.43143	1.514909	3.79848	9.9864	9.9864	0.818839	2.15277
Chromium										
Copper										
Cyanide	0.00004448	2.2187E-05	0.000777467	0.0002336	0.000821947	0.001144383	0.0030086	0.0030086	0.000444267	0.001168
Dibenzofuran	9.591E-06	4.784E-06	0.00016779	0.00005037	0.000177381	0.004403	0.0115757	0.0115757	0.000095914	0.0002522
2,4-dimethylphenol										
Ethylbenzene	0.00124328	0.00062015	0.021719704	0.006529444	0.022962981	0.070650741	0.1857444	0.1857444	0.012402444	0.0326067
Fluoranthene										
Fluorene	1.0395E-06	5.1851E-07	0.000018207	5.45936E-06	1.92465E-05	0.00008449	0.0002221	0.0002221	1.04125E-05	2.738E-05
Lead										
2-methylnaphthalene	2.4097E-05	1.2019E-05	0.00042126	0.000126551	0.000445357	0.00169575	0.0044582	0.0044582	0.000240975	0.0006335
Cresols										
Naphthalene	0.00148929	0.00074286	0.025942	0.007821429	0.027431286	0.093296	0.24528	0.24528	0.0148512	0.0390446
Phenanthrene	2.574E-08	1.2839E-08	4.4982E-07	1.35183E-07	4.7556E-07	2.54444E-06	6.689E-06	6.689E-06	2.56715E-07	6.749E-07
Phenol	2.0475E-07	1.0213E-07	3.57774E-06	1.07529E-06	3.78248E-06	9.8294E-06	2.584E-05	2.584E-05	2.04502E-06	5.376E-06
Pyrene	2.0141E-08	1.0046E-08	3.51526E-07	1.05777E-07	3.71667E-07	2.37405E-06	6.242E-06	6.242E-06	2.00753E-07	5.278E-07
Toluene	0.00011426	5.6992E-05	0.00169932	0.00060006	0.001813578	0.00589764	0.0155052	0.0155052	0.00114121	0.0030003
TPH C_6-C_8 (ali)	0.00025609	0.00012774	0.004472848	0.001344946	0.00472894	0.010910489	0.0286842	0.0286842	0.002557853	0.0067247
TPH C_8-C_{16} (ali)	0.00033944	0.00016931	0.00593096	0.00178266	0.006270398	0.0144942	0.038106	0.038106	0.00339031	0.0089133
TPH $C_{>16}$ (ali)										
TPH C_8-C_{16} (aro)	0.00018744	9.3496E-05	0.003277855	0.000984405	0.003465297	0.0079968	0.021024	0.021024	0.00187425	0.0049275
TPH $C_{>16}$ (aro)										
Trimethylbenzene	0.00069184	0.00034509	0.0120785	0.003633409	0.012770341	0.043164545	0.1134818	0.1134818	0.006891182	0.0181173
Xylenes	0.00035421	0.00017668	0.006194839	0.001860241	0.006549049	0.017138736	0.0450586	0.0450586	0.003533069	0.0092886

Constituent	Risk / HI	Background adjustment	Bioavailability adjustment	Mixture adjustment	Criteria (no odour assessment)						Odour threshold
					Zone 1 Criteria	Zone 2 Criteria	Zone 3 Criteria	Zone 4 Criteria	Zone 5 Criteria	Zone 6 Criteria	
Acenaphthene	7.175E-05	0	1	0.2	897.1081	93551.62	540.75191	3972.961	384.3303	2787.512	0.5
Acenaphthylene	4.005E-05	0	1	0.2	902.4258	169717.5	879.36091	7086.499	624.6932	4994.292	
Ammonia	0.0011576	0	1	1	5155.398	25776.99	11.573479	1228.572	202.3004	863.8776	1
Anthracene	1.009E-06	0	1	0.2	4541.299	6880590	30297.617	281995.2	22127.01	198139.3	
Arsenic		0.3	1	1	194.4444		3275641				
Benzo(a)pyrene		0	1	1			61.774154				
Benzene	5.509E-05	0.13	1	1	0.930234	4.821312	0.0167765	0.096322	0.034045	0.157931	5
Benzene	2.15277	0.13	1	0.5	1.094086	6.168638	6.685E-05	0.287146	0.043559	0.202065	
Chromium		0	1	1	625		58823.529				
Copper		0.17	1	1	6384.615		2.555E+09				
Cyanide	0.001168	0	1	1	306.0254	20402.22	231.33672	1216.624	332.3758	856.1644	0.64
Dibenzofuran	0.0002522	0	1	1	4364.395	150771.1	0.348186	5637.582	86.38776	3965.691	0.8
2,4-dimethylphenol		0	1	1	1754.386		3291.847				
Ethylbenzene	0.0326067	0	1	1	188.4081	986.3014	7.6272585	43.54835	5.383741	30.66857	0.8
Fluoranthene		0	1	0.2	606.0606		180728.86				
Fluorene	2.738E-05	0	1	0.2	604.0356	250203.3	1233.2459	10391.49	900.3794	7305.936	
Lead		0.2	0.5	1	484.8485		692271219				
2-methylnaphthalene	0.0006335	0	1	0.2	60.12968	10566.44	16.417921	449.0783	44.86101	315.6886	0.058
Cresols		0	1	1	4347.826		7242.0635				0.0003
Naphthalene	0.0390446	0	1	0.2	32.66676	168.2288	1.1585743	7.290945	0.815395	5.122351	0.35
Phenanthrene	6.749E-07	0	1	0.2	4542.706	10367040	39038.591	420556.6	29897.8	296332.2	
Phenol	5.376E-06	0	1	1	26150.29	5743660	27840.387	264376.7	38696.7	185996.3	0.02
Pyrene	5.278E-07	0	1	0.2	454.5243	13489542	38077.525	538116	32043.58	378938.6	
Toluene	0.0030003	0	1	0.075	129.8872	785.4719	6.7879817	41.35471	4.837087	24.9975	1
TPH C_6-C_8 (ali)	0.0067247	0	1	1	884.606	4445.411	49.512224	211.4639	34.86235	148.7049	
TPH C_8-C_{16} (ali)	0.0089133	0	1	1	658.9353	3357.507	37.354983	159.4795	26.24259	112.1919	
TPH $C_{>16}$ (ali)		0	1	1	175438.6						
TPH C_8-C_{16} (aro)	0.0049275	0	1	1	1129.135	6047.96	67.590219	288.5756	47.56469	202.9427	
TPH $C_{>16}$ (aro)		0	1	1	2631.579						
Trimethylbenzene	0.0181173	0.17	1	0.25	6.332542	374.2325	1.9296857	16.24859	1.828487	11.45316	0.6
Xylenes	0.0092886	0	1	0.1	61.52585	331.0502	2.4738319	15.26939	2.219331	10.76586	0.2

Barangaroo Central RISC Models

Zone 1 Soils : 0-0.5m Outdoor & Excavation, Zone 2 Soils >0.5m Excavation

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger model for outdoor air
with volatile emissions from soil

Title:
Barangaroo Central - Zone 1 Soils Outdoor & Excavation, Zone 2 Excavation

Simulation time (years).	70

Soil Source for Vapor Model

Total porosity in source (cm3/cm3).	0.38
Water content in source (cm3/cm3)	5.30E-02
Fraction organic carbon in source(mg/mg)	3.00E-03
Soil bulk density in source (g/cm3).	1.7

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to surface (m)	0.10

OUTDOOR AIR PARAMETERS

Height of box (breathing zone) (m)	2.0
Length of box (m).	10.
Wind speed (m/s)	2.0

TPH Data for Vapor Model Source

Concentration of TPH (mg/kg)	0.0
Molecular weight of TPH (g/mol).	0.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	4.82E+05
Vapor pressure (mmHg)	7.51E+03
Kd (partition coefficient) (L/kg)	0.40
Henry's Law coefficient (-).	6.58E-04
Molecular weight (g/mol).	17.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s)	3.90E-02
Diffusion coefficient in water (cm2/s)	7.85E-06
Solubility (mg/l)	4.34E-02
Vapor pressure (mmHg)	6.53E-06
KOC (L/kg).	1.64E+04
Henry's Law coefficient (-).	2.27E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s)	8.95E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	1.79E+03
Vapor pressure (mmHg)	95.
KOC (L/kg).	1.46E+02
Henry's Law coefficient (-).	0.23
Molecular weight (g/mol).	78.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 1.0

CHEMICAL DATA FOR: Cyanide

Diffusion coefficient in air (cm2/s)	0.21
Diffusion coefficient in water (cm2/s)	2.46E-05
Solubility (mg/l)	1.00E+06
Vapor pressure (mmHg)	7.42E+02
Kd (partition coefficient) (L/kg)	9.9
Henry's Law coefficient (-).	5.44E-03
Molecular weight (g/mol).	27.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Dibenzofuran

Diffusion coefficient in air (cm2/s)	4.10E-03
Diffusion coefficient in water (cm2/s)	7.38E-06
Solubility (mg/l)	3.1
Vapor pressure (mmHg)	2.48E-03
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	8.71E-03
Molecular weight (g/mol).	1.68E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s)	6.85E-02
Diffusion coefficient in water (cm2/s)	8.46E-06
Solubility (mg/l)	1.69E+02
Vapor pressure (mmHg)	9.6
KOC (L/kg).	4.46E+02
Henry's Law coefficient (-).	0.32
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s)	4.40E-02
Diffusion coefficient in water (cm2/s)	7.89E-06
Solubility (mg/l)	1.7
Vapor pressure (mmHg)	6.00E-04
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	3.93E-03
Molecular weight (g/mol).	1.66E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Methyl napthalene (2)

Diffusion coefficient in air (cm2/s)	5.24E-02
Diffusion coefficient in water (cm2/s)	7.78E-06
Solubility (mg/l)	25.
Vapor pressure (mmHg)	8.30E-03
KOC (L/kg).	2.48E+03
Henry's Law coefficient (-).	2.12E-03
Molecular weight (g/mol).	1.42E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s)	6.05E-02
Diffusion coefficient in water (cm2/s)	8.38E-06
Solubility (mg/l)	31.
Vapor pressure (mmHg)	8.50E-02
KOC (L/kg).	1.54E+03
Henry's Law coefficient (-).	1.80E-02
Molecular weight (g/mol).	1.28E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenanthrene

Diffusion coefficient in air (cm2/s)	3.45E-02
Diffusion coefficient in water (cm2/s)	6.69E-06
Solubility (mg/l)	1.1
Vapor pressure (mmHg)	1.21E-04
KOC (L/kg).	1.67E+04
Henry's Law coefficient (-).	1.73E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenol

Diffusion coefficient in air (cm2/s)	8.34E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	8.28E+04
Vapor pressure (mmHg)	0.35
KOC (L/kg).	1.87E+02
Henry's Law coefficient (-).	1.36E-05
Molecular weight (g/mol).	94.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s)	2.78E-02
Diffusion coefficient in water (cm2/s)	7.25E-06
Solubility (mg/l)	0.14
Vapor pressure (mmHg)	4.50E-06
KOC (L/kg).	5.43E+04
Henry's Law coefficient (-).	4.87E-04
Molecular weight (g/mol).	2.02E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s)	7.78E-02
Diffusion coefficient in water (cm2/s)	9.20E-06
Solubility (mg/l)	5.26E+02
Vapor pressure (mmHg)	28.
KOC (L/kg).	2.34E+02
Henry's Law coefficient (-).	0.27
Molecular weight (g/mol).	92.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C6-8

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	5.4
Vapor pressure (mmHg)	48.
KOC (L/kg).	4.00E+03
Henry's Law coefficient (-).	51.
Molecular weight (g/mol).	1.00E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	3.40E-02
Vapor pressure (mmHg)	0.49
KOC (L/kg).	2.50E+05
Henry's Law coefficient (-).	1.30E+02
Molecular weight (g/mol).	1.60E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aromatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	25.
Vapor pressure (mmHg)	0.48
KOC (L/kg).	2.50E+03
Henry's Law coefficient (-).	0.14
Molecular weight (g/mol).	1.30E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s)	6.07E-02
Diffusion coefficient in water (cm2/s)	7.92E-06
Solubility (mg/l)	57.
Vapor pressure (mmHg)	2.1
KOC (L/kg).	7.18E+02
Henry's Law coefficient (-).	0.25
Molecular weight (g/mol).	1.69E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

Zone 2 Soils >0.5m Outdoor

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger model for outdoor air
with volatile emissions from soil

Title:
Barangaroo Central - Zone 2 Soils Outdoor, >0.5m

Simulation time (years).	70

Soil Source for Vapor Model

Total porosity in source (cm3/cm3).	0.38
Water content in source (cm3/cm3)	5.30E-02
Fraction organic carbon in source(mg/mg)	3.00E-03
Soil bulk density in source (g/cm3).	1.7

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to surface (m)	0.50

OUTDOOR AIR PARAMETERS

Height of box (breathing zone) (m)	2.0
Length of box (m).	10.
Wind speed (m/s)	2.0

TPH Data for Vapor Model Source

Concentration of TPH (mg/kg)	0.0
Molecular weight of TPH (g/mol).	0.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	4.82E+05
Vapor pressure (mmHg)	7.51E+03
Kd (partition coefficient) (L/kg)	0.40
Henry's Law coefficient (-).	6.58E-04
Molecular weight (g/mol).	17.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s)	3.90E-02
Diffusion coefficient in water (cm2/s)	7.85E-06
Solubility (mg/l)	4.34E-02
Vapor pressure (mmHg)	6.53E-06
KOC (L/kg).	1.64E+04
Henry's Law coefficient (-).	2.27E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s)	8.95E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	1.79E+03
Vapor pressure (mmHg)	95.
KOC (L/kg).	1.46E+02
Henry's Law coefficient (-).	0.23
Molecular weight (g/mol).	78.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Cyanide

Diffusion coefficient in air (cm2/s)	0.21
Diffusion coefficient in water (cm2/s)	2.46E-05
Solubility (mg/l)	1.00E+06
Vapor pressure (mmHg)	7.42E+02
Kd (partition coefficient) (L/kg)	9.9
Henry's Law coefficient (-).	5.44E-03
Molecular weight (g/mol).	27.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Dibenzofuran

Diffusion coefficient in air (cm2/s)	4.10E-03
Diffusion coefficient in water (cm2/s)	7.38E-06
Solubility (mg/l)	3.1
Vapor pressure (mmHg)	2.48E-03
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	8.71E-03
Molecular weight (g/mol).	1.68E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s)	6.85E-02
Diffusion coefficient in water (cm2/s)	8.46E-06
Solubility (mg/l)	1.69E+02
Vapor pressure (mmHg)	9.6
KOC (L/kg).	4.46E+02
Henry's Law coefficient (-).	0.32
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s)	4.40E-02
Diffusion coefficient in water (cm2/s)	7.89E-06
Solubility (mg/l)	1.7
Vapor pressure (mmHg)	6.00E-04
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	3.93E-03
Molecular weight (g/mol).	1.66E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Methyl napthalene (2)

Diffusion coefficient in air (cm2/s)	5.24E-02
Diffusion coefficient in water (cm2/s)	7.78E-06
Solubility (mg/l)	25.
Vapor pressure (mmHg)	8.30E-03
KOC (L/kg).	2.48E+03
Henry's Law coefficient (-).	2.12E-03
Molecular weight (g/mol).	1.42E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s)	6.05E-02
Diffusion coefficient in water (cm2/s)	8.38E-06
Solubility (mg/l)	31.
Vapor pressure (mmHg)	8.50E-02
KOC (L/kg).	1.54E+03
Henry's Law coefficient (-).	1.80E-02
Molecular weight (g/mol).	1.28E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenanthrene

Diffusion coefficient in air (cm2/s)	3.45E-02
Diffusion coefficient in water (cm2/s)	6.69E-06
Solubility (mg/l)	1.1
Vapor pressure (mmHg)	1.21E-04
KOC (L/kg).	1.67E+04
Henry's Law coefficient (-).	1.73E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenol

Diffusion coefficient in air (cm2/s)	8.34E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	8.28E+04
Vapor pressure (mmHg)	0.35
KOC (L/kg).	1.87E+02
Henry's Law coefficient (-).	1.36E-05
Molecular weight (g/mol).	94.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s)	2.78E-02
Diffusion coefficient in water (cm2/s)	7.25E-06
Solubility (mg/l)	0.14
Vapor pressure (mmHg)	4.50E-06
KOC (L/kg).	5.43E+04
Henry's Law coefficient (-).	4.87E-04
Molecular weight (g/mol).	2.02E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s)	7.78E-02
Diffusion coefficient in water (cm2/s)	9.20E-06
Solubility (mg/l)	5.26E+02
Vapor pressure (mmHg)	28.
KOC (L/kg).	2.34E+02
Henry's Law coefficient (-).	0.27
Molecular weight (g/mol).	92.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C6-8

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	5.4
Vapor pressure (mmHg)	48.
KOC (L/kg).	4.00E+03
Henry's Law coefficient (-).	51.
Molecular weight (g/mol).	1.00E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	3.40E-02
Vapor pressure (mmHg)	0.49
KOC (L/kg).	2.50E+05
Henry's Law coefficient (-).	1.30E+02
Molecular weight (g/mol).	1.60E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aromatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	25.
Vapor pressure (mmHg)	0.48
KOC (L/kg).	2.50E+03
Henry's Law coefficient (-).	0.14
Molecular weight (g/mol).	1.30E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s)	6.07E-02
Diffusion coefficient in water (cm2/s)	7.92E-06
Solubility (mg/l)	57.
Vapor pressure (mmHg)	2.1
KOC (L/kg).	7.18E+02
Henry's Law coefficient (-).	0.25
Molecular weight (g/mol).	1.69E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	1.0

Zone 3 Soils, 0-10m Car Park, Soil Source

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger Indoor air model
with volatile emissions from soil

Title:
Zone 3, Car Park, 0-10m

Simulation time (years).	70

Soil Source for Vapor Model

Total porosity in source (cm3/cm3).	0.38
Water content in source (cm3/cm3)	5.30E-02
Fraction organic carbon in source(mg/mg)	3.00E-03
Soil bulk density in source (g/cm3).	1.7

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to building (m)	0.10

Building Parameters

Cross-sect. area of basement (m2).	1.50E+02
Volume of building (m3).	4.00E+02
Number of air changes per day.	84.
Foundation thickness (m)	0.15
Flow rate of soil gas into building (cm3/s)	83.

TPH Data for Vapor Model Source

Concentration of TPH (mg/kg)	0.0
Molecular weight of TPH (g/mol).	0.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	4.82E+05
Vapor pressure (mmHg)	7.51E+03
Kd (partition coefficient) (L/kg)	0.40
Henry's Law coefficient (-).	6.58E-04
Molecular weight (g/mol).	17.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s)	3.90E-02
Diffusion coefficient in water (cm2/s)	7.85E-06
Solubility (mg/l)	4.34E-02
Vapor pressure (mmHg)	6.53E-06
KOC (L/kg).	1.64E+04
Henry's Law coefficient (-).	2.27E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s)	8.95E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	1.79E+03
Vapor pressure (mmHg)	95.
KOC (L/kg).	1.46E+02
Henry's Law coefficient (-).	0.23
Molecular weight (g/mol).	78.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Cyanide

Diffusion coefficient in air (cm2/s)	0.21
Diffusion coefficient in water (cm2/s)	2.46E-05
Solubility (mg/l)	1.00E+06
Vapor pressure (mmHg)	7.42E+02
Kd (partition coefficient) (L/kg)	9.9
Henry's Law coefficient (-).	5.44E-03
Molecular weight (g/mol).	27.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Dibenzofuran

Diffusion coefficient in air (cm2/s)	4.10E-03
Diffusion coefficient in water (cm2/s)	7.38E-06
Solubility (mg/l)	3.1
Vapor pressure (mmHg)	2.48E-03
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	8.71E-03
Molecular weight (g/mol).	1.68E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s)	6.85E-02
Diffusion coefficient in water (cm2/s)	8.46E-06
Solubility (mg/l)	1.69E+02
Vapor pressure (mmHg)	9.6
KOC (L/kg).	4.46E+02
Henry's Law coefficient (-).	0.32
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s)	4.40E-02
Diffusion coefficient in water (cm2/s)	7.89E-06
Solubility (mg/l)	1.7
Vapor pressure (mmHg)	6.00E-04
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	3.93E-03
Molecular weight (g/mol).	1.66E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Methyl napthalene (2)

Diffusion coefficient in air (cm2/s)	5.24E-02
Diffusion coefficient in water (cm2/s)	7.78E-06
Solubility (mg/l)	25.
Vapor pressure (mmHg)	8.30E-03
KOC (L/kg).	2.48E+03
Henry's Law coefficient (-).	2.12E-03
Molecular weight (g/mol).	1.42E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s)	6.05E-02
Diffusion coefficient in water (cm2/s)	8.38E-06
Solubility (mg/l)	31.
Vapor pressure (mmHg)	8.50E-02
KOC (L/kg).	1.54E+03
Henry's Law coefficient (-).	1.80E-02
Molecular weight (g/mol).	1.28E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenanthrene

Diffusion coefficient in air (cm2/s)	3.45E-02
Diffusion coefficient in water (cm2/s)	6.69E-06
Solubility (mg/l)	1.1
Vapor pressure (mmHg)	1.21E-04
KOC (L/kg).	1.67E+04
Henry's Law coefficient (-).	1.73E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenol

Diffusion coefficient in air (cm2/s)	8.34E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	8.28E+04
Vapor pressure (mmHg)	0.35
KOC (L/kg).	1.87E+02
Henry's Law coefficient (-).	1.36E-05
Molecular weight (g/mol).	94.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s)	2.78E-02
Diffusion coefficient in water (cm2/s)	7.25E-06
Solubility (mg/l)	0.14
Vapor pressure (mmHg)	4.50E-06
KOC (L/kg).	5.43E+04
Henry's Law coefficient (-).	4.87E-04
Molecular weight (g/mol).	2.02E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s)	7.78E-02
Diffusion coefficient in water (cm2/s)	9.20E-06
Solubility (mg/l)	5.26E+02
Vapor pressure (mmHg)	28.
KOC (L/kg).	2.34E+02
Henry's Law coefficient (-).	0.27
Molecular weight (g/mol).	92.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C6-8

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	5.4
Vapor pressure (mmHg)	48.
KOC (L/kg).	4.00E+03
Henry's Law coefficient (-).	51.
Molecular weight (g/mol).	1.00E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	3.40E-02
Vapor pressure (mmHg)	0.49
KOC (L/kg).	2.50E+05
Henry's Law coefficient (-).	1.30E+02
Molecular weight (g/mol).	1.60E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aromatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	25.
Vapor pressure (mmHg)	0.48
KOC (L/kg).	2.50E+03
Henry's Law coefficient (-).	0.14
Molecular weight (g/mol).	1.30E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s)	6.07E-02
Diffusion coefficient in water (cm2/s)	7.92E-06
Solubility (mg/l)	57.
Vapor pressure (mmHg)	2.1
KOC (L/kg).	7.18E+02
Henry's Law coefficient (-).	0.25
Molecular weight (g/mol).	1.69E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

Zone 3 Soils, 0-10m Residential Building (via Car Park), Soil Source

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger Indoor air model
with volatile emissions from soil

Title:
Zone 3, Residential Building, 0-10m

Simulation time (years).	70

Soil Source for Vapor Model

Total porosity in source (cm3/cm3).	0.38
Water content in source (cm3/cm3)	5.30E-02
Fraction organic carbon in source(mg/mg)	3.00E-03
Soil bulk density in source (g/cm3).	1.7

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to building (m)	0.10

Building Parameters

Cross-sect. area of basement (m2).	1.50E+02
Volume of building (m3).	4.00E+02
Number of air changes per day.	96.
Foundation thickness (m)	0.15
Flow rate of soil gas into building (cm3/s)	83.

TPH Data for Vapor Model Source

Concentration of TPH (mg/kg)	0.0
Molecular weight of TPH (g/mol).	0.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	4.82E+05
Vapor pressure (mmHg)	7.51E+03
Kd (partition coefficient) (L/kg)	0.40
Henry's Law coefficient (-).	6.58E-04
Molecular weight (g/mol).	17.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s)	3.90E-02
Diffusion coefficient in water (cm2/s)	7.85E-06
Solubility (mg/l)	4.34E-02
Vapor pressure (mmHg)	6.53E-06
KOC (L/kg).	1.64E+04
Henry's Law coefficient (-).	2.27E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s)	8.95E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	1.79E+03
Vapor pressure (mmHg)	95.
KOC (L/kg).	1.46E+02
Henry's Law coefficient (-).	0.23
Molecular weight (g/mol).	78.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Cyanide

Diffusion coefficient in air (cm2/s)	0.21
Diffusion coefficient in water (cm2/s)	2.46E-05
Solubility (mg/l)	1.00E+06
Vapor pressure (mmHg)	7.42E+02
Kd (partition coefficient) (L/kg)	9.9
Henry's Law coefficient (-).	5.44E-03
Molecular weight (g/mol).	27.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Dibenzofuran

Diffusion coefficient in air (cm2/s)	4.10E-03
Diffusion coefficient in water (cm2/s)	7.38E-06
Solubility (mg/l)	3.1
Vapor pressure (mmHg)	2.48E-03
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	8.71E-03
Molecular weight (g/mol).	1.68E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s)	6.85E-02
Diffusion coefficient in water (cm2/s)	8.46E-06
Solubility (mg/l)	1.69E+02
Vapor pressure (mmHg)	9.6
KOC (L/kg).	4.46E+02
Henry's Law coefficient (-).	0.32
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s)	4.40E-02
Diffusion coefficient in water (cm2/s)	7.89E-06
Solubility (mg/l)	1.7
Vapor pressure (mmHg)	6.00E-04
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	3.93E-03
Molecular weight (g/mol).	1.66E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Methyl napthalene (2)

Diffusion coefficient in air (cm2/s)	5.24E-02
Diffusion coefficient in water (cm2/s)	7.78E-06
Solubility (mg/l)	25.
Vapor pressure (mmHg)	8.30E-03
KOC (L/kg).	2.48E+03
Henry's Law coefficient (-).	2.12E-03
Molecular weight (g/mol).	1.42E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s)	6.05E-02
Diffusion coefficient in water (cm2/s)	8.38E-06
Solubility (mg/l)	31.
Vapor pressure (mmHg)	8.50E-02
KOC (L/kg).	1.54E+03
Henry's Law coefficient (-).	1.80E-02
Molecular weight (g/mol).	1.28E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenanthrene

Diffusion coefficient in air (cm2/s)	3.45E-02
Diffusion coefficient in water (cm2/s)	6.69E-06
Solubility (mg/l)	1.1
Vapor pressure (mmHg)	1.21E-04
KOC (L/kg).	1.67E+04
Henry's Law coefficient (-).	1.73E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenol

Diffusion coefficient in air (cm2/s)	8.34E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	8.28E+04
Vapor pressure (mmHg)	0.35
KOC (L/kg).	1.87E+02
Henry's Law coefficient (-).	1.36E-05
Molecular weight (g/mol).	94.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s)	2.78E-02
Diffusion coefficient in water (cm2/s)	7.25E-06
Solubility (mg/l)	0.14
Vapor pressure (mmHg)	4.50E-06
KOC (L/kg).	5.43E+04
Henry's Law coefficient (-).	4.87E-04
Molecular weight (g/mol).	2.02E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s)	7.78E-02
Diffusion coefficient in water (cm2/s)	9.20E-06
Solubility (mg/l)	5.26E+02
Vapor pressure (mmHg)	28.
KOC (L/kg).	2.34E+02
Henry's Law coefficient (-).	0.27
Molecular weight (g/mol).	92.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C6-8

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	5.4
Vapor pressure (mmHg)	48.
KOC (L/kg).	4.00E+03
Henry's Law coefficient (-).	51.
Molecular weight (g/mol).	1.00E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	3.40E-02
Vapor pressure (mmHg)	0.49
KOC (L/kg).	2.50E+05
Henry's Law coefficient (-).	1.30E+02
Molecular weight (g/mol).	1.60E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aromatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	25.
Vapor pressure (mmHg)	0.48
KOC (L/kg).	2.50E+03
Henry's Law coefficient (-).	0.14
Molecular weight (g/mol).	1.30E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s)	6.07E-02
Diffusion coefficient in water (cm2/s)	7.92E-06
Solubility (mg/l)	57.
Vapor pressure (mmHg)	2.1
KOC (L/kg).	7.18E+02
Henry's Law coefficient (-).	0.25
Molecular weight (g/mol).	1.69E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

Zone 4 Soils, >10m Car Park, Soil Source

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger Indoor air model
with volatile emissions from soil

Title:
Zone 4, Car Park, >10m

Simulation time (years).	70

Soil Source for Vapor Model

Total porosity in source (cm3/cm3).	0.38
Water content in source (cm3/cm3)	5.30E-02
Fraction organic carbon in source(mg/mg)	3.00E-03
Soil bulk density in source (g/cm3).	1.7

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to building (m)	10.

Building Parameters

Cross-sect. area of basement (m2).	1.50E+02
Volume of building (m3).	4.00E+02
Number of air changes per day.	84.
Foundation thickness (m)	0.15
Flow rate of soil gas into building (cm3/s)	83.

TPH Data for Vapor Model Source

Concentration of TPH (mg/kg)	0.0
Molecular weight of TPH (g/mol).	0.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	4.82E+05
Vapor pressure (mmHg)	7.51E+03
Kd (partition coefficient) (L/kg)	0.40
Henry's Law coefficient (-).	6.58E-04
Molecular weight (g/mol).	17.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s)	3.90E-02
Diffusion coefficient in water (cm2/s)	7.85E-06
Solubility (mg/l)	4.34E-02
Vapor pressure (mmHg)	6.53E-06
KOC (L/kg).	1.64E+04
Henry's Law coefficient (-).	2.27E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s)	8.95E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	1.79E+03
Vapor pressure (mmHg)	95.
KOC (L/kg).	1.46E+02
Henry's Law coefficient (-).	0.23
Molecular weight (g/mol).	78.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Cyanide

Diffusion coefficient in air (cm2/s)	0.21
Diffusion coefficient in water (cm2/s)	2.46E-05
Solubility (mg/l)	1.00E+06
Vapor pressure (mmHg)	7.42E+02
Kd (partition coefficient) (L/kg)	9.9
Henry's Law coefficient (-).	5.44E-03
Molecular weight (g/mol).	27.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Dibenzofuran

Diffusion coefficient in air (cm2/s)	4.10E-03
Diffusion coefficient in water (cm2/s)	7.38E-06
Solubility (mg/l)	3.1
Vapor pressure (mmHg)	2.48E-03
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	8.71E-03
Molecular weight (g/mol).	1.68E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s)	6.85E-02
Diffusion coefficient in water (cm2/s)	8.46E-06
Solubility (mg/l)	1.69E+02
Vapor pressure (mmHg)	9.6
KOC (L/kg).	4.46E+02
Henry's Law coefficient (-).	0.32
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s)	4.40E-02
Diffusion coefficient in water (cm2/s)	7.89E-06
Solubility (mg/l)	1.7
Vapor pressure (mmHg)	6.00E-04
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	3.93E-03
Molecular weight (g/mol).	1.66E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Methyl napthalene (2)

Diffusion coefficient in air (cm2/s)	5.24E-02
Diffusion coefficient in water (cm2/s)	7.78E-06
Solubility (mg/l)	25.
Vapor pressure (mmHg)	8.30E-03
KOC (L/kg).	2.48E+03
Henry's Law coefficient (-).	2.12E-03
Molecular weight (g/mol).	1.42E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s)	6.05E-02
Diffusion coefficient in water (cm2/s)	8.38E-06
Solubility (mg/l)	31.
Vapor pressure (mmHg)	8.50E-02
KOC (L/kg).	1.54E+03
Henry's Law coefficient (-).	1.80E-02
Molecular weight (g/mol).	1.28E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenanthrene

Diffusion coefficient in air (cm2/s)	3.45E-02
Diffusion coefficient in water (cm2/s)	6.69E-06
Solubility (mg/l)	1.1
Vapor pressure (mmHg)	1.21E-04
KOC (L/kg).	1.67E+04
Henry's Law coefficient (-).	1.73E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenol

Diffusion coefficient in air (cm2/s)	8.34E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	8.28E+04
Vapor pressure (mmHg)	0.35
KOC (L/kg).	1.87E+02
Henry's Law coefficient (-).	1.36E-05
Molecular weight (g/mol).	94.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s)	2.78E-02
Diffusion coefficient in water (cm2/s)	7.25E-06
Solubility (mg/l)	0.14
Vapor pressure (mmHg)	4.50E-06
KOC (L/kg).	5.43E+04
Henry's Law coefficient (-).	4.87E-04
Molecular weight (g/mol).	2.02E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s)	7.78E-02
Diffusion coefficient in water (cm2/s)	9.20E-06
Solubility (mg/l)	5.26E+02
Vapor pressure (mmHg)	28.
KOC (L/kg).	2.34E+02
Henry's Law coefficient (-).	0.27
Molecular weight (g/mol).	92.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C6-8

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	5.4
Vapor pressure (mmHg)	48.
KOC (L/kg).	4.00E+03
Henry's Law coefficient (-).	51.
Molecular weight (g/mol).	1.00E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	3.40E-02
Vapor pressure (mmHg)	0.49
KOC (L/kg).	2.50E+05
Henry's Law coefficient (-).	1.30E+02
Molecular weight (g/mol).	1.60E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aromatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	25.
Vapor pressure (mmHg)	0.48
KOC (L/kg).	2.50E+03
Henry's Law coefficient (-).	0.14
Molecular weight (g/mol).	1.30E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s)	6.07E-02
Diffusion coefficient in water (cm2/s)	7.92E-06
Solubility (mg/l)	57.
Vapor pressure (mmHg)	2.1
KOC (L/kg).	7.18E+02
Henry's Law coefficient (-).	0.25
Molecular weight (g/mol).	1.69E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

Zone 4 Soils, >10m Residential Building (via Car Park), Soil Source

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger Indoor air model
with volatile emissions from soil

Title:
Zone 4, Residential Building, >10m

Simulation time (years).	70

Soil Source for Vapor Model

Total porosity in source (cm3/cm3).	0.38
Water content in source (cm3/cm3)	5.30E-02
Fraction organic carbon in source(mg/mg)	3.00E-03
Soil bulk density in source (g/cm3).	1.7

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to building (m)	10.

Building Parameters

Cross-sect. area of basement (m2).	1.50E+02
Volume of building (m3).	4.00E+02
Number of air changes per day.	96.
Foundation thickness (m)	0.15
Flow rate of soil gas into building (cm3/s)	83.

TPH Data for Vapor Model Source

Concentration of TPH (mg/kg)	0.0
Molecular weight of TPH (g/mol).	0.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	4.82E+05
Vapor pressure (mmHg)	7.51E+03
Kd (partition coefficient) (L/kg)	0.40
Henry's Law coefficient (-).	6.58E-04
Molecular weight (g/mol).	17.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s)	3.90E-02
Diffusion coefficient in water (cm2/s)	7.85E-06
Solubility (mg/l)	4.34E-02
Vapor pressure (mmHg)	6.53E-06
KOC (L/kg).	1.64E+04
Henry's Law coefficient (-).	2.27E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s)	8.95E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	1.79E+03
Vapor pressure (mmHg)	95.
KOC (L/kg).	1.46E+02
Henry's Law coefficient (-).	0.23
Molecular weight (g/mol).	78.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Cyanide

Diffusion coefficient in air (cm2/s)	0.21
Diffusion coefficient in water (cm2/s)	2.46E-05
Solubility (mg/l)	1.00E+06
Vapor pressure (mmHg)	7.42E+02
Kd (partition coefficient) (L/kg)	9.9
Henry's Law coefficient (-).	5.44E-03
Molecular weight (g/mol).	27.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Dibenzofuran

Diffusion coefficient in air (cm2/s)	4.10E-03
Diffusion coefficient in water (cm2/s)	7.38E-06
Solubility (mg/l)	3.1
Vapor pressure (mmHg)	2.48E-03
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	8.71E-03
Molecular weight (g/mol).	1.68E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s)	6.85E-02
Diffusion coefficient in water (cm2/s)	8.46E-06
Solubility (mg/l)	1.69E+02
Vapor pressure (mmHg)	9.6
KOC (L/kg).	4.46E+02
Henry's Law coefficient (-).	0.32
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s)	4.40E-02
Diffusion coefficient in water (cm2/s)	7.89E-06
Solubility (mg/l)	1.7
Vapor pressure (mmHg)	6.00E-04
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	3.93E-03
Molecular weight (g/mol).	1.66E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Methyl napthalene (2)

Diffusion coefficient in air (cm2/s)	5.24E-02
Diffusion coefficient in water (cm2/s)	7.78E-06
Solubility (mg/l)	25.
Vapor pressure (mmHg)	8.30E-03
KOC (L/kg).	2.48E+03
Henry's Law coefficient (-).	2.12E-03
Molecular weight (g/mol).	1.42E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s)	6.05E-02
Diffusion coefficient in water (cm2/s)	8.38E-06
Solubility (mg/l)	31.
Vapor pressure (mmHg)	8.50E-02
KOC (L/kg).	1.54E+03
Henry's Law coefficient (-).	1.80E-02
Molecular weight (g/mol).	1.28E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenanthrene

Diffusion coefficient in air (cm2/s)	3.45E-02
Diffusion coefficient in water (cm2/s)	6.69E-06
Solubility (mg/l)	1.1
Vapor pressure (mmHg)	1.21E-04
KOC (L/kg).	1.67E+04
Henry's Law coefficient (-).	1.73E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenol

Diffusion coefficient in air (cm2/s)	8.34E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	8.28E+04
Vapor pressure (mmHg)	0.35
KOC (L/kg).	1.87E+02
Henry's Law coefficient (-).	1.36E-05
Molecular weight (g/mol).	94.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s)	2.78E-02
Diffusion coefficient in water (cm2/s)	7.25E-06
Solubility (mg/l)	0.14
Vapor pressure (mmHg)	4.50E-06
KOC (L/kg).	5.43E+04
Henry's Law coefficient (-).	4.87E-04
Molecular weight (g/mol).	2.02E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s)	7.78E-02
Diffusion coefficient in water (cm2/s)	9.20E-06
Solubility (mg/l)	5.26E+02
Vapor pressure (mmHg)	28.
KOC (L/kg).	2.34E+02
Henry's Law coefficient (-).	0.27
Molecular weight (g/mol).	92.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C6-8

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	5.4
Vapor pressure (mmHg)	48.
KOC (L/kg).	4.00E+03
Henry's Law coefficient (-).	51.
Molecular weight (g/mol).	1.00E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	3.40E-02
Vapor pressure (mmHg)	0.49
KOC (L/kg).	2.50E+05
Henry's Law coefficient (-).	1.30E+02
Molecular weight (g/mol).	1.60E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aromatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	25.
Vapor pressure (mmHg)	0.48
KOC (L/kg).	2.50E+03
Henry's Law coefficient (-).	0.14
Molecular weight (g/mol).	1.30E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s)	6.07E-02
Diffusion coefficient in water (cm2/s)	7.92E-06
Solubility (mg/l)	57.
Vapor pressure (mmHg)	2.1
KOC (L/kg).	7.18E+02
Henry's Law coefficient (-).	0.25
Molecular weight (g/mol).	1.69E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

Zone 5 Soils, 0-10m Cultural Space (North-West)

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger Indoor air model
with volatile emissions from soil

Title:
Zone 5, Cultural Space, 0-10m

Simulation time (years).	70

Soil Source for Vapor Model

Total porosity in source (cm3/cm3).	0.38
Water content in source (cm3/cm3)	5.30E-02
Fraction organic carbon in source(mg/mg)	3.00E-03
Soil bulk density in source (g/cm3).	1.7

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to building (m)	0.10

Building Parameters

Cross-sect. area of basement (m2).	1.50E+02
Volume of building (m3).	4.00E+02
Number of air changes per day.	17.
Foundation thickness (m)	0.15
Flow rate of soil gas into building (cm3/s)	83.

TPH Data for Vapor Model Source

Concentration of TPH (mg/kg)	0.0
Molecular weight of TPH (g/mol).	0.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	4.82E+05
Vapor pressure (mmHg)	7.51E+03
Kd (partition coefficient) (L/kg)	0.40
Henry's Law coefficient (-).	6.58E-04
Molecular weight (g/mol).	17.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s)	3.90E-02
Diffusion coefficient in water (cm2/s)	7.85E-06
Solubility (mg/l)	4.34E-02
Vapor pressure (mmHg)	6.53E-06
KOC (L/kg).	1.64E+04
Henry's Law coefficient (-).	2.27E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s)	8.95E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	1.79E+03
Vapor pressure (mmHg)	95.
KOC (L/kg).	1.46E+02
Henry's Law coefficient (-).	0.23
Molecular weight (g/mol).	78.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Cyanide

Diffusion coefficient in air (cm2/s)	0.21
Diffusion coefficient in water (cm2/s)	2.46E-05
Solubility (mg/l)	1.00E+06
Vapor pressure (mmHg)	7.42E+02
Kd (partition coefficient) (L/kg)	9.9
Henry's Law coefficient (-).	5.44E-03
Molecular weight (g/mol).	27.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Dibenzofuran

Diffusion coefficient in air (cm2/s)	4.10E-03
Diffusion coefficient in water (cm2/s)	7.38E-06
Solubility (mg/l)	3.1
Vapor pressure (mmHg)	2.48E-03
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	8.71E-03
Molecular weight (g/mol).	1.68E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s)	6.85E-02
Diffusion coefficient in water (cm2/s)	8.46E-06
Solubility (mg/l)	1.69E+02
Vapor pressure (mmHg)	9.6
KOC (L/kg).	4.46E+02
Henry's Law coefficient (-).	0.32
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s)	4.40E-02
Diffusion coefficient in water (cm2/s)	7.89E-06
Solubility (mg/l)	1.7
Vapor pressure (mmHg)	6.00E-04
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	3.93E-03
Molecular weight (g/mol).	1.66E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Methyl napthalene (2)

Diffusion coefficient in air (cm2/s)	5.24E-02
Diffusion coefficient in water (cm2/s)	7.78E-06
Solubility (mg/l)	25.
Vapor pressure (mmHg)	8.30E-03
KOC (L/kg).	2.48E+03
Henry's Law coefficient (-).	2.12E-03
Molecular weight (g/mol).	1.42E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s)	6.05E-02
Diffusion coefficient in water (cm2/s)	8.38E-06
Solubility (mg/l)	31.
Vapor pressure (mmHg)	8.50E-02
KOC (L/kg).	1.54E+03
Henry's Law coefficient (-).	1.80E-02
Molecular weight (g/mol).	1.28E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenanthrene

Diffusion coefficient in air (cm2/s)	3.45E-02
Diffusion coefficient in water (cm2/s)	6.69E-06
Solubility (mg/l)	1.1
Vapor pressure (mmHg)	1.21E-04
KOC (L/kg).	1.67E+04
Henry's Law coefficient (-).	1.73E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenol

Diffusion coefficient in air (cm2/s)	8.34E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	8.28E+04
Vapor pressure (mmHg)	0.35
KOC (L/kg).	1.87E+02
Henry's Law coefficient (-).	1.36E-05
Molecular weight (g/mol).	94.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s)	2.78E-02
Diffusion coefficient in water (cm2/s)	7.25E-06
Solubility (mg/l)	0.14
Vapor pressure (mmHg)	4.50E-06
KOC (L/kg).	5.43E+04
Henry's Law coefficient (-).	4.87E-04
Molecular weight (g/mol).	2.02E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s)	7.78E-02
Diffusion coefficient in water (cm2/s)	9.20E-06
Solubility (mg/l)	5.26E+02
Vapor pressure (mmHg)	28.
KOC (L/kg).	2.34E+02
Henry's Law coefficient (-).	0.27
Molecular weight (g/mol).	92.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C6-8

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	5.4
Vapor pressure (mmHg)	48.
KOC (L/kg).	4.00E+03
Henry's Law coefficient (-).	51.
Molecular weight (g/mol).	1.00E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	3.40E-02
Vapor pressure (mmHg)	0.49
KOC (L/kg).	2.50E+05
Henry's Law coefficient (-).	1.30E+02
Molecular weight (g/mol).	1.60E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aromatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	25.
Vapor pressure (mmHg)	0.48
KOC (L/kg).	2.50E+03
Henry's Law coefficient (-).	0.14
Molecular weight (g/mol).	1.30E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s)	6.07E-02
Diffusion coefficient in water (cm2/s)	7.92E-06
Solubility (mg/l)	57.
Vapor pressure (mmHg)	2.1
KOC (L/kg).	7.18E+02
Henry's Law coefficient (-).	0.25
Molecular weight (g/mol).	1.69E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

Zone 6 Soils, >10m Cultural Space (North-West)

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger Indoor air model
with volatile emissions from soil

Title:
Zone 6, Cultural Space, >10m

Simulation time (years).	70

Soil Source for Vapor Model

Total porosity in source (cm3/cm3).	0.38
Water content in source (cm3/cm3)	5.30E-02
Fraction organic carbon in source(mg/mg)	3.00E-03
Soil bulk density in source (g/cm3).	1.7

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to building (m)	10.

Building Parameters

Cross-sect. area of basement (m2).	1.50E+02
Volume of building (m3).	4.00E+02
Number of air changes per day.	17.
Foundation thickness (m)	0.15
Flow rate of soil gas into building (cm3/s)	83.

TPH Data for Vapor Model Source

Concentration of TPH (mg/kg)	0.0
Molecular weight of TPH (g/mol).	0.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	4.82E+05
Vapor pressure (mmHg)	7.51E+03
Kd (partition coefficient) (L/kg)	0.40
Henry's Law coefficient (-).	6.58E-04
Molecular weight (g/mol).	17.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s)	3.90E-02
Diffusion coefficient in water (cm2/s)	7.85E-06
Solubility (mg/l)	4.34E-02
Vapor pressure (mmHg)	6.53E-06
KOC (L/kg).	1.64E+04
Henry's Law coefficient (-).	2.27E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s)	8.95E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	1.79E+03
Vapor pressure (mmHg)	95.
KOC (L/kg).	1.46E+02
Henry's Law coefficient (-).	0.23
Molecular weight (g/mol).	78.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Cyanide

Diffusion coefficient in air (cm2/s)	0.21
Diffusion coefficient in water (cm2/s)	2.46E-05
Solubility (mg/l)	1.00E+06
Vapor pressure (mmHg)	7.42E+02
Kd (partition coefficient) (L/kg)	9.9
Henry's Law coefficient (-).	5.44E-03
Molecular weight (g/mol).	27.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Dibenzofuran

Diffusion coefficient in air (cm2/s)	4.10E-03
Diffusion coefficient in water (cm2/s)	7.38E-06
Solubility (mg/l)	3.1
Vapor pressure (mmHg)	2.48E-03
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	8.71E-03
Molecular weight (g/mol).	1.68E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s)	6.85E-02
Diffusion coefficient in water (cm2/s)	8.46E-06
Solubility (mg/l)	1.69E+02
Vapor pressure (mmHg)	9.6
KOC (L/kg).	4.46E+02
Henry's Law coefficient (-).	0.32
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s)	4.40E-02
Diffusion coefficient in water (cm2/s)	7.89E-06
Solubility (mg/l)	1.7
Vapor pressure (mmHg)	6.00E-04
KOC (L/kg).	9.16E+03
Henry's Law coefficient (-).	3.93E-03
Molecular weight (g/mol).	1.66E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Methyl napthalene (2)

Diffusion coefficient in air (cm2/s)	5.24E-02
Diffusion coefficient in water (cm2/s)	7.78E-06
Solubility (mg/l)	25.
Vapor pressure (mmHg)	8.30E-03
KOC (L/kg).	2.48E+03
Henry's Law coefficient (-).	2.12E-03
Molecular weight (g/mol).	1.42E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s)	6.05E-02
Diffusion coefficient in water (cm2/s)	8.38E-06
Solubility (mg/l)	31.
Vapor pressure (mmHg)	8.50E-02
KOC (L/kg).	1.54E+03
Henry's Law coefficient (-).	1.80E-02
Molecular weight (g/mol).	1.28E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenanthrene

Diffusion coefficient in air (cm2/s)	3.45E-02
Diffusion coefficient in water (cm2/s)	6.69E-06
Solubility (mg/l)	1.1
Vapor pressure (mmHg)	1.21E-04
KOC (L/kg).	1.67E+04
Henry's Law coefficient (-).	1.73E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Phenol

Diffusion coefficient in air (cm2/s)	8.34E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	8.28E+04
Vapor pressure (mmHg)	0.35
KOC (L/kg).	1.87E+02
Henry's Law coefficient (-).	1.36E-05
Molecular weight (g/mol).	94.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s)	2.78E-02
Diffusion coefficient in water (cm2/s)	7.25E-06
Solubility (mg/l)	0.14
Vapor pressure (mmHg)	4.50E-06
KOC (L/kg).	5.43E+04
Henry's Law coefficient (-).	4.87E-04
Molecular weight (g/mol).	2.02E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s)	7.78E-02
Diffusion coefficient in water (cm2/s)	9.20E-06
Solubility (mg/l)	5.26E+02
Vapor pressure (mmHg)	28.
KOC (L/kg).	2.34E+02
Henry's Law coefficient (-).	0.27
Molecular weight (g/mol).	92.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C6-8

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	5.4
Vapor pressure (mmHg)	48.
KOC (L/kg).	4.00E+03
Henry's Law coefficient (-).	51.
Molecular weight (g/mol).	1.00E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aliphatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	3.40E-02
Vapor pressure (mmHg)	0.49
KOC (L/kg).	2.50E+05
Henry's Law coefficient (-).	1.30E+02
Molecular weight (g/mol).	1.60E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: TPH Aromatic C10-12

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	25.
Vapor pressure (mmHg)	0.48
KOC (L/kg).	2.50E+03
Henry's Law coefficient (-).	0.14
Molecular weight (g/mol).	1.30E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s)	6.07E-02
Diffusion coefficient in water (cm2/s)	7.92E-06
Solubility (mg/l)	57.
Vapor pressure (mmHg)	2.1
KOC (L/kg).	7.18E+02
Henry's Law coefficient (-).	0.25
Molecular weight (g/mol).	1.69E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg)	1.0

Zone 1 Soils – Oral & Dermal, Recreational Child

Title:
Zone 1 Soils - Oral & Dermal - Recreational Child
File not saved

Scenarios:
Child Resident - Typical
Child Resident - RME

Routes:
INGESTION OF SOIL
DERMAL CONTACT WITH SOIL

Chemicals:
- Acenaphthene
- Acenaphthylene
- Ammonia / ammonium
- Anthracene
- Arsenic
- Benzene
- Benzo(a)pyrene
- Chromium (III)
- Copper
- Cyanide
- Dibenzofuran
- Dimethylphenol (2,4)
- Ethylbenzene
- Fluoranthene
- Fluorene
- Lead
- Methyl napthalene (2)
- 3- & 4-methylphenol
- Naphthalene

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1	2
LIFETIME AND BODY WEIGHT		
Body Weight (kg)	13.2	34.5
Lifetime (years)	70.0	70.0
INGESTION OF SOIL		
Soil Ingestion Rate (mg/day)	100.	50.0
Exp. Frequency Soil (events/year)	265.	265.
Exp. Duration Soil (years)	6.00	10.0
Absorption Adjustment Factor for Ingestion of Soil (-)		
Acenaphthene	1.0	1.0
Acenaphthylene	1.0	1.0
Ammonia / ammonium	1.0	1.0
Anthracene	1.0	1.0
Arsenic	1.0	1.0
Benzene	1.0	1.0
Benzo(a)pyrene	1.0	1.0
Chromium (III)	1.0	1.0
Copper	1.0	1.0
Cyanide	1.0	1.0
Dibenzofuran	1.0	1.0
Dimethylphenol (2,4)	1.0	1.0
Ethylbenzene	1.0	1.0
Fluoranthene	1.0	1.0
Fluorene	1.0	1.0
Lead	1.0	1.0
Methyl napthalene (2)	1.0	1.0
3- & 4-methylphenol	1.0	1.0
Naphthalene	1.0	1.0

Soil Bioavailability (-)		
Acenaphthene	1.0	1.0
Acenaphthylene	1.0	1.0
Ammonia / ammonium	1.0	1.0
Anthracene	1.0	1.0
Arsenic	1.0	1.0
Benzene	1.0	1.0
Benzo(a)pyrene	1.0	1.0
Chromium (III)	1.0	1.0
Copper	1.0	1.0
Cyanide	1.0	1.0
Dibenzofuran	1.0	1.0
Dimethylphenol (2,4)	1.0	1.0
Ethylbenzene	1.0	1.0
Fluoranthene	1.0	1.0
Fluorene	1.0	1.0
Lead	1.0	1.0
Methyl napthalene (2)	1.0	1.0
3- & 4-methylphenol	1.0	1.0
Naphthalene	1.0	1.0

DERMAL CONTACT WITH SOIL

Total Skin Surface Area (cm^2)	2.158E+03	3.480E+03
Fraction Skin Exposed to Soil (-)	1.00	1.00
Adherence Factor for Soil (mg/cm^2)	0.500	0.500
Exposure Freq. Soil (events/year)	265.	265.
Exposure Duration Soil (years)	6.00	10.0
Absorption Adjustment Factor for Dermal Exposure to Soil (-)		
Acenaphthene	0.13	0.13
Acenaphthylene	0.13	0.13
Ammonia / ammonium	1.0	1.0
Anthracene	0.13	0.13
Arsenic	3.00E-02	3.00E-02
Benzene	1.0	1.0
Benzo(a)pyrene	0.13	0.13
Chromium (III)	1.0	1.0
Copper	1.0	1.0
Cyanide	1.0	1.0
Dibenzofuran	0.13	0.13
Dimethylphenol (2,4)	0.10	0.10
Ethylbenzene	1.0	1.0
Fluoranthene	0.13	0.13
Fluorene	0.13	0.13
Lead	0.10	0.10
Methyl napthalene (2)	0.13	0.13
3- & 4-methylphenol	0.10	0.10
Naphthalene	0.13	0.13
Soil Bioavailability (-)		
Acenaphthene	1.0	1.0
Acenaphthylene	1.0	1.0
Ammonia / ammonium	1.0	1.0
Anthracene	1.0	1.0
Arsenic	1.0	1.0
Benzene	1.0	1.0
Benzo(a)pyrene	1.0	1.0
Chromium (III)	1.0	1.0
Copper	1.0	1.0
Cyanide	1.0	1.0
Dibenzofuran	1.0	1.0
Dimethylphenol (2,4)	1.0	1.0
Ethylbenzene	1.0	1.0
Fluoranthene	1.0	1.0
Fluorene	1.0	1.0
Lead	1.0	1.0
Methyl napthalene (2)	1.0	1.0

3- & 4-methylphenol	1.0	1.0
Naphthalene	1.0	1.0

MEDIA CONCENTRATIONS

Concentration in Surficial Soil (mg/kg)
- Used to calculate risk and hazard index.

Acenaphthene	1.0	1.0
Acenaphthylene	1.0	1.0
Ammonia / ammonium	1.0	1.0
Anthracene	1.0	1.0
Arsenic	1.0	1.0
Benzene	1.0	1.0
Benzo(a)pyrene	1.0	1.0
Chromium (III)	1.0	1.0
Copper	1.0	1.0
Cyanide	1.0	1.0
Dibenzofuran	1.0	1.0
Dimethylphenol (2,4)	1.0	1.0
Ethylbenzene	1.0	1.0
Fluoranthene	1.0	1.0
Fluorene	1.0	1.0
Lead	1.0	1.0
Methyl napthalene (2)	1.0	1.0
3- & 4-methylphenol	1.0	1.0
Naphthalene	1.0	1.0

SLOPE FACTORS AND REFERENCE DOSES

Ingestion Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND	ND
Acenaphthylene	ND	ND
Ammonia / ammonium	ND	ND
Anthracene	ND	ND
Arsenic	ND	ND
Benzene	3.50E-02	3.50E-02
Benzo(a)pyrene	0.50	0.50
Chromium (III)	ND	ND
Copper	ND	ND
Cyanide	ND	ND
Dibenzofuran	ND	ND
Dimethylphenol (2,4)	ND	ND
Ethylbenzene	ND	ND
Fluoranthene	ND	ND
Fluorene	ND	ND
Lead	ND	ND
Methyl napthalene (2)	ND	ND
3- & 4-methylphenol	ND	ND
Naphthalene	ND	ND

Ingestion Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02	6.00E-02
Acenaphthylene	6.00E-02	6.00E-02
Ammonia / ammonium	ND	ND
Anthracene	0.30	0.30
Arsenic	2.00E-03	2.00E-03
Benzene	5.00E-04	5.00E-04
Benzo(a)pyrene	ND	ND
Chromium (III)	1.5	1.5
Copper	0.50	0.50
Cyanide	2.00E-02	2.00E-02
Dibenzofuran	6.00E-02	6.00E-02
Dimethylphenol (2,4)	2.00E-02	2.00E-02
Ethylbenzene	9.70E-02	9.70E-02
Fluoranthene	4.00E-02	4.00E-02
Fluorene	4.00E-02	4.00E-02
Lead	3.50E-03	3.50E-03

Methyl napthalene (2)	4.00E-03	4.00E-03
3- & 4-methylphenol	5.00E-02	5.00E-02
Naphthalene	2.00E-02	2.00E-02

Dermal Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND	ND
Acenaphthylene	ND	ND
Ammonia / ammonium	ND	ND
Anthracene	ND	ND
Arsenic	ND	ND
Benzene	3.50E-02	3.50E-02
Benzo(a)pyrene	25.	25.
Chromium (III)	ND	ND
Copper	ND	ND
Cyanide	ND	ND
Dibenzofuran	ND	ND
Dimethylphenol (2,4)	ND	ND
Ethylbenzene	ND	ND
Fluoranthene	ND	ND
Fluorene	ND	ND
Lead	ND	ND
Methyl napthalene (2)	ND	ND
3- & 4-methylphenol	ND	ND
Naphthalene	ND	ND

Dermal Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02	6.00E-02
Acenaphthylene	6.00E-02	6.00E-02
Ammonia / ammonium	ND	ND
Anthracene	0.30	0.30
Arsenic	2.00E-03	2.00E-03
Benzene	5.00E-04	5.00E-04
Benzo(a)pyrene	ND	ND
Chromium (III)	3.75E-02	3.75E-02
Copper	0.50	0.50
Cyanide	2.00E-02	2.00E-02
Dibenzofuran	6.00E-02	6.00E-02
Dimethylphenol (2,4)	2.00E-02	2.00E-02
Ethylbenzene	9.70E-02	9.70E-02
Fluoranthene	4.00E-02	4.00E-02
Fluorene	4.00E-02	4.00E-02
Lead	3.50E-03	3.50E-03
Methyl napthalene (2)	4.00E-03	4.00E-03
3- & 4-methylphenol	5.00E-02	5.00E-02
Naphthalene	2.00E-02	2.00E-02

SUMMARY OF RESULTS	SCENARIO: 1	2	Added

INGESTION OF SOIL

Daily Doses and Risk for : Acenaphthene

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	9.167E-05	1.754E-05	

Daily Doses and Risk for : Acenaphthylene

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	9.167E-05	1.754E-05	

Daily Doses and Risk for : Ammonia / ammonium

CADD (mg/kg-day)	5.50E-06	1.05E-06

LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	0.000E+00	0.000E+00	

Daily Doses and Risk for : Anthracene

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.833E-05	3.507E-06	

Daily Doses and Risk for : Arsenic

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.750E-03	5.261E-04	

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	1.650E-08	5.261E-09	2.176E-08
Hazard Index (-)	1.100E-02	2.104E-03	

Daily Doses and Risk for : Benzo(a)pyrene

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	2.357E-07	7.516E-08	3.109E-07
Hazard Index (-)	0.000E+00	0.000E+00	

Daily Doses and Risk for : Chromium (III)

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.667E-06	7.015E-07	

Daily Doses and Risk for : Copper

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.100E-05	2.104E-06	

Daily Doses and Risk for : Cyanide

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.750E-04	5.261E-05	

Daily Doses and Risk for : Dibenzofuran

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	9.167E-05	1.754E-05	

Daily Doses and Risk for : Dimethylphenol (2,4)

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.750E-04	5.261E-05	

Daily Doses and Risk for : Ethylbenzene

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	5.670E-05	1.085E-05	

Daily Doses and Risk for : Fluoranthene

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00

Hazard Index (-)	1.375E-04	2.631E-05	

Daily Doses and Risk for : Fluorene

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.375E-04	2.631E-05	

Daily Doses and Risk for : Lead

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.571E-03	3.006E-04	

Daily Doses and Risk for : Methyl napthalene (2)

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.375E-03	2.631E-04	

Daily Doses and Risk for : 3- & 4-methylphenol

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.100E-04	2.104E-05	

Daily Doses and Risk for : Naphthalene

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.750E-04	5.261E-05	

DERMAL CONTACT WITH SOIL

Daily Doses and Risk for : Acenaphthene

CADD (mg/kg-day)	7.72E-06	4.76E-06	
LADD (mg/kg-day)	6.61E-07	6.80E-07	1.34E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.286E-04	7.934E-05	

Daily Doses and Risk for : Acenaphthylene

CADD (mg/kg-day)	7.72E-06	4.76E-06	
LADD (mg/kg-day)	6.61E-07	6.80E-07	1.34E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.286E-04	7.934E-05	

Daily Doses and Risk for : Ammonia / ammonium

CADD (mg/kg-day)	5.93E-05	3.66E-05	
LADD (mg/kg-day)	5.09E-06	5.23E-06	1.03E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	0.000E+00	0.000E+00	

Daily Doses and Risk for : Anthracene

CADD (mg/kg-day)	7.72E-06	4.76E-06	
LADD (mg/kg-day)	6.61E-07	6.80E-07	1.34E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.572E-05	1.587E-05	

Daily Doses and Risk for : Arsenic

CADD (mg/kg-day)	1.78E-06	1.10E-06	
LADD (mg/kg-day)	1.53E-07	1.57E-07	3.10E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	8.902E-04	5.493E-04	

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	5.93E-05	3.66E-05	
LADD (mg/kg-day)	5.09E-06	5.23E-06	1.03E-05

Cancer Risk (-)	1.780E-07	1.831E-07	3.611E-07
Hazard Index (-)	1.187E-01	7.323E-02	

Daily Doses and Risk for : Benzo(a)pyrene

CADD (mg/kg-day)	7.72E-06	4.76E-06	
LADD (mg/kg-day)	6.61E-07	6.80E-07	1.34E-06
Cancer Risk (-)	1.653E-05	1.700E-05	3.353E-05
Hazard Index (-)	0.000E+00	0.000E+00	

Daily Doses and Risk for : Chromium (III)

CADD (mg/kg-day)	5.93E-05	3.66E-05	
LADD (mg/kg-day)	5.09E-06	5.23E-06	1.03E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.583E-03	9.765E-04	

Daily Doses and Risk for : Copper

CADD (mg/kg-day)	5.93E-05	3.66E-05	
LADD (mg/kg-day)	5.09E-06	5.23E-06	1.03E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.187E-04	7.323E-05	

Daily Doses and Risk for : Cyanide

CADD (mg/kg-day)	5.93E-05	3.66E-05	
LADD (mg/kg-day)	5.09E-06	5.23E-06	1.03E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.967E-03	1.831E-03	

Daily Doses and Risk for : Dibenzofuran

CADD (mg/kg-day)	7.72E-06	4.76E-06	
LADD (mg/kg-day)	6.61E-07	6.80E-07	1.34E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.286E-04	7.934E-05	

Daily Doses and Risk for : Dimethylphenol (2,4)

CADD (mg/kg-day)	5.93E-06	3.66E-06	
LADD (mg/kg-day)	5.09E-07	5.23E-07	1.03E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.967E-04	1.831E-04	

Daily Doses and Risk for : Ethylbenzene

CADD (mg/kg-day)	5.93E-05	3.66E-05	
LADD (mg/kg-day)	5.09E-06	5.23E-06	1.03E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	6.118E-04	3.775E-04	

Daily Doses and Risk for : Fluoranthene

CADD (mg/kg-day)	7.72E-06	4.76E-06	
LADD (mg/kg-day)	6.61E-07	6.80E-07	1.34E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.929E-04	1.190E-04	

Daily Doses and Risk for : Fluorene

CADD (mg/kg-day)	7.72E-06	4.76E-06	
LADD (mg/kg-day)	6.61E-07	6.80E-07	1.34E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.929E-04	1.190E-04	

Daily Doses and Risk for : Lead

CADD (mg/kg-day)	5.93E-06	3.66E-06	
LADD (mg/kg-day)	5.09E-07	5.23E-07	1.03E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.696E-03	1.046E-03	

Daily Doses and Risk for : Methyl napthalene (2)

CADD (mg/kg-day)	7.72E-06	4.76E-06	
LADD (mg/kg-day)	6.61E-07	6.80E-07	1.34E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.929E-03	1.190E-03	

Daily Doses and Risk for : 3- & 4-methylphenol			
CADD (mg/kg-day)	5.93E-06	3.66E-06	
LADD (mg/kg-day)	5.09E-07	5.23E-07	1.03E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.187E-04	7.323E-05	
Daily Doses and Risk for : Naphthalene			
CADD (mg/kg-day)	7.72E-06	4.76E-06	
LADD (mg/kg-day)	6.61E-07	6.80E-07	1.34E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.858E-04	2.380E-04	

Title:
Zone 1 Soils - Oral & Dermal - Recreational Child
File not saved

Scenarios:
Child Resident - Typical
Child Resident - RME

Routes:
INGESTION OF SOIL
DERMAL CONTACT WITH SOIL

Chemicals:
- Phenanthrene
- Phenol
- Pyrene
- Toluene
- TPH Aliphatic C6-8
- TPH Aliphatic C10-12
- TPH Aliphatic C16-35
- TPH Aromatic C10-12
- TPH Aromatic C16-21
- 1,2,4-trimethylbenzene
- Xylenes

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1	2
LIFETIME AND BODY WEIGHT		
Body Weight (kg)	13.2	34.5
Lifetime (years)	70.0	70.0
INGESTION OF SOIL		
Soil Ingestion Rate (mg/day)	100.	50.0
Exp. Frequency Soil (events/year)	265.	265.
Exp. Duration Soil (years)	6.00	10.0
Absorption Adjustment Factor for Ingestion of Soil (-)		
Phenanthrene	1.0	1.0
Phenol	1.0	1.0
Pyrene	1.0	1.0
Toluene	1.0	1.0
TPH Aliphatic C6-8	1.0	1.0
TPH Aliphatic C10-12	1.0	1.0
TPH Aliphatic C16-35	1.0	1.0
TPH Aromatic C10-12	1.0	1.0
TPH Aromatic C16-21	1.0	1.0
1,2,4-trimethylbenzene	1.0	1.0
Xylenes	1.0	1.0
Soil Bioavailability (-)		
Phenanthrene	1.0	1.0
Phenol	1.0	1.0

Pyrene	1.0	1.0
Toluene	1.0	1.0
TPH Aliphatic C6-8	1.0	1.0
TPH Aliphatic C10-12	1.0	1.0
TPH Aliphatic C16-35	1.0	1.0
TPH Aromatic C10-12	1.0	1.0
TPH Aromatic C16-21	1.0	1.0
1,2,4-trimethylbenzene	1.0	1.0
Xylenes	1.0	1.0

DERMAL CONTACT WITH SOIL

Total Skin Surface Area (cm^2)	2.158E+03	3.480E+03
Fraction Skin Exposed to Soil (-)	1.00	1.00
Adherence Factor for Soil (mg/cm^2)	0.500	0.500
Exposure Freq. Soil (events/year)	265.	265.
Exposure Duration Soil (years)	6.00	10.0
Absorption Adjustment Factor for Dermal Exposure to Soil (-)		
Phenanthrene	0.13	0.13
Phenol	0.10	0.10
Pyrene	0.13	0.13
Toluene	1.0	1.0
TPH Aliphatic C6-8	1.0	1.0
TPH Aliphatic C10-12	0.10	0.10
TPH Aliphatic C16-35	0.10	0.10
TPH Aromatic C10-12	0.10	0.10
TPH Aromatic C16-21	0.10	0.10
1,2,4-trimethylbenzene	1.0	1.0
Xylenes	1.0	1.0
Soil Bioavailability (-)		
Phenanthrene	1.0	1.0
Phenol	1.0	1.0
Pyrene	1.0	1.0
Toluene	1.0	1.0
TPH Aliphatic C6-8	1.0	1.0
TPH Aliphatic C10-12	1.0	1.0
TPH Aliphatic C16-35	1.0	1.0
TPH Aromatic C10-12	1.0	1.0
TPH Aromatic C16-21	1.0	1.0
1,2,4-trimethylbenzene	1.0	1.0
Xylenes	1.0	1.0

MEDIA CONCENTRATIONS

Concentration in Surficial Soil (mg/kg)
- Used to calculate risk and hazard index.

Phenanthrene	1.0	1.0
Phenol	1.0	1.0
Pyrene	1.0	1.0
Toluene	1.0	1.0
TPH Aliphatic C6-8	1.0	1.0
TPH Aliphatic C10-12	1.0	1.0
TPH Aliphatic C16-35	1.0	1.0
TPH Aromatic C10-12	1.0	1.0
TPH Aromatic C16-21	1.0	1.0
1,2,4-trimethylbenzene	1.0	1.0
Xylenes	1.0	1.0

SLOPE FACTORS AND REFERENCE DOSES

Ingestion Slope Factor [1/(mg/kg-day)]

Phenanthrene	ND	ND
Phenol	ND	ND
Pyrene	ND	ND
Toluene	ND	ND
TPH Aliphatic C6-8	ND	ND

TPH Aliphatic C10-12	ND	ND
TPH Aliphatic C16-35	ND	ND
TPH Aromatic C10-12	ND	ND
TPH Aromatic C16-21	ND	ND
1,2,4-trimethylbenzene	ND	ND
Xylenes	ND	ND

Ingestion Reference Dose (mg/kg-day)

Phenanthrene	0.30	0.30
Phenol	0.30	0.30
Pyrene	3.00E-02	3.00E-02
Toluene	0.22	0.22
TPH Aliphatic C6-8	5.0	5.0
TPH Aliphatic C10-12	0.10	0.10
TPH Aliphatic C16-35	2.0	2.0
TPH Aromatic C10-12	4.00E-02	4.00E-02
TPH Aromatic C16-21	3.00E-02	3.00E-02
1,2,4-trimethylbenzene	2.00E-03	2.00E-03
Xylenes	0.18	0.18

Dermal Slope Factor [1/(mg/kg-day)]

Phenanthrene	ND	ND
Phenol	ND	ND
Pyrene	ND	ND
Toluene	ND	ND
TPH Aliphatic C6-8	ND	ND
TPH Aliphatic C10-12	ND	ND
TPH Aliphatic C16-35	ND	ND
TPH Aromatic C10-12	ND	ND
TPH Aromatic C16-21	ND	ND
1,2,4-trimethylbenzene	ND	ND
Xylenes	ND	ND

Dermal Reference Dose (mg/kg-day)

Phenanthrene	0.30	0.30
Phenol	0.30	0.30
Pyrene	3.00E-02	3.00E-02
Toluene	0.22	0.22
TPH Aliphatic C6-8	5.0	5.0
TPH Aliphatic C10-12	0.10	0.10
TPH Aliphatic C16-35	2.0	2.0
TPH Aromatic C10-12	4.00E-02	4.00E-02
TPH Aromatic C16-21	3.00E-02	3.00E-02
1,2,4-trimethylbenzene	2.00E-03	2.00E-03
Xylenes	0.18	0.18

SUMMARY OF RESULTS	SCENARIO: 1	2	Added

INGESTION OF SOIL

Daily Doses and Risk for : Phenanthrene

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.833E-05	3.507E-06	

Daily Doses and Risk for : Phenol

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.833E-05	3.507E-06	

Daily Doses and Risk for : Pyrene

CADD (mg/kg-day)	5.50E-06	1.05E-06

LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.833E-04	3.507E-05	

Daily Doses and Risk for : Toluene

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.466E-05	4.718E-06	

Daily Doses and Risk for : TPH Aliphatic C6-8

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.100E-06	2.104E-07	

Daily Doses and Risk for : TPH Aliphatic C10-12

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	5.500E-05	1.052E-05	

Daily Doses and Risk for : TPH Aliphatic C16-35

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.750E-06	5.261E-07	

Daily Doses and Risk for : TPH Aromatic C10-12

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.375E-04	2.631E-05	

Daily Doses and Risk for : TPH Aromatic C16-21

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.833E-04	3.507E-05	

Daily Doses and Risk for : 1,2,4-trimethylbenzene

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.750E-03	5.261E-04	

Daily Doses and Risk for : Xylenes

CADD (mg/kg-day)	5.50E-06	1.05E-06	
LADD (mg/kg-day)	4.71E-07	1.50E-07	6.22E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.073E-05	5.878E-06	

DERMAL CONTACT WITH SOIL

Daily Doses and Risk for : Phenanthrene

CADD (mg/kg-day)	7.72E-06	4.76E-06	
LADD (mg/kg-day)	6.61E-07	6.80E-07	1.34E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.572E-05	1.587E-05	

Daily Doses and Risk for : Phenol

CADD (mg/kg-day)	5.93E-06	3.66E-06	
LADD (mg/kg-day)	5.09E-07	5.23E-07	1.03E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.978E-05	1.221E-05	

Daily Doses and Risk for : Pyrene

CADD (mg/kg-day)	7.72E-06	4.76E-06	
LADD (mg/kg-day)	6.61E-07	6.80E-07	1.34E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.572E-04	1.587E-04	

Daily Doses and Risk for : Toluene

CADD (mg/kg-day)	5.93E-05	3.66E-05	
LADD (mg/kg-day)	5.09E-06	5.23E-06	1.03E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.661E-04	1.642E-04	

Daily Doses and Risk for : TPH Aliphatic C6-8

CADD (mg/kg-day)	5.93E-05	3.66E-05	
LADD (mg/kg-day)	5.09E-06	5.23E-06	1.03E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.187E-05	7.323E-06	

Daily Doses and Risk for : TPH Aliphatic C10-12

CADD (mg/kg-day)	5.93E-06	3.66E-06	
LADD (mg/kg-day)	5.09E-07	5.23E-07	1.03E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	5.935E-05	3.662E-05	

Daily Doses and Risk for : TPH Aliphatic C16-35

CADD (mg/kg-day)	5.93E-06	3.66E-06	
LADD (mg/kg-day)	5.09E-07	5.23E-07	1.03E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.967E-06	1.831E-06	

Daily Doses and Risk for : TPH Aromatic C10-12

CADD (mg/kg-day)	5.93E-06	3.66E-06	
LADD (mg/kg-day)	5.09E-07	5.23E-07	1.03E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.484E-04	9.154E-05	

Daily Doses and Risk for : TPH Aromatic C16-21

CADD (mg/kg-day)	5.93E-06	3.66E-06	
LADD (mg/kg-day)	5.09E-07	5.23E-07	1.03E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.978E-04	1.221E-04	

Daily Doses and Risk for : 1,2,4-trimethylbenzene

CADD (mg/kg-day)	5.93E-05	3.66E-05	
LADD (mg/kg-day)	5.09E-06	5.23E-06	1.03E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.967E-02	1.831E-02	

Daily Doses and Risk for : Xylenes

CADD (mg/kg-day)	5.93E-05	3.66E-05	
LADD (mg/kg-day)	5.09E-06	5.23E-06	1.03E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.315E-04	2.046E-04	

Zone 1 Soils – Oral & Dermal, Recreational Adult

Title:
Zone 1 Soils - Oral & Dermal - Recreational Adult
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Scenarios:
Adult Resident - RME

Routes:
INGESTION OF SOIL
DERMAL CONTACT WITH SOIL

Chemicals:
- Acenaphthene
- Acenaphthylene
- Ammonia / ammonium
- Anthracene
- Arsenic
- Benzene
- Benzo(a)pyrene
- Chromium (III)
- Copper
- Cyanide
- Dibenzofuran
- Dimethylphenol (2,4)
- Ethylbenzene
- Fluoranthene
- Fluorene
- Lead
- Methyl napthalene (2)
- 3- & 4-methylphenol
- Naphthalene

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1
LIFETIME AND BODY WEIGHT	
Body Weight (kg)	70.0
Lifetime (years)	70.0
INGESTION OF SOIL	
Soil Ingestion Rate (mg/day)	50.0
Exp. Frequency Soil (events/year)	265.
Exp. Duration Soil (years)	54.0
Absorption Adjustment Factor for Ingestion of Soil (-)	
Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0
Naphthalene	1.0

Soil Bioavailability (-)	
Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0
Naphthalene	1.0

DERMAL CONTACT WITH SOIL

Total Skin Surface Area (cm^2)	4.700E+03
Fraction Skin Exposed to Soil (-)	1.00
Adherence Factor for Soil (mg/cm^2)	0.500
Exposure Freq. Soil (events/year)	265.
Exposure Duration Soil (years)	54.0
Absorption Adjustment Factor for Dermal Exposure to Soil (-)	
Acenaphthene	0.13
Acenaphthylene	0.13
Ammonia / ammonium	1.0
Anthracene	0.13
Arsenic	3.00E-02
Benzene	1.0
Benzo(a)pyrene	0.13
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	0.13
Dimethylphenol (2,4)	0.10
Ethylbenzene	1.0
Fluoranthene	0.13
Fluorene	0.13
Lead	0.10
Methyl napthalene (2)	0.13
3- & 4-methylphenol	0.10
Naphthalene	0.13

Soil Bioavailability (-)	
Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0

Naphthalene	1.0

MEDIA CONCENTRATIONS

Concentration in Surficial Soil (mg/kg)

- Used to calculate risk and hazard index.

Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0
Naphthalene	1.0

SLOPE FACTORS AND REFERENCE DOSES

Ingestion Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND
Acenaphthylene	ND
Ammonia / ammonium	ND
Anthracene	ND
Arsenic	ND
Benzene	3.50E-02
Benzo(a)pyrene	0.50
Chromium (III)	ND
Copper	ND
Cyanide	ND
Dibenzofuran	ND
Dimethylphenol (2,4)	ND
Ethylbenzene	ND
Fluoranthene	ND
Fluorene	ND
Lead	ND
Methyl napthalene (2)	ND
3- & 4-methylphenol	ND
Naphthalene	ND

Ingestion Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02
Acenaphthylene	6.00E-02
Ammonia / ammonium	ND
Anthracene	0.30
Arsenic	2.00E-03
Benzene	5.00E-04
Benzo(a)pyrene	ND
Chromium (III)	1.5
Copper	0.50
Cyanide	2.00E-02
Dibenzofuran	6.00E-02
Dimethylphenol (2,4)	2.00E-02
Ethylbenzene	9.70E-02
Fluoranthene	4.00E-02
Fluorene	4.00E-02
Lead	3.50E-03
Methyl napthalene (2)	4.00E-03

3- & 4-methylphenol	5.00E-02
Naphthalene	2.00E-02

Dermal Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND
Acenaphthylene	ND
Ammonia / ammonium	ND
Anthracene	ND
Arsenic	ND
Benzene	3.50E-02
Benzo(a)pyrene	25.
Chromium (III)	ND
Copper	ND
Cyanide	ND
Dibenzofuran	ND
Dimethylphenol (2,4)	ND
Ethylbenzene	ND
Fluoranthene	ND
Fluorene	ND
Lead	ND
Methyl napthalene (2)	ND
3- & 4-methylphenol	ND
Naphthalene	ND

Dermal Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02
Acenaphthylene	6.00E-02
Ammonia / ammonium	ND
Anthracene	0.30
Arsenic	2.00E-03
Benzene	5.00E-04
Benzo(a)pyrene	ND
Chromium (III)	3.75E-02
Copper	0.50
Cyanide	2.00E-02
Dibenzofuran	6.00E-02
Dimethylphenol (2,4)	2.00E-02
Ethylbenzene	9.70E-02
Fluoranthene	4.00E-02
Fluorene	4.00E-02
Lead	3.50E-03
Methyl napthalene (2)	4.00E-03
3- & 4-methylphenol	5.00E-02
Naphthalene	2.00E-02

SUMMARY OF RESULTS

INGESTION OF SOIL

Daily Doses and Risk for : Acenaphthene

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	8.643E-06

Daily Doses and Risk for : Acenaphthylene

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	8.643E-06

Daily Doses and Risk for : Ammonia / ammonium

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07

Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Anthracene

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.729E-06

Daily Doses and Risk for : Arsenic

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.593E-04

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	1.400E-08
Hazard Index (-)	1.037E-03

Daily Doses and Risk for : Benzo(a)pyrene

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	2.000E-07
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Chromium (III)

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.457E-07

Daily Doses and Risk for : Copper

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.037E-06

Daily Doses and Risk for : Cyanide

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.593E-05

Daily Doses and Risk for : Dibenzofuran

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	8.643E-06

Daily Doses and Risk for : Dimethylphenol (2,4)

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.593E-05

Daily Doses and Risk for : Ethylbenzene

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	5.346E-06

Daily Doses and Risk for : Fluoranthene

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.296E-05

Daily Doses and Risk for : Fluorene

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.296E-05

Daily Doses and Risk for : Lead

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.482E-04

Daily Doses and Risk for : Methyl napthalene (2)

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.296E-04

Daily Doses and Risk for : 3- & 4-methylphenol

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.037E-05

Daily Doses and Risk for : Naphthalene

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.593E-05

DERMAL CONTACT WITH SOIL

Daily Doses and Risk for : Acenaphthene

CADD (mg/kg-day)	3.17E-06
LADD (mg/kg-day)	2.44E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	5.281E-05

Daily Doses and Risk for : Acenaphthylene

CADD (mg/kg-day)	3.17E-06
LADD (mg/kg-day)	2.44E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	5.281E-05

Daily Doses and Risk for : Ammonia / ammonium

CADD (mg/kg-day)	2.44E-05
LADD (mg/kg-day)	1.88E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Anthracene

CADD (mg/kg-day)	3.17E-06
LADD (mg/kg-day)	2.44E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.056E-05

Daily Doses and Risk for : Arsenic

CADD (mg/kg-day)	7.31E-07
LADD (mg/kg-day)	5.64E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.656E-04

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	2.44E-05
LADD (mg/kg-day)	1.88E-05
Cancer Risk (-)	6.581E-07

Hazard Index (-)	4.875E-02

Daily Doses and Risk for : Benzo(a)pyrene

CADD (mg/kg-day)	3.17E-06
LADD (mg/kg-day)	2.44E-06
Cancer Risk (-)	6.111E-05
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Chromium (III)

CADD (mg/kg-day)	2.44E-05
LADD (mg/kg-day)	1.88E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.500E-04

Daily Doses and Risk for : Copper

CADD (mg/kg-day)	2.44E-05
LADD (mg/kg-day)	1.88E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.875E-05

Daily Doses and Risk for : Cyanide

CADD (mg/kg-day)	2.44E-05
LADD (mg/kg-day)	1.88E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.219E-03

Daily Doses and Risk for : Dibenzofuran

CADD (mg/kg-day)	3.17E-06
LADD (mg/kg-day)	2.44E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	5.281E-05

Daily Doses and Risk for : Dimethylphenol (2,4)

CADD (mg/kg-day)	2.44E-06
LADD (mg/kg-day)	1.88E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.219E-04

Daily Doses and Risk for : Ethylbenzene

CADD (mg/kg-day)	2.44E-05
LADD (mg/kg-day)	1.88E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.513E-04

Daily Doses and Risk for : Fluoranthene

CADD (mg/kg-day)	3.17E-06
LADD (mg/kg-day)	2.44E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.921E-05

Daily Doses and Risk for : Fluorene

CADD (mg/kg-day)	3.17E-06
LADD (mg/kg-day)	2.44E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.921E-05

Daily Doses and Risk for : Lead

CADD (mg/kg-day)	2.44E-06
LADD (mg/kg-day)	1.88E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.964E-04

Daily Doses and Risk for : Methyl napthalene (2)

CADD (mg/kg-day)	3.17E-06
LADD (mg/kg-day)	2.44E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.921E-04

Daily Doses and Risk for : 3- & 4-methylphenol

CADD (mg/kg-day)	2.44E-06
LADD (mg/kg-day)	1.88E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.875E-05

Daily Doses and Risk for : Naphthalene

CADD (mg/kg-day)	3.17E-06
LADD (mg/kg-day)	2.44E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.584E-04

Title:
Zone 1 Soils - Oral & Dermal - Recreational Adult
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Scenarios:
Adult Resident - RME

Routes:
INGESTION OF SOIL
DERMAL CONTACT WITH SOIL

Chemicals:
- Phenanthrene
- Phenol
- Pyrene
- Toluene
- TPH Aliphatic C6-8
- TPH Aliphatic C10-12
- TPH Aliphatic C16-35
- TPH Aromatic C10-12
- TPH Aromatic C16-21
- 1,2,4-trimethylbenzene
- Xylenes

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1
LIFETIME AND BODY WEIGHT	
Body Weight (kg)	70.0
Lifetime (years)	70.0
INGESTION OF SOIL	
Soil Ingestion Rate (mg/day)	50.0
Exp. Frequency Soil (events/year)	265.
Exp. Duration Soil (years)	54.0
Absorption Adjustment Factor for Ingestion of Soil (-)	
Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0
Soil Bioavailability (-)	
Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0

TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

DERMAL CONTACT WITH SOIL

Total Skin Surface Area (cm^2)	4.700E+03
Fraction Skin Exposed to Soil (-)	1.00
Adherence Factor for Soil (mg/cm^2)	0.500
Exposure Freq. Soil (events/year)	265.
Exposure Duration Soil (years)	54.0

Absorption Adjustment Factor for Dermal Exposure to Soil (-)

Phenanthrene	0.13
Phenol	0.10
Pyrene	0.13
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	0.10
TPH Aliphatic C16-35	0.10
TPH Aromatic C10-12	0.10
TPH Aromatic C16-21	0.10
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

Soil Bioavailability (-)

Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

MEDIA CONCENTRATIONS

Concentration in Surficial Soil (mg/kg)
- Used to calculate risk and hazard index.

Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

SLOPE FACTORS AND REFERENCE DOSES

Ingestion Slope Factor [1/(mg/kg-day)]

Phenanthrene	ND
Phenol	ND
Pyrene	ND
Toluene	ND
TPH Aliphatic C6-8	ND
TPH Aliphatic C10-12	ND
TPH Aliphatic C16-35	ND

TPH Aromatic C10-12	ND
TPH Aromatic C16-21	ND
1,2,4-trimethylbenzene	ND
Xylenes	ND

Ingestion Reference Dose (mg/kg-day)

Phenanthrene	0.30
Phenol	0.30
Pyrene	3.00E-02
Toluene	0.22
TPH Aliphatic C6-8	5.0
TPH Aliphatic C10-12	0.10
TPH Aliphatic C16-35	2.0
TPH Aromatic C10-12	4.00E-02
TPH Aromatic C16-21	3.00E-02
1,2,4-trimethylbenzene	2.00E-03
Xylenes	0.18

Dermal Slope Factor [1/(mg/kg-day)]

Phenanthrene	ND
Phenol	ND
Pyrene	ND
Toluene	ND
TPH Aliphatic C6-8	ND
TPH Aliphatic C10-12	ND
TPH Aliphatic C16-35	ND
TPH Aromatic C10-12	ND
TPH Aromatic C16-21	ND
1,2,4-trimethylbenzene	ND
Xylenes	ND

Dermal Reference Dose (mg/kg-day)

Phenanthrene	0.30
Phenol	0.30
Pyrene	3.00E-02
Toluene	0.22
TPH Aliphatic C6-8	5.0
TPH Aliphatic C10-12	0.10
TPH Aliphatic C16-35	2.0
TPH Aromatic C10-12	4.00E-02
TPH Aromatic C16-21	3.00E-02
1,2,4-trimethylbenzene	2.00E-03
Xylenes	0.18

SUMMARY OF RESULTS

INGESTION OF SOIL

Daily Doses and Risk for : Phenanthrene

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.729E-06

Daily Doses and Risk for : Phenol

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.729E-06

Daily Doses and Risk for : Pyrene

CADD (mg/kg-day)	5.19E-07
LADD (mg/kg-day)	4.00E-07
Cancer Risk (-)	0.000E+00

Hazard Index (-) 1.729E-05

Daily Doses and Risk for : Toluene
CADD (mg/kg-day) 5.19E-07
LADD (mg/kg-day) 4.00E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 2.326E-06

Daily Doses and Risk for : TPH Aliphatic C6-8
CADD (mg/kg-day) 5.19E-07
LADD (mg/kg-day) 4.00E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 1.037E-07

Daily Doses and Risk for : TPH Aliphatic C10-12
CADD (mg/kg-day) 5.19E-07
LADD (mg/kg-day) 4.00E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 5.186E-06

Daily Doses and Risk for : TPH Aliphatic C16-35
CADD (mg/kg-day) 5.19E-07
LADD (mg/kg-day) 4.00E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 2.593E-07

Daily Doses and Risk for : TPH Aromatic C10-12
CADD (mg/kg-day) 5.19E-07
LADD (mg/kg-day) 4.00E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 1.296E-05

Daily Doses and Risk for : TPH Aromatic C16-21
CADD (mg/kg-day) 5.19E-07
LADD (mg/kg-day) 4.00E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 1.729E-05

Daily Doses and Risk for : 1,2,4-trimethylbenzene
CADD (mg/kg-day) 5.19E-07
LADD (mg/kg-day) 4.00E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 2.593E-04

Daily Doses and Risk for : Xylenes
CADD (mg/kg-day) 5.19E-07
LADD (mg/kg-day) 4.00E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 2.897E-06

DERMAL CONTACT WITH SOIL

Daily Doses and Risk for : Phenanthrene
CADD (mg/kg-day) 3.17E-06
LADD (mg/kg-day) 2.44E-06
Cancer Risk (-) 0.000E+00
Hazard Index (-) 1.056E-05

Daily Doses and Risk for : Phenol
CADD (mg/kg-day) 2.44E-06
LADD (mg/kg-day) 1.88E-06
Cancer Risk (-) 0.000E+00
Hazard Index (-) 8.125E-06

Daily Doses and Risk for : Pyrene
CADD (mg/kg-day) 3.17E-06
LADD (mg/kg-day) 2.44E-06

Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.056E-04

Daily Doses and Risk for : Toluene

CADD (mg/kg-day)	2.44E-05
LADD (mg/kg-day)	1.88E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.093E-04

Daily Doses and Risk for : TPH Aliphatic C6-8

CADD (mg/kg-day)	2.44E-05
LADD (mg/kg-day)	1.88E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.875E-06

Daily Doses and Risk for : TPH Aliphatic C10-12

CADD (mg/kg-day)	2.44E-06
LADD (mg/kg-day)	1.88E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.437E-05

Daily Doses and Risk for : TPH Aliphatic C16-35

CADD (mg/kg-day)	2.44E-06
LADD (mg/kg-day)	1.88E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.219E-06

Daily Doses and Risk for : TPH Aromatic C10-12

CADD (mg/kg-day)	2.44E-06
LADD (mg/kg-day)	1.88E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.093E-05

Daily Doses and Risk for : TPH Aromatic C16-21

CADD (mg/kg-day)	2.44E-06
LADD (mg/kg-day)	1.88E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	8.125E-05

Daily Doses and Risk for : 1,2,4-trimethylbenzene

CADD (mg/kg-day)	2.44E-05
LADD (mg/kg-day)	1.88E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.219E-02

Daily Doses and Risk for : Xylenes

CADD (mg/kg-day)	2.44E-05
LADD (mg/kg-day)	1.88E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.362E-04

Zone 1 Soils – Oral & Dermal, Sub-Surface Maintenance Worker

Title:
Zone 1 Soils - Oral & Dermal - Sub-Surface Maintenance Worker
File not saved

Scenarios:
Worker - Typical

Routes:
INGESTION OF SOIL
DERMAL CONTACT WITH SOIL

Chemicals:
- Acenaphthene
- Acenaphthylene
- Ammonia / ammonium
- Anthracene
- Arsenic
- Benzene
- Benzo(a)pyrene
- Chromium (III)
- Copper
- Cyanide
- Dibenzofuran
- Dimethylphenol (2,4)
- Ethylbenzene
- Fluoranthene
- Fluorene
- Lead
- Methyl napthalene (2)
- 3- & 4-methylphenol
- Naphthalene

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1
LIFETIME AND BODY WEIGHT	
Body Weight (kg)	70.0
Lifetime (years)	70.0
INGESTION OF SOIL	
Soil Ingestion Rate (mg/day)	330.
Exp. Frequency Soil (events/year)	15.0
Exp. Duration Soil (years)	8.00
Absorption Adjustment Factor for Ingestion of Soil (-)	
Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0
Naphthalene	1.0

Soil Bioavailability (-)	
Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0
Naphthalene	1.0

DERMAL CONTACT WITH SOIL

Total Skin Surface Area (cm^2)	3.870E+03
Fraction Skin Exposed to Soil (-)	1.00
Adherence Factor for Soil (mg/cm^2)	1.50
Exposure Freq. Soil (events/year)	15.0
Exposure Duration Soil (years)	8.00
Absorption Adjustment Factor for Dermal Exposure to Soil (-)	
Acenaphthene	0.13
Acenaphthylene	0.13
Ammonia / ammonium	1.0
Anthracene	0.13
Arsenic	3.00E-02
Benzene	1.0
Benzo(a)pyrene	0.13
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	0.13
Dimethylphenol (2,4)	0.10
Ethylbenzene	1.0
Fluoranthene	0.13
Fluorene	0.13
Lead	0.10
Methyl napthalene (2)	0.13
3- & 4-methylphenol	0.10
Naphthalene	0.13

Soil Bioavailability (-)	
Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0

Naphthalene	1.0

MEDIA CONCENTRATIONS

Concentration in Surficial Soil (mg/kg)

- Used to calculate risk and hazard index.

Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0
Naphthalene	1.0

SLOPE FACTORS AND REFERENCE DOSES

Ingestion Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND
Acenaphthylene	ND
Ammonia / ammonium	ND
Anthracene	ND
Arsenic	ND
Benzene	3.50E-02
Benzo(a)pyrene	0.50
Chromium (III)	ND
Copper	ND
Cyanide	ND
Dibenzofuran	ND
Dimethylphenol (2,4)	ND
Ethylbenzene	ND
Fluoranthene	ND
Fluorene	ND
Lead	ND
Methyl napthalene (2)	ND
3- & 4-methylphenol	ND
Naphthalene	ND

Ingestion Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02
Acenaphthylene	6.00E-02
Ammonia / ammonium	ND
Anthracene	0.30
Arsenic	2.00E-03
Benzene	5.00E-04
Benzo(a)pyrene	ND
Chromium (III)	1.5
Copper	0.50
Cyanide	2.00E-02
Dibenzofuran	6.00E-02
Dimethylphenol (2,4)	2.00E-02
Ethylbenzene	9.70E-02
Fluoranthene	4.00E-02
Fluorene	4.00E-02
Lead	3.50E-03
Methyl napthalene (2)	4.00E-03

3- & 4-methylphenol	5.00E-02
Naphthalene	2.00E-02

Dermal Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND
Acenaphthylene	ND
Ammonia / ammonium	ND
Anthracene	ND
Arsenic	ND
Benzene	3.50E-02
Benzo(a)pyrene	25.
Chromium (III)	ND
Copper	ND
Cyanide	ND
Dibenzofuran	ND
Dimethylphenol (2,4)	ND
Ethylbenzene	ND
Fluoranthene	ND
Fluorene	ND
Lead	ND
Methyl napthalene (2)	ND
3- & 4-methylphenol	ND
Naphthalene	ND

Dermal Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02
Acenaphthylene	6.00E-02
Ammonia / ammonium	ND
Anthracene	0.30
Arsenic	2.00E-03
Benzene	5.00E-04
Benzo(a)pyrene	ND
Chromium (III)	3.75E-02
Copper	0.50
Cyanide	2.00E-02
Dibenzofuran	6.00E-02
Dimethylphenol (2,4)	2.00E-02
Ethylbenzene	9.70E-02
Fluoranthene	4.00E-02
Fluorene	4.00E-02
Lead	3.50E-03
Methyl napthalene (2)	4.00E-03
3- & 4-methylphenol	5.00E-02
Naphthalene	2.00E-02

SUMMARY OF RESULTS

INGESTION OF SOIL

Daily Doses and Risk for : Acenaphthene

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.229E-06

Daily Doses and Risk for : Acenaphthylene

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.229E-06

Daily Doses and Risk for : Ammonia / ammonium

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08

Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Anthracene

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.458E-07

Daily Doses and Risk for : Arsenic

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	9.687E-05

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	7.750E-10
Hazard Index (-)	3.875E-04

Daily Doses and Risk for : Benzo(a)pyrene

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	1.107E-08
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Chromium (III)

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.292E-07

Daily Doses and Risk for : Copper

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.875E-07

Daily Doses and Risk for : Cyanide

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	9.687E-06

Daily Doses and Risk for : Dibenzofuran

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.229E-06

Daily Doses and Risk for : Dimethylphenol (2,4)

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	9.687E-06

Daily Doses and Risk for : Ethylbenzene

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.997E-06

Daily Doses and Risk for : Fluoranthene

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.843E-06

Daily Doses and Risk for : Fluorene

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.843E-06

Daily Doses and Risk for : Lead

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	5.535E-05

Daily Doses and Risk for : Methyl napthalene (2)

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.843E-05

Daily Doses and Risk for : 3- & 4-methylphenol

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.875E-06

Daily Doses and Risk for : Naphthalene

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	9.687E-06

DERMAL CONTACT WITH SOIL

Daily Doses and Risk for : Acenaphthene

CADD (mg/kg-day)	4.43E-07
LADD (mg/kg-day)	5.06E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.384E-06

Daily Doses and Risk for : Acenaphthylene

CADD (mg/kg-day)	4.43E-07
LADD (mg/kg-day)	5.06E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.384E-06

Daily Doses and Risk for : Ammonia / ammonium

CADD (mg/kg-day)	3.41E-06
LADD (mg/kg-day)	3.89E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Anthracene

CADD (mg/kg-day)	4.43E-07
LADD (mg/kg-day)	5.06E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.477E-06

Daily Doses and Risk for : Arsenic

CADD (mg/kg-day)	1.02E-07
LADD (mg/kg-day)	1.17E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	5.112E-05

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	3.41E-06
LADD (mg/kg-day)	3.89E-07
Cancer Risk (-)	1.363E-08

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  Hazard Index (-)              6.816E-03

Daily Doses and Risk for : Benzo(a)pyrene
  CADD (mg/kg-day)              4.43E-07
  LADD (mg/kg-day)              5.06E-08
  Cancer Risk (-)               1.266E-06
  Hazard Index (-)              0.000E+00

Daily Doses and Risk for : Chromium (III)
  CADD (mg/kg-day)              3.41E-06
  LADD (mg/kg-day)              3.89E-07
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              9.088E-05

Daily Doses and Risk for : Copper
  CADD (mg/kg-day)              3.41E-06
  LADD (mg/kg-day)              3.89E-07
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              6.816E-06

Daily Doses and Risk for : Cyanide
  CADD (mg/kg-day)              3.41E-06
  LADD (mg/kg-day)              3.89E-07
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              1.704E-04

Daily Doses and Risk for : Dibenzofuran
  CADD (mg/kg-day)              4.43E-07
  LADD (mg/kg-day)              5.06E-08
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              7.384E-06

Daily Doses and Risk for : Dimethylphenol (2,4)
  CADD (mg/kg-day)              3.41E-07
  LADD (mg/kg-day)              3.89E-08
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              1.704E-05

Daily Doses and Risk for : Ethylbenzene
  CADD (mg/kg-day)              3.41E-06
  LADD (mg/kg-day)              3.89E-07
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              3.513E-05

Daily Doses and Risk for : Fluoranthene
  CADD (mg/kg-day)              4.43E-07
  LADD (mg/kg-day)              5.06E-08
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              1.108E-05

Daily Doses and Risk for : Fluorene
  CADD (mg/kg-day)              4.43E-07
  LADD (mg/kg-day)              5.06E-08
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              1.108E-05

Daily Doses and Risk for : Lead
  CADD (mg/kg-day)              3.41E-07
  LADD (mg/kg-day)              3.89E-08
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              9.737E-05

Daily Doses and Risk for : Methyl napthalene (2)
  CADD (mg/kg-day)              4.43E-07
  LADD (mg/kg-day)              5.06E-08
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              1.108E-04
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Daily Doses and Risk for : 3- & 4-methylphenol

CADD (mg/kg-day)	3.41E-07
LADD (mg/kg-day)	3.89E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.816E-06

Daily Doses and Risk for : Naphthalene

CADD (mg/kg-day)	4.43E-07
LADD (mg/kg-day)	5.06E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.215E-05

Title:
Zone 1 Soils - Oral & Dermal - Sub-Surface Maintenance Worker
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Scenarios:
Worker - Typical

Routes:
INGESTION OF SOIL
DERMAL CONTACT WITH SOIL

Chemicals:
- Phenanthrene
- Phenol
- Pyrene
- Toluene
- TPH Aliphatic C6-8
- TPH Aliphatic C10-12
- TPH Aliphatic C16-35
- TPH Aromatic C10-12
- TPH Aromatic C16-21
- 1,2,4-trimethylbenzene
- Xylenes

SUMMARY OF INPUT PARAMETERS — SCENARIO: 1

LIFETIME AND BODY WEIGHT

Body Weight (kg)	70.0
Lifetime (years)	70.0

INGESTION OF SOIL

Soil Ingestion Rate (mg/day)	330.
Exp. Frequency Soil (events/year)	15.0
Exp. Duration Soil (years)	8.00

Absorption Adjustment Factor for Ingestion of Soil (-)

Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

Soil Bioavailability (-)

Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0

TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

DERMAL CONTACT WITH SOIL

Total Skin Surface Area (cm^2)	3.870E+03
Fraction Skin Exposed to Soil (-)	1.00
Adherence Factor for Soil (mg/cm^2)	1.50
Exposure Freq. Soil (events/year)	15.0
Exposure Duration Soil (years)	8.00

Absorption Adjustment Factor for Dermal Exposure to Soil (-)

Phenanthrene	0.13
Phenol	0.10
Pyrene	0.13
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	0.10
TPH Aliphatic C16-35	0.10
TPH Aromatic C10-12	0.10
TPH Aromatic C16-21	0.10
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

Soil Bioavailability (-)

Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

MEDIA CONCENTRATIONS

Concentration in Surficial Soil (mg/kg)
- Used to calculate risk and hazard index.

Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

SLOPE FACTORS AND REFERENCE DOSES

Ingestion Slope Factor [1/(mg/kg-day)]

Phenanthrene	ND
Phenol	ND
Pyrene	ND
Toluene	ND
TPH Aliphatic C6-8	ND
TPH Aliphatic C10-12	ND
TPH Aliphatic C16-35	ND
TPH Aromatic C10-12	ND

TPH Aromatic C16-21	ND
1,2,4-trimethylbenzene	ND
Xylenes	ND

Ingestion Reference Dose (mg/kg-day)

Phenanthrene	0.30
Phenol	0.30
Pyrene	3.00E-02
Toluene	0.22
TPH Aliphatic C6-8	5.0
TPH Aliphatic C10-12	0.10
TPH Aliphatic C16-35	2.0
TPH Aromatic C10-12	4.00E-02
TPH Aromatic C16-21	3.00E-02
1,2,4-trimethylbenzene	2.00E-03
Xylenes	0.18

Dermal Slope Factor [1/(mg/kg-day)]

Phenanthrene	ND
Phenol	ND
Pyrene	ND
Toluene	ND
TPH Aliphatic C6-8	ND
TPH Aliphatic C10-12	ND
TPH Aliphatic C16-35	ND
TPH Aromatic C10-12	ND
TPH Aromatic C16-21	ND
1,2,4-trimethylbenzene	ND
Xylenes	ND

Dermal Reference Dose (mg/kg-day)

Phenanthrene	0.30
Phenol	0.30
Pyrene	3.00E-02
Toluene	0.22
TPH Aliphatic C6-8	5.0
TPH Aliphatic C10-12	0.10
TPH Aliphatic C16-35	2.0
TPH Aromatic C10-12	4.00E-02
TPH Aromatic C16-21	3.00E-02
1,2,4-trimethylbenzene	2.00E-03
Xylenes	0.18

SUMMARY OF RESULTS

INGESTION OF SOIL

Daily Doses and Risk for : Phenanthrene

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.458E-07

Daily Doses and Risk for : Phenol

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.458E-07

Daily Doses and Risk for : Pyrene

CADD (mg/kg-day)	1.94E-07
LADD (mg/kg-day)	2.21E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.458E-06

Daily Doses and Risk for : Toluene
CADD (mg/kg-day) 1.94E-07
LADD (mg/kg-day) 2.21E-08
Cancer Risk (-) 0.000E+00
Hazard Index (-) 8.688E-07

Daily Doses and Risk for : TPH Aliphatic C6-8
CADD (mg/kg-day) 1.94E-07
LADD (mg/kg-day) 2.21E-08
Cancer Risk (-) 0.000E+00
Hazard Index (-) 3.875E-08

Daily Doses and Risk for : TPH Aliphatic C10-12
CADD (mg/kg-day) 1.94E-07
LADD (mg/kg-day) 2.21E-08
Cancer Risk (-) 0.000E+00
Hazard Index (-) 1.937E-06

Daily Doses and Risk for : TPH Aliphatic C16-35
CADD (mg/kg-day) 1.94E-07
LADD (mg/kg-day) 2.21E-08
Cancer Risk (-) 0.000E+00
Hazard Index (-) 9.687E-08

Daily Doses and Risk for : TPH Aromatic C10-12
CADD (mg/kg-day) 1.94E-07
LADD (mg/kg-day) 2.21E-08
Cancer Risk (-) 0.000E+00
Hazard Index (-) 4.843E-06

Daily Doses and Risk for : TPH Aromatic C16-21
CADD (mg/kg-day) 1.94E-07
LADD (mg/kg-day) 2.21E-08
Cancer Risk (-) 0.000E+00
Hazard Index (-) 6.458E-06

Daily Doses and Risk for : 1,2,4-trimethylbenzene
CADD (mg/kg-day) 1.94E-07
LADD (mg/kg-day) 2.21E-08
Cancer Risk (-) 0.000E+00
Hazard Index (-) 9.687E-05

Daily Doses and Risk for : Xylenes
CADD (mg/kg-day) 1.94E-07
LADD (mg/kg-day) 2.21E-08
Cancer Risk (-) 0.000E+00
Hazard Index (-) 1.082E-06

DERMAL CONTACT WITH SOIL

Daily Doses and Risk for : Phenanthrene
CADD (mg/kg-day) 4.43E-07
LADD (mg/kg-day) 5.06E-08
Cancer Risk (-) 0.000E+00
Hazard Index (-) 1.477E-06

Daily Doses and Risk for : Phenol
CADD (mg/kg-day) 3.41E-07
LADD (mg/kg-day) 3.89E-08
Cancer Risk (-) 0.000E+00
Hazard Index (-) 1.136E-06

Daily Doses and Risk for : Pyrene
CADD (mg/kg-day) 4.43E-07
LADD (mg/kg-day) 5.06E-08
Cancer Risk (-) 0.000E+00

Hazard Index (-)	1.477E-05

Daily Doses and Risk for : Toluene

CADD (mg/kg-day)	3.41E-06
LADD (mg/kg-day)	3.89E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.528E-05

Daily Doses and Risk for : TPH Aliphatic C6-8

CADD (mg/kg-day)	3.41E-06
LADD (mg/kg-day)	3.89E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.816E-07

Daily Doses and Risk for : TPH Aliphatic C10-12

CADD (mg/kg-day)	3.41E-07
LADD (mg/kg-day)	3.89E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.408E-06

Daily Doses and Risk for : TPH Aliphatic C16-35

CADD (mg/kg-day)	3.41E-07
LADD (mg/kg-day)	3.89E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.704E-07

Daily Doses and Risk for : TPH Aromatic C10-12

CADD (mg/kg-day)	3.41E-07
LADD (mg/kg-day)	3.89E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	8.520E-06

Daily Doses and Risk for : TPH Aromatic C16-21

CADD (mg/kg-day)	3.41E-07
LADD (mg/kg-day)	3.89E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.136E-05

Daily Doses and Risk for : 1,2,4-trimethylbenzene

CADD (mg/kg-day)	3.41E-06
LADD (mg/kg-day)	3.89E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.704E-03

Daily Doses and Risk for : Xylenes

CADD (mg/kg-day)	3.41E-06
LADD (mg/kg-day)	3.89E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.904E-05

Zone 1 Soils – Oral & Dermal, Commercial / Industrial (Gardener / Landscaper)

Title:
Zone 1 Soils - Oral & Dermal - Commercial / Industrial (Landscaper / Gardener)
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Scenarios:
Worker - RME

Routes:
INGESTION OF SOIL
DERMAL CONTACT WITH SOIL

Chemicals:
- Acenaphthene
- Acenaphthylene
- Ammonia / ammonium
- Anthracene
- Arsenic
- Benzene
- Benzo(a)pyrene
- Chromium (III)
- Copper
- Cyanide
- Dibenzofuran
- Dimethylphenol (2,4)
- Ethylbenzene
- Fluoranthene
- Fluorene
- Lead
- Methyl napthalene (2)
- 3- & 4-methylphenol
- Naphthalene

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1
LIFETIME AND BODY WEIGHT	
Body Weight (kg)	70.0
Lifetime (years)	70.0
INGESTION OF SOIL	
Soil Ingestion Rate (mg/day)	25.0
Exp. Frequency Soil (events/year)	240.
Exp. Duration Soil (years)	30.0
Absorption Adjustment Factor for Ingestion of Soil (-)	
Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0

3- & 4-methylphenol	1.0
Naphthalene	1.0

Soil Bioavailability (-)

Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0
Naphthalene	1.0

DERMAL CONTACT WITH SOIL

Total Skin Surface Area (cm^2)	4.700E+03
Fraction Skin Exposed to Soil (-)	1.00
Adherence Factor for Soil (mg/cm^2)	0.500
Exposure Freq. Soil (events/year)	240.
Exposure Duration Soil (years)	30.0

Absorption Adjustment Factor for Dermal Exposure to Soil (-)

Acenaphthene	0.13
Acenaphthylene	0.13
Ammonia / ammonium	1.0
Anthracene	0.13
Arsenic	3.00E-02
Benzene	1.0
Benzo(a)pyrene	0.13
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	0.13
Dimethylphenol (2,4)	0.10
Ethylbenzene	1.0
Fluoranthene	0.13
Fluorene	0.13
Lead	0.10
Methyl napthalene (2)	0.13
3- & 4-methylphenol	0.10
Naphthalene	0.13

Soil Bioavailability (-)

Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0

Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0
Naphthalene	1.0

MEDIA CONCENTRATIONS

Concentration in Surficial Soil (mg/kg)
- Used to calculate risk and hazard index.

Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (III)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0
Naphthalene	1.0

SLOPE FACTORS AND REFERENCE DOSES

Ingestion Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND
Acenaphthylene	ND
Ammonia / ammonium	ND
Anthracene	ND
Arsenic	ND
Benzene	3.50E-02
Benzo(a)pyrene	0.50
Chromium (III)	ND
Copper	ND
Cyanide	ND
Dibenzofuran	ND
Dimethylphenol (2,4)	ND
Ethylbenzene	ND
Fluoranthene	ND
Fluorene	ND
Lead	ND
Methyl napthalene (2)	ND
3- & 4-methylphenol	ND
Naphthalene	ND

Ingestion Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02
Acenaphthylene	6.00E-02
Ammonia / ammonium	ND
Anthracene	0.30
Arsenic	2.00E-03
Benzene	5.00E-04
Benzo(a)pyrene	ND
Chromium (III)	1.5
Copper	0.50
Cyanide	2.00E-02
Dibenzofuran	6.00E-02
Dimethylphenol (2,4)	2.00E-02
Ethylbenzene	9.70E-02
Fluoranthene	4.00E-02

Fluorene	4.00E-02
Lead	3.50E-03
Methyl napthalene (2)	4.00E-03
3- & 4-methylphenol	5.00E-02
Naphthalene	2.00E-02

Dermal Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND
Acenaphthylene	ND
Ammonia / ammonium	ND
Anthracene	ND
Arsenic	ND
Benzene	3.50E-02
Benzo(a)pyrene	25.
Chromium (III)	ND
Copper	ND
Cyanide	ND
Dibenzofuran	ND
Dimethylphenol (2,4)	ND
Ethylbenzene	ND
Fluoranthene	ND
Fluorene	ND
Lead	ND
Methyl napthalene (2)	ND
3- & 4-methylphenol	ND
Naphthalene	ND

Dermal Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02
Acenaphthylene	6.00E-02
Ammonia / ammonium	ND
Anthracene	0.30
Arsenic	2.00E-03
Benzene	5.00E-04
Benzo(a)pyrene	ND
Chromium (III)	3.75E-02
Copper	0.50
Cyanide	2.00E-02
Dibenzofuran	6.00E-02
Dimethylphenol (2,4)	2.00E-02
Ethylbenzene	9.70E-02
Fluoranthene	4.00E-02
Fluorene	4.00E-02
Lead	3.50E-03
Methyl napthalene (2)	4.00E-03
3- & 4-methylphenol	5.00E-02
Naphthalene	2.00E-02

SUMMARY OF RESULTS

INGESTION OF SOIL

Daily Doses and Risk for : Acenaphthene

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.914E-06

Daily Doses and Risk for : Acenaphthylene

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.914E-06

Daily Doses and Risk for : Ammonia / ammonium
  CADD (mg/kg-day) 2.35E-07
  LADD (mg/kg-day) 1.01E-07
  Cancer Risk (-) 0.000E+00
  Hazard Index (-) 0.000E+00

Daily Doses and Risk for : Anthracene
  CADD (mg/kg-day) 2.35E-07
  LADD (mg/kg-day) 1.01E-07
  Cancer Risk (-) 0.000E+00
  Hazard Index (-) 7.828E-07

Daily Doses and Risk for : Arsenic
  CADD (mg/kg-day) 2.35E-07
  LADD (mg/kg-day) 1.01E-07
  Cancer Risk (-) 0.000E+00
  Hazard Index (-) 1.174E-04

Daily Doses and Risk for : Benzene
  CADD (mg/kg-day) 2.35E-07
  LADD (mg/kg-day) 1.01E-07
  Cancer Risk (-) 3.523E-09
  Hazard Index (-) 4.697E-04

Daily Doses and Risk for : Benzo(a)pyrene
  CADD (mg/kg-day) 2.35E-07
  LADD (mg/kg-day) 1.01E-07
  Cancer Risk (-) 5.032E-08
  Hazard Index (-) 0.000E+00

Daily Doses and Risk for : Chromium (III)
  CADD (mg/kg-day) 2.35E-07
  LADD (mg/kg-day) 1.01E-07
  Cancer Risk (-) 0.000E+00
  Hazard Index (-) 1.566E-07

Daily Doses and Risk for : Copper
  CADD (mg/kg-day) 2.35E-07
  LADD (mg/kg-day) 1.01E-07
  Cancer Risk (-) 0.000E+00
  Hazard Index (-) 4.697E-07

Daily Doses and Risk for : Cyanide
  CADD (mg/kg-day) 2.35E-07
  LADD (mg/kg-day) 1.01E-07
  Cancer Risk (-) 0.000E+00
  Hazard Index (-) 1.174E-05

Daily Doses and Risk for : Dibenzofuran
  CADD (mg/kg-day) 2.35E-07
  LADD (mg/kg-day) 1.01E-07
  Cancer Risk (-) 0.000E+00
  Hazard Index (-) 3.914E-06

Daily Doses and Risk for : Dimethylphenol (2,4)
  CADD (mg/kg-day) 2.35E-07
  LADD (mg/kg-day) 1.01E-07
  Cancer Risk (-) 0.000E+00
  Hazard Index (-) 1.174E-05

Daily Doses and Risk for : Ethylbenzene
  CADD (mg/kg-day) 2.35E-07
  LADD (mg/kg-day) 1.01E-07
  Cancer Risk (-) 0.000E+00
  Hazard Index (-) 2.421E-06

Daily Doses and Risk for : Fluoranthene
  CADD (mg/kg-day) 2.35E-07

LADD (mg/kg-day) 1.01E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 5.871E-06

Daily Doses and Risk for : Fluorene
CADD (mg/kg-day) 2.35E-07
LADD (mg/kg-day) 1.01E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 5.871E-06

Daily Doses and Risk for : Lead
CADD (mg/kg-day) 2.35E-07
LADD (mg/kg-day) 1.01E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 6.710E-05

Daily Doses and Risk for : Methyl napthalene (2)
CADD (mg/kg-day) 2.35E-07
LADD (mg/kg-day) 1.01E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 5.871E-05

Daily Doses and Risk for : 3- & 4-methylphenol
CADD (mg/kg-day) 2.35E-07
LADD (mg/kg-day) 1.01E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 4.697E-06

Daily Doses and Risk for : Naphthalene
CADD (mg/kg-day) 2.35E-07
LADD (mg/kg-day) 1.01E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 1.174E-05

DERMAL CONTACT WITH SOIL

Daily Doses and Risk for : Acenaphthene
CADD (mg/kg-day) 2.87E-06
LADD (mg/kg-day) 1.23E-06
Cancer Risk (-) 0.000E+00
Hazard Index (-) 4.783E-05

Daily Doses and Risk for : Acenaphthylene
CADD (mg/kg-day) 2.87E-06
LADD (mg/kg-day) 1.23E-06
Cancer Risk (-) 0.000E+00
Hazard Index (-) 4.783E-05

Daily Doses and Risk for : Ammonia / ammonium
CADD (mg/kg-day) 2.21E-05
LADD (mg/kg-day) 9.46E-06
Cancer Risk (-) 0.000E+00
Hazard Index (-) 0.000E+00

Daily Doses and Risk for : Anthracene
CADD (mg/kg-day) 2.87E-06
LADD (mg/kg-day) 1.23E-06
Cancer Risk (-) 0.000E+00
Hazard Index (-) 9.566E-06

Daily Doses and Risk for : Arsenic
CADD (mg/kg-day) 6.62E-07
LADD (mg/kg-day) 2.84E-07
Cancer Risk (-) 0.000E+00
Hazard Index (-) 3.311E-04

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	2.21E-05
LADD (mg/kg-day)	9.46E-06
Cancer Risk (-)	3.311E-07
Hazard Index (-)	4.415E-02

Daily Doses and Risk for : Benzo(a)pyrene

CADD (mg/kg-day)	2.87E-06
LADD (mg/kg-day)	1.23E-06
Cancer Risk (-)	3.075E-05
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Chromium (III)

CADD (mg/kg-day)	2.21E-05
LADD (mg/kg-day)	9.46E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	5.886E-04

Daily Doses and Risk for : Copper

CADD (mg/kg-day)	2.21E-05
LADD (mg/kg-day)	9.46E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.415E-05

Daily Doses and Risk for : Cyanide

CADD (mg/kg-day)	2.21E-05
LADD (mg/kg-day)	9.46E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.104E-03

Daily Doses and Risk for : Dibenzofuran

CADD (mg/kg-day)	2.87E-06
LADD (mg/kg-day)	1.23E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.783E-05

Daily Doses and Risk for : Dimethylphenol (2,4)

CADD (mg/kg-day)	2.21E-06
LADD (mg/kg-day)	9.46E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.104E-04

Daily Doses and Risk for : Ethylbenzene

CADD (mg/kg-day)	2.21E-05
LADD (mg/kg-day)	9.46E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.276E-04

Daily Doses and Risk for : Fluoranthene

CADD (mg/kg-day)	2.87E-06
LADD (mg/kg-day)	1.23E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.174E-05

Daily Doses and Risk for : Fluorene

CADD (mg/kg-day)	2.87E-06
LADD (mg/kg-day)	1.23E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.174E-05

Daily Doses and Risk for : Lead

CADD (mg/kg-day)	2.21E-06
LADD (mg/kg-day)	9.46E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.307E-04

Daily Doses and Risk for : Methyl napthalene (2)

CADD (mg/kg-day)	2.87E-06
LADD (mg/kg-day)	1.23E-06

Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.174E-04

Daily Doses and Risk for : 3- & 4-methylphenol

CADD (mg/kg-day)	2.21E-06
LADD (mg/kg-day)	9.46E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.415E-05

Daily Doses and Risk for : Naphthalene

CADD (mg/kg-day)	2.87E-06
LADD (mg/kg-day)	1.23E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.435E-04

Title:
Zone 1 Soils - Oral & Dermal - Commercial / Industrial (Landscaper / Gardener)
File not saved

Scenarios:
Worker - RME

Routes:
INGESTION OF SOIL
DERMAL CONTACT WITH SOIL

Chemicals:
- Phenanthrene
- Phenol
- Pyrene
- Toluene
- TPH Aliphatic C6-8
- TPH Aliphatic C10-12
- TPH Aliphatic C16-35
- TPH Aromatic C10-12
- TPH Aromatic C16-21
- 1,2,4-trimethylbenzene
- Xylenes

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1
LIFETIME AND BODY WEIGHT	
Body Weight (kg)	70.0
Lifetime (years)	70.0
INGESTION OF SOIL	
Soil Ingestion Rate (mg/day)	25.0
Exp. Frequency Soil (events/year)	240.
Exp. Duration Soil (years)	30.0
Absorption Adjustment Factor for Ingestion of Soil (-)	
Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0
Soil Bioavailability (-)	

Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

DERMAL CONTACT WITH SOIL

Total Skin Surface Area (cm^2)	4.700E+03
Fraction Skin Exposed to Soil (-)	1.00
Adherence Factor for Soil (mg/cm^2)	0.500
Exposure Freq. Soil (events/year)	240.
Exposure Duration Soil (years)	30.0

Absorption Adjustment Factor for Dermal Exposure to Soil (-)

Phenanthrene	0.13
Phenol	0.10
Pyrene	0.13
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	0.10
TPH Aliphatic C16-35	0.10
TPH Aromatic C10-12	0.10
TPH Aromatic C16-21	0.10
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

Soil Bioavailability (-)

Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

MEDIA CONCENTRATIONS

Concentration in Surficial Soil (mg/kg)
- Used to calculate risk and hazard index.

Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

SLOPE FACTORS AND REFERENCE DOSES

Ingestion Slope Factor [1/(mg/kg-day)]

Phenanthrene	ND
Phenol	ND
Pyrene	ND

Toluene	ND
TPH Aliphatic C6-8	ND
TPH Aliphatic C10-12	ND
TPH Aliphatic C16-35	ND
TPH Aromatic C10-12	ND
TPH Aromatic C16-21	ND
1,2,4-trimethylbenzene	ND
Xylenes	ND

Ingestion Reference Dose (mg/kg-day)

Phenanthrene	0.30
Phenol	0.30
Pyrene	3.00E-02
Toluene	0.22
TPH Aliphatic C6-8	5.0
TPH Aliphatic C10-12	0.10
TPH Aliphatic C16-35	2.0
TPH Aromatic C10-12	4.00E-02
TPH Aromatic C16-21	3.00E-02
1,2,4-trimethylbenzene	2.00E-03
Xylenes	0.18

Dermal Slope Factor [1/(mg/kg-day)]

Phenanthrene	ND
Phenol	ND
Pyrene	ND
Toluene	ND
TPH Aliphatic C6-8	ND
TPH Aliphatic C10-12	ND
TPH Aliphatic C16-35	ND
TPH Aromatic C10-12	ND
TPH Aromatic C16-21	ND
1,2,4-trimethylbenzene	ND
Xylenes	ND

Dermal Reference Dose (mg/kg-day)

Phenanthrene	0.30
Phenol	0.30
Pyrene	3.00E-02
Toluene	0.22
TPH Aliphatic C6-8	5.0
TPH Aliphatic C10-12	0.10
TPH Aliphatic C16-35	2.0
TPH Aromatic C10-12	4.00E-02
TPH Aromatic C16-21	3.00E-02
1,2,4-trimethylbenzene	2.00E-03
Xylenes	0.18

SUMMARY OF RESULTS

INGESTION OF SOIL

Daily Doses and Risk for : Phenanthrene

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.828E-07

Daily Doses and Risk for : Phenol

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.828E-07

Daily Doses and Risk for : Pyrene

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.828E-06

Daily Doses and Risk for : Toluene

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.053E-06

Daily Doses and Risk for : TPH Aliphatic C6-8

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.697E-08

Daily Doses and Risk for : TPH Aliphatic C10-12

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.348E-06

Daily Doses and Risk for : TPH Aliphatic C16-35

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.174E-07

Daily Doses and Risk for : TPH Aromatic C10-12

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	5.871E-06

Daily Doses and Risk for : TPH Aromatic C16-21

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.828E-06

Daily Doses and Risk for : 1,2,4-trimethylbenzene

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.174E-04

Daily Doses and Risk for : Xylenes

CADD (mg/kg-day)	2.35E-07
LADD (mg/kg-day)	1.01E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.312E-06

DERMAL CONTACT WITH SOIL

Daily Doses and Risk for : Phenanthrene

CADD (mg/kg-day)	2.87E-06
LADD (mg/kg-day)	1.23E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	9.566E-06

Daily Doses and Risk for : Phenol

CADD (mg/kg-day)	2.21E-06
LADD (mg/kg-day)	9.46E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.358E-06

Daily Doses and Risk for : Pyrene

CADD (mg/kg-day)	2.87E-06
LADD (mg/kg-day)	1.23E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	9.566E-05

Daily Doses and Risk for : Toluene

CADD (mg/kg-day)	2.21E-05
LADD (mg/kg-day)	9.46E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	9.899E-05

Daily Doses and Risk for : TPH Aliphatic C6-8

CADD (mg/kg-day)	2.21E-05
LADD (mg/kg-day)	9.46E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.415E-06

Daily Doses and Risk for : TPH Aliphatic C10-12

CADD (mg/kg-day)	2.21E-06
LADD (mg/kg-day)	9.46E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.207E-05

Daily Doses and Risk for : TPH Aliphatic C16-35

CADD (mg/kg-day)	2.21E-06
LADD (mg/kg-day)	9.46E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.104E-06

Daily Doses and Risk for : TPH Aromatic C10-12

CADD (mg/kg-day)	2.21E-06
LADD (mg/kg-day)	9.46E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	5.519E-05

Daily Doses and Risk for : TPH Aromatic C16-21

CADD (mg/kg-day)	2.21E-06
LADD (mg/kg-day)	9.46E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.358E-05

Daily Doses and Risk for : 1,2,4-trimethylbenzene

CADD (mg/kg-day)	2.21E-05
LADD (mg/kg-day)	9.46E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.104E-02

Daily Doses and Risk for : Xylenes

CADD (mg/kg-day)	2.21E-05
LADD (mg/kg-day)	9.46E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.233E-04

Zone 3 Seepage Water – Dermal – Adult

Title:
Zone 3 - Seepage Water Dermal - Adult
File not saved

Scenarios:
Adult Resident - RME

Routes:
DERMAL CONTACT WHILE SWIMMING

Chemicals:
- Acenaphthene
- Acenaphthylene
- Ammonia / ammonium
- Anthracene
- Arsenic
- Benzene
- Benzo(a)pyrene
- Chromium (VI)
- Copper
- Cyanide
- Dibenzofuran
- Dimethylphenol (2,4)
- Ethylbenzene
- Fluoranthene
- Fluorene
- Lead
- Methyl napthalene (2)
- 3- & 4-methylphenol
- Naphthalene

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1
LIFETIME AND BODY WEIGHT	
Body Weight (kg)	70.0
Lifetime (years)	70.0
DERMAL CONTACT WHILE SWIMMING	
Total Skin Surface Area (cm^2)	904.
Time in Surface Water (hour/day)	1.00
Exp. Freq Surface Water (events/yr)	24.0
Exp. Duration Surface Water (years)	54.0
Dermal Permeability Surface Water (cm/hour)	
Acenaphthene	8.60E-02
Acenaphthylene	9.11E-02
Ammonia / ammonium	1.00E-03
Anthracene	0.14
Arsenic	1.00E-03
Benzene	1.49E-02
Benzo(a)pyrene	0.71
Chromium (VI)	2.00E-03
Copper	1.00E-03
Cyanide	7.50E-04
Dibenzofuran	9.75E-02
Dimethylphenol (2,4)	1.09E-02
Ethylbenzene	4.93E-02
Fluoranthene	0.31
Fluorene	0.11
Lead	1.00E-04
Methyl napthalene (2)	9.17E-02
3- & 4-methylphenol	7.66E-03
Naphthalene	4.66E-02
Absorption Adjustment Factor for	

Dermal Exposure to Water (-)

Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (VI)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0
Naphthalene	1.0

MEDIA CONCENTRATIONS

Concentration in Surface Water (mg/l)
- Used to calculate risk and hazard index.

Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Chromium (VI)	1.0
Copper	1.0
Cyanide	1.0
Dibenzofuran	1.0
Dimethylphenol (2,4)	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Methyl napthalene (2)	1.0
3- & 4-methylphenol	1.0
Naphthalene	1.0

SLOPE FACTORS AND REFERENCE DOSES

Dermal Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND
Acenaphthylene	ND
Ammonia / ammonium	ND
Anthracene	ND
Arsenic	ND
Benzene	3.50E-02
Benzo(a)pyrene	0.50
Chromium (VI)	ND
Copper	ND
Cyanide	ND
Dibenzofuran	ND
Dimethylphenol (2,4)	ND
Ethylbenzene	ND
Fluoranthene	ND
Fluorene	ND
Lead	ND
Methyl napthalene (2)	ND
3- & 4-methylphenol	ND
Naphthalene	ND

Dermal Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02
Acenaphthylene	6.00E-02
Ammonia / ammonium	ND
Anthracene	0.30
Arsenic	2.00E-03
Benzene	5.00E-04
Benzo(a)pyrene	ND
Chromium (VI)	2.50E-05
Copper	0.50
Cyanide	2.00E-02
Dibenzofuran	6.00E-02
Dimethylphenol (2,4)	2.00E-02
Ethylbenzene	9.70E-02
Fluoranthene	4.00E-02
Fluorene	4.00E-02
Lead	3.50E-03
Methyl napthalene (2)	4.00E-03
3- & 4-methylphenol	5.00E-02
Naphthalene	2.00E-02

SUMMARY OF RESULTS

DERMAL CONTACT WHILE SWIMMING

Daily Doses and Risk for : Acenaphthene

CADD (mg/kg-day)	7.30E-05
LADD (mg/kg-day)	5.63E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.217E-03

Daily Doses and Risk for : Acenaphthylene

CADD (mg/kg-day)	7.74E-05
LADD (mg/kg-day)	5.97E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.289E-03

Daily Doses and Risk for : Ammonia / ammonium

CADD (mg/kg-day)	8.49E-07
LADD (mg/kg-day)	6.55E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Anthracene

CADD (mg/kg-day)	1.21E-04
LADD (mg/kg-day)	9.30E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.019E-04

Daily Doses and Risk for : Arsenic

CADD (mg/kg-day)	8.49E-07
LADD (mg/kg-day)	6.55E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.246E-04

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	1.27E-05
LADD (mg/kg-day)	9.76E-06
Cancer Risk (-)	3.416E-07
Hazard Index (-)	2.530E-02

Daily Doses and Risk for : Benzo(a)pyrene

CADD (mg/kg-day)	6.05E-04

LADD (mg/kg-day)	4.67E-04
Cancer Risk (-)	2.335E-04
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Chromium (VI)

CADD (mg/kg-day)	1.70E-06
LADD (mg/kg-day)	1.31E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.793E-02

Daily Doses and Risk for : Copper

CADD (mg/kg-day)	8.49E-07
LADD (mg/kg-day)	6.55E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.698E-06

Daily Doses and Risk for : Cyanide

CADD (mg/kg-day)	6.37E-07
LADD (mg/kg-day)	4.91E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.184E-05

Daily Doses and Risk for : Dibenzofuran

CADD (mg/kg-day)	8.28E-05
LADD (mg/kg-day)	6.39E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.380E-03

Daily Doses and Risk for : Dimethylphenol (2,4)

CADD (mg/kg-day)	9.26E-06
LADD (mg/kg-day)	7.14E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.628E-04

Daily Doses and Risk for : Ethylbenzene

CADD (mg/kg-day)	4.19E-05
LADD (mg/kg-day)	3.23E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.316E-04

Daily Doses and Risk for : Fluoranthene

CADD (mg/kg-day)	2.62E-04
LADD (mg/kg-day)	2.02E-04
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.539E-03

Daily Doses and Risk for : Fluorene

CADD (mg/kg-day)	9.34E-05
LADD (mg/kg-day)	7.21E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.335E-03

Daily Doses and Risk for : Lead

CADD (mg/kg-day)	8.49E-08
LADD (mg/kg-day)	6.55E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.426E-05

Daily Doses and Risk for : Methyl napthalene (2)

CADD (mg/kg-day)	7.79E-05
LADD (mg/kg-day)	6.01E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.947E-02

Daily Doses and Risk for : 3- & 4-methylphenol

CADD (mg/kg-day)	6.50E-06
LADD (mg/kg-day)	5.02E-06
Cancer Risk (-)	0.000E+00

Hazard Index (-) 1.301E-04

Daily Doses and Risk for : Naphthalene
CADD (mg/kg-day) 3.96E-05
LADD (mg/kg-day) 3.05E-05
Cancer Risk (-) 0.000E+00
Hazard Index (-) 1.979E-03

Title:
Zone 3 - Seepage Water Dermal - Adult
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Scenarios:
Adult Resident - RME

Routes:
DERMAL CONTACT WHILE SWIMMING

Chemicals:
Phenanthrene
Phenol
Pyrene
Toluene
TPH Aliphatic C6-8
TPH Aliphatic C10-12
TPH Aliphatic C16-35
TPH Aromatic C10-12
TPH Aromatic C16-21
1,2,4-trimethylbenzene
Xylenes

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1
LIFETIME AND BODY WEIGHT	
Body Weight (kg)	70.0
Lifetime (years)	70.0
DERMAL CONTACT WHILE SWIMMING	
Total Skin Surface Area (cm^2)	904.
Time in Surface Water (hour/day)	1.00
Exp. Freq Surface Water (events/yr)	24.0
Exp. Duration Surface Water (years)	54.0
Dermal Permeability Surface Water (cm/hour)	
Phenanthrene	0.14
Phenol	4.34E-03
Pyrene	0.20
Toluene	3.11E-02
TPH Aliphatic C6-8	0.75
TPH Aliphatic C10-12	1.9
TPH Aliphatic C16-35	0.30
TPH Aromatic C10-12	8.70E-02
TPH Aromatic C16-21	0.30
1,2,4-trimethylbenzene	8.57E-02
Xylenes	4.71E-02
Absorption Adjustment Factor for Dermal Exposure to Water (-)	
Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0

TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

MEDIA CONCENTRATIONS

Concentration in Surface Water (mg/l)
- Used to calculate risk and hazard index.

Phenanthrene	1.0
Phenol	1.0
Pyrene	1.0
Toluene	1.0
TPH Aliphatic C6-8	1.0
TPH Aliphatic C10-12	1.0
TPH Aliphatic C16-35	1.0
TPH Aromatic C10-12	1.0
TPH Aromatic C16-21	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

SLOPE FACTORS AND REFERENCE DOSES

Dermal Slope Factor [1/(mg/kg-day)]

Phenanthrene	ND
Phenol	ND
Pyrene	ND
Toluene	ND
TPH Aliphatic C6-8	ND
TPH Aliphatic C10-12	ND
TPH Aliphatic C16-35	ND
TPH Aromatic C10-12	ND
TPH Aromatic C16-21	ND
1,2,4-trimethylbenzene	ND
Xylenes	ND

Dermal Reference Dose (mg/kg-day)

Phenanthrene	0.30
Phenol	0.30
Pyrene	3.00E-02
Toluene	0.22
TPH Aliphatic C6-8	5.0
TPH Aliphatic C10-12	0.10
TPH Aliphatic C16-35	2.0
TPH Aromatic C10-12	4.00E-02
TPH Aromatic C16-21	3.00E-02
1,2,4-trimethylbenzene	2.00E-03
Xylenes	0.18

SUMMARY OF RESULTS

DERMAL CONTACT WHILE SWIMMING

Daily Doses and Risk for : Phenanthrene

CADD (mg/kg-day)	1.22E-04
LADD (mg/kg-day)	9.43E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.076E-04

Daily Doses and Risk for : Phenol

CADD (mg/kg-day)	3.69E-06
LADD (mg/kg-day)	2.84E-06
Cancer Risk (-)	0.000E+00

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  Hazard Index (-)              1.228E-05

Daily Doses and Risk for : Pyrene
  CADD (mg/kg-day)              1.71E-04
  LADD (mg/kg-day)              1.32E-04
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              5.689E-03

Daily Doses and Risk for : Toluene
  CADD (mg/kg-day)              2.64E-05
  LADD (mg/kg-day)              2.04E-05
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              1.184E-04

Daily Doses and Risk for : TPH Aliphatic C6-8
  CADD (mg/kg-day)              6.37E-04
  LADD (mg/kg-day)              4.91E-04
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              1.274E-04

Daily Doses and Risk for : TPH Aliphatic C10-12
  CADD (mg/kg-day)              1.61E-03
  LADD (mg/kg-day)              1.24E-03
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              1.613E-02

Daily Doses and Risk for : TPH Aliphatic C16-35
  CADD (mg/kg-day)              2.55E-04
  LADD (mg/kg-day)              1.97E-04
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              1.274E-04

Daily Doses and Risk for : TPH Aromatic C10-12
  CADD (mg/kg-day)              7.39E-05
  LADD (mg/kg-day)              5.70E-05
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              1.847E-03

Daily Doses and Risk for : TPH Aromatic C16-21
  CADD (mg/kg-day)              2.55E-04
  LADD (mg/kg-day)              1.97E-04
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              8.492E-03

Daily Doses and Risk for : 1,2,4-trimethylbenzene
  CADD (mg/kg-day)              7.28E-05
  LADD (mg/kg-day)              5.61E-05
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              3.639E-02

Daily Doses and Risk for : Xylenes
  CADD (mg/kg-day)              4.00E-05
  LADD (mg/kg-day)              3.09E-05
  Cancer Risk (-)               0.000E+00
  Hazard Index (-)              2.234E-04
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Zone 3 Seepage Water – Dermal - Child

Title:
Zone 3 - Seepage Water Dermal - Child
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Scenarios:
Child Resident - RME
Child Resident - Typical

Routes:
DERMAL CONTACT WHILE SWIMMING

Chemicals:
- Acenaphthene
- Acenaphthylene
- Ammonia / ammonium
- Anthracene
- Arsenic
- Benzene
- Benzo(a)pyrene
- Chromium (VI)
- Copper
- Cyanide
- Dibenzofuran
- Dimethylphenol (2,4)
- Ethylbenzene
- Fluoranthene
- Fluorene
- Lead
- Methyl napthalene (2)
- 3- & 4-methylphenol
- Naphthalene

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1	2
LIFETIME AND BODY WEIGHT		
Body Weight (kg)	13.2	34.5
Lifetime (years)	70.0	70.0
DERMAL CONTACT WHILE SWIMMING		
Total Skin Surface Area (cm^2)	313.	633.
Time in Surface Water (hour/day)	0.500	0.500
Exp. Freq Surface Water (events/yr)	24.0	24.0
Exp. Duration Surface Water (years)	6.00	10.0
Dermal Permeability Surface Water (cm/hour)		
Acenaphthene	8.60E-02	8.60E-02
Acenaphthylene	9.11E-02	9.11E-02
Ammonia / ammonium	1.00E-03	1.00E-03
Anthracene	0.14	0.14
Arsenic	1.00E-03	1.00E-03
Benzene	1.49E-02	1.49E-02
Benzo(a)pyrene	0.71	0.71
Chromium (VI)	2.00E-03	2.00E-03
Copper	1.00E-03	1.00E-03
Cyanide	7.50E-04	7.50E-04
Dibenzofuran	9.75E-02	9.75E-02
Dimethylphenol (2,4)	1.09E-02	1.09E-02
Ethylbenzene	4.93E-02	4.93E-02
Fluoranthene	0.31	0.31
Fluorene	0.11	0.11
Lead	1.00E-04	1.00E-04
Methyl napthalene (2)	9.17E-02	9.17E-02
3- & 4-methylphenol	7.66E-03	7.66E-03
Naphthalene	4.66E-02	4.66E-02

Absorption Adjustment Factor for Dermal Exposure to Water (-)		
Acenaphthene	1.0	1.0
Acenaphthylene	1.0	1.0
Ammonia / ammonium	1.0	1.0
Anthracene	1.0	1.0
Arsenic	1.0	1.0
Benzene	1.0	1.0
Benzo(a)pyrene	1.0	1.0
Chromium (VI)	1.0	1.0
Copper	1.0	1.0
Cyanide	1.0	1.0
Dibenzofuran	1.0	1.0
Dimethylphenol (2,4)	1.0	1.0
Ethylbenzene	1.0	1.0
Fluoranthene	1.0	1.0
Fluorene	1.0	1.0
Lead	1.0	1.0
Methyl napthalene (2)	1.0	1.0
3- & 4-methylphenol	1.0	1.0
Naphthalene	1.0	1.0

MEDIA CONCENTRATIONS

Concentration in Surface Water (mg/l) - Used to calculate risk and hazard index.		
Acenaphthene	1.0	1.0
Acenaphthylene	1.0	1.0
Ammonia / ammonium	1.0	1.0
Anthracene	1.0	1.0
Arsenic	1.0	1.0
Benzene	1.0	1.0
Benzo(a)pyrene	1.0	1.0
Chromium (VI)	1.0	1.0
Copper	1.0	1.0
Cyanide	1.0	1.0
Dibenzofuran	1.0	1.0
Dimethylphenol (2,4)	1.0	1.0
Ethylbenzene	1.0	1.0
Fluoranthene	1.0	1.0
Fluorene	1.0	1.0
Lead	1.0	1.0
Methyl napthalene (2)	1.0	1.0
3- & 4-methylphenol	1.0	1.0
Naphthalene	1.0	1.0

SLOPE FACTORS AND REFERENCE DOSES

Dermal Slope Factor [1/(mg/kg-day)]		
Acenaphthene	ND	ND
Acenaphthylene	ND	ND
Ammonia / ammonium	ND	ND
Anthracene	ND	ND
Arsenic	ND	ND
Benzene	3.50E-02	3.50E-02
Benzo(a)pyrene	0.50	0.50
Chromium (VI)	ND	ND
Copper	ND	ND
Cyanide	ND	ND
Dibenzofuran	ND	ND
Dimethylphenol (2,4)	ND	ND
Ethylbenzene	ND	ND
Fluoranthene	ND	ND
Fluorene	ND	ND
Lead	ND	ND
Methyl napthalene (2)	ND	ND
3- & 4-methylphenol	ND	ND

Naphthalene	ND	ND

Dermal Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02	6.00E-02
Acenaphthylene	6.00E-02	6.00E-02
Ammonia / ammonium	ND	ND
Anthracene	0.30	0.30
Arsenic	2.00E-03	2.00E-03
Benzene	5.00E-04	5.00E-04
Benzo(a)pyrene	ND	ND
Chromium (VI)	2.50E-05	2.50E-05
Copper	0.50	0.50
Cyanide	2.00E-02	2.00E-02
Dibenzofuran	6.00E-02	6.00E-02
Dimethylphenol (2,4)	2.00E-02	2.00E-02
Ethylbenzene	9.70E-02	9.70E-02
Fluoranthene	4.00E-02	4.00E-02
Fluorene	4.00E-02	4.00E-02
Lead	3.50E-03	3.50E-03
Methyl napthalene (2)	4.00E-03	4.00E-03
3- & 4-methylphenol	5.00E-02	5.00E-02
Naphthalene	2.00E-02	2.00E-02

SUMMARY OF RESULTS	SCENARIO: 1	2	Added

DERMAL CONTACT WHILE SWIMMING

Daily Doses and Risk for : Acenaphthene

CADD (mg/kg-day)	6.70E-05	5.19E-05	
LADD (mg/kg-day)	5.75E-06	7.41E-06	1.32E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.117E-03	8.646E-04	

Daily Doses and Risk for : Acenaphthylene

CADD (mg/kg-day)	7.10E-05	5.50E-05	
LADD (mg/kg-day)	6.09E-06	7.85E-06	1.39E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.184E-03	9.159E-04	

Daily Doses and Risk for : Ammonia / ammonium

CADD (mg/kg-day)	7.80E-07	6.03E-07	
LADD (mg/kg-day)	6.68E-08	8.62E-08	1.53E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	0.000E+00	0.000E+00	

Daily Doses and Risk for : Anthracene

CADD (mg/kg-day)	1.11E-04	8.57E-05	
LADD (mg/kg-day)	9.49E-06	1.22E-05	2.17E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.690E-04	2.855E-04	

Daily Doses and Risk for : Arsenic

CADD (mg/kg-day)	7.80E-07	6.03E-07	
LADD (mg/kg-day)	6.68E-08	8.62E-08	1.53E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.898E-04	3.016E-04	

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	1.16E-05	8.99E-06	
LADD (mg/kg-day)	9.96E-07	1.28E-06	2.28E-06
Cancer Risk (-)	3.485E-08	4.494E-08	7.979E-08
Hazard Index (-)	2.323E-02	1.798E-02	

Daily Doses and Risk for : Benzo(a)pyrene

CADD (mg/kg-day)	5.56E-04	4.30E-04	
LADD (mg/kg-day)	4.76E-05	6.14E-05	1.09E-04
Cancer Risk (-)	2.382E-05	3.072E-05	5.454E-05
Hazard Index (-)	0.000E+00	0.000E+00	

Daily Doses and Risk for : Chromium (VI)

CADD (mg/kg-day)	1.56E-06	1.21E-06	
LADD (mg/kg-day)	1.34E-07	1.72E-07	3.06E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	6.237E-02	4.826E-02	

Daily Doses and Risk for : Copper

CADD (mg/kg-day)	7.80E-07	6.03E-07	
LADD (mg/kg-day)	6.68E-08	8.62E-08	1.53E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.559E-06	1.206E-06	

Daily Doses and Risk for : Cyanide

CADD (mg/kg-day)	5.85E-07	4.52E-07	
LADD (mg/kg-day)	5.01E-08	6.46E-08	1.15E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.923E-05	2.262E-05	

Daily Doses and Risk for : Dibenzofuran

CADD (mg/kg-day)	7.60E-05	5.88E-05	
LADD (mg/kg-day)	6.52E-06	8.40E-06	1.49E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.267E-03	9.802E-04	

Daily Doses and Risk for : Dimethylphenol (2,4)

CADD (mg/kg-day)	8.50E-06	6.58E-06	
LADD (mg/kg-day)	7.28E-07	9.39E-07	1.67E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	4.249E-04	3.288E-04	

Daily Doses and Risk for : Ethylbenzene

CADD (mg/kg-day)	3.84E-05	2.97E-05	
LADD (mg/kg-day)	3.29E-06	4.25E-06	7.54E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.962E-04	3.066E-04	

Daily Doses and Risk for : Fluoranthene

CADD (mg/kg-day)	2.40E-04	1.86E-04	
LADD (mg/kg-day)	2.06E-05	2.65E-05	4.71E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	6.003E-03	4.645E-03	

Daily Doses and Risk for : Fluorene

CADD (mg/kg-day)	8.58E-05	6.64E-05	
LADD (mg/kg-day)	7.35E-06	9.48E-06	1.68E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.144E-03	1.659E-03	

Daily Doses and Risk for : Lead

CADD (mg/kg-day)	7.80E-08	6.03E-08	
LADD (mg/kg-day)	6.68E-09	8.62E-09	1.53E-08
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.227E-05	1.723E-05	

Daily Doses and Risk for : Methyl napthalene (2)

CADD (mg/kg-day)	7.15E-05	5.53E-05	
LADD (mg/kg-day)	6.13E-06	7.90E-06	1.40E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.787E-02	1.383E-02	

Daily Doses and Risk for : 3- & 4-methylphenol

CADD (mg/kg-day)	5.97E-06	4.62E-06	
LADD (mg/kg-day)	5.12E-07	6.60E-07	1.17E-06

Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.194E-04	9.241E-05	
Daily Doses and Risk for : Naphthalene			
CADD (mg/kg-day)	3.63E-05	2.81E-05	
LADD (mg/kg-day)	3.11E-06	4.02E-06	7.13E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.816E-03	1.405E-03	

Title:
Zone 3 - Seepage Water Dermal - Child
File not saved

Scenarios:
Child Resident - RME
Child Resident - Typical

Routes:
DERMAL CONTACT WHILE SWIMMING

Chemicals:
- Phenanthrene
- Phenol
- Pyrene
- Toluene
- TPH Aliphatic C6-8
- TPH Aliphatic C10-12
- TPH Aliphatic C16-35
- TPH Aromatic C10-12
- TPH Aromatic C16-21
- 1,2,4-trimethylbenzene
- Xylenes

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1	2
LIFETIME AND BODY WEIGHT		
Body Weight (kg)	13.2	34.5
Lifetime (years)	70.0	70.0
DERMAL CONTACT WHILE SWIMMING		
Total Skin Surface Area (cm^2)	313.	633.
Time in Surface Water (hour/day)	0.500	0.500
Exp. Freq Surface Water (events/yr)	24.0	24.0
Exp. Duration Surface Water (years)	6.00	10.0
Dermal Permeability Surface Water (cm/hour)		
Phenanthrene	0.14	0.14
Phenol	4.34E-03	4.34E-03
Pyrene	0.20	0.20
Toluene	3.11E-02	3.11E-02
TPH Aliphatic C6-8	0.75	0.75
TPH Aliphatic C10-12	1.9	1.9
TPH Aliphatic C16-35	0.30	0.30
TPH Aromatic C10-12	8.70E-02	8.70E-02
TPH Aromatic C16-21	0.30	0.30
1,2,4-trimethylbenzene	8.57E-02	8.57E-02
Xylenes	4.71E-02	4.71E-02
Absorption Adjustment Factor for Dermal Exposure to Water (-)		
Phenanthrene	1.0	1.0
Phenol	1.0	1.0
Pyrene	1.0	1.0
Toluene	1.0	1.0
TPH Aliphatic C6-8	1.0	1.0
TPH Aliphatic C10-12	1.0	1.0

TPH Aliphatic C16-35	1.0	1.0
TPH Aromatic C10-12	1.0	1.0
TPH Aromatic C16-21	1.0	1.0
1,2,4-trimethylbenzene	1.0	1.0
Xylenes	1.0	1.0

MEDIA CONCENTRATIONS

Concentration in Surface Water (mg/l)
- Used to calculate risk and hazard index.

Phenanthrene	1.0	1.0
Phenol	1.0	1.0
Pyrene	1.0	1.0
Toluene	1.0	1.0
TPH Aliphatic C6-8	1.0	1.0
TPH Aliphatic C10-12	1.0	1.0
TPH Aliphatic C16-35	1.0	1.0
TPH Aromatic C10-12	1.0	1.0
TPH Aromatic C16-21	1.0	1.0
1,2,4-trimethylbenzene	1.0	1.0
Xylenes	1.0	1.0

SLOPE FACTORS AND REFERENCE DOSES

Dermal Slope Factor [1/(mg/kg-day)]

Phenanthrene	ND	ND
Phenol	ND	ND
Pyrene	ND	ND
Toluene	ND	ND
TPH Aliphatic C6-8	ND	ND
TPH Aliphatic C10-12	ND	ND
TPH Aliphatic C16-35	ND	ND
TPH Aromatic C10-12	ND	ND
TPH Aromatic C16-21	ND	ND
1,2,4-trimethylbenzene	ND	ND
Xylenes	ND	ND

Dermal Reference Dose (mg/kg-day)

Phenanthrene	0.30	0.30
Phenol	0.30	0.30
Pyrene	3.00E-02	3.00E-02
Toluene	0.22	0.22
TPH Aliphatic C6-8	5.0	5.0
TPH Aliphatic C10-12	0.10	0.10
TPH Aliphatic C16-35	2.0	2.0
TPH Aromatic C10-12	4.00E-02	4.00E-02
TPH Aromatic C16-21	3.00E-02	3.00E-02
1,2,4-trimethylbenzene	2.00E-03	2.00E-03
Xylenes	0.18	0.18

SUMMARY OF RESULTS	SCENARIO: 1	2	Added

DERMAL CONTACT WHILE SWIMMING

Daily Doses and Risk for : Phenanthrene			
CADD (mg/kg-day)	1.12E-04	8.69E-05	
LADD (mg/kg-day)	9.62E-06	1.24E-05	2.20E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.742E-04	2.895E-04	
Daily Doses and Risk for : Phenol			
CADD (mg/kg-day)	3.38E-06	2.62E-06	
LADD (mg/kg-day)	2.90E-07	3.74E-07	6.64E-07

Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.128E-05	8.727E-06	

Daily Doses and Risk for : Pyrene

CADD (mg/kg-day)	1.57E-04	1.21E-04	
LADD (mg/kg-day)	1.34E-05	1.73E-05	3.08E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	5.223E-03	4.042E-03	

Daily Doses and Risk for : Toluene

CADD (mg/kg-day)	2.42E-05	1.88E-05	
LADD (mg/kg-day)	2.08E-06	2.68E-06	4.76E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.087E-04	8.413E-05	

Daily Doses and Risk for : TPH Aliphatic C6-8

CADD (mg/kg-day)	5.85E-04	4.52E-04	
LADD (mg/kg-day)	5.01E-05	6.46E-05	1.15E-04
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.169E-04	9.048E-05	

Daily Doses and Risk for : TPH Aliphatic C10-12

CADD (mg/kg-day)	1.48E-03	1.15E-03	
LADD (mg/kg-day)	1.27E-04	1.64E-04	2.91E-04
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.481E-02	1.146E-02	

Daily Doses and Risk for : TPH Aliphatic C16-35

CADD (mg/kg-day)	2.34E-04	1.81E-04	
LADD (mg/kg-day)	2.00E-05	2.59E-05	4.59E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.169E-04	9.048E-05	

Daily Doses and Risk for : TPH Aromatic C10-12

CADD (mg/kg-day)	6.78E-05	5.25E-05	
LADD (mg/kg-day)	5.81E-06	7.50E-06	1.33E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.696E-03	1.312E-03	

Daily Doses and Risk for : TPH Aromatic C16-21

CADD (mg/kg-day)	2.34E-04	1.81E-04	
LADD (mg/kg-day)	2.00E-05	2.59E-05	4.59E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	7.796E-03	6.032E-03	

Daily Doses and Risk for : 1,2,4-trimethylbenzene

CADD (mg/kg-day)	6.68E-05	5.17E-05	
LADD (mg/kg-day)	5.73E-06	7.39E-06	1.31E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.340E-02	2.585E-02	

Daily Doses and Risk for : Xylenes

CADD (mg/kg-day)	3.67E-05	2.84E-05	
LADD (mg/kg-day)	3.15E-06	4.06E-06	7.21E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.051E-04	1.587E-04	

Appendix D

Ecological Risk Assessment

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Ecological Risk Assessment for Proposed Imported Soils

Barangaroo Delivery Authority

Barangaroo Central
Hickson Road, Sydney, NSW

May 2012
JBS42021–50172 Rev B
JBS Environmental Pty Ltd

Ecological Risk Assessment for Proposed Imported Soils

Barangaroo Delivery Authority

Barangaroo Central
Hickson Road, Sydney, NSW

May 2012
JBS42021–50172 Rev B
JBS Environmental Pty Ltd

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Table of Contents

List of Abbreviations v

Definitions vii

Executive Summary viii

1 Introduction 1

1.1 Introduction and Background 1

1.2 Objectives 1

2 Summary Site Condition/Surrounding Environment 2

2.1 Site Identification 2

2.2 Current Site Condition 3

2.3 The Proposed Development / Current Design 3

2.3.1 Barangaroo Central Stage 1 Public Domain 4

2.3.2 Barangaroo Central Residential / Open Space Development 4

2.4 Surrounding Land use 5

2.5 Proposed Site Condition 5

2.6 Topography 6

2.7 Hydrology 6

2.8 Geology 7

2.8.1 Current Site Geology 7

2.8.2 Proposed Site Geology 7

2.9 Hydrogeology 8

2.10 Meteorology 9

3 Summary Site History/Previous Assessments 10

3.1 Barangaroo Project Site 10

3.2 Barangaroo Central 10

3.3 Previous Site Assessments 12

3.3.1 Environmental Site Assessment (ERM 2007) 12

3.3.2 Additional Investigation Works (ERM 2008a) 13

3.3.3 Stage 2 Remedial Action Plan (ERM 2008b) 14

3.3.4 AECOM Data Gap Investigation Remediation Works (South) Area (AECOM 2010a) 14

3.3.5 AECOM Data Gap Investigation EPA Declaration Area (AECOM 2010b) 14

3.3.6 AECOM Data Gap Investigation Remediation Works (North) Area (AECOM 2010c) 15

3.3.7 AECOM Additional Analysis 15

3.3.8 AECOM Intertidal Study (AECOM 2010d) 15

3.3.9 Douglas Partners Sampling and Analysis 15
3.3.10 JBS Data Gap Investigation (JBS 2012) 16
3.3.11 Data Quality 16
4 Conceptual Site Model 17
4.1 Geology 17
4.2 Hydrogeology and Water Balance 18
4.3 Constituents of Potential Concern (COPCs) 18
4.4 Existing Environmental Data 19
4.5 Potential Off-Site Sources of COPCs 19
4.6 Preferential Pathways 19
4.7 Potential Leaching of Environmental Impact 20
4.8 Exposure Pathways 20
4.9 Receptors 20
5 Issue Identification 21
5.1 Issue Identification 21
5.2 Identification of Environmental Hazards 21
5.3 Environmental Sampling and Analysis 22
5.4 Putting Hazards into their Environmental Health Context 22
5.5 Identification of Potential Interactions between Agents 23
5.6 Why is Risk Assessment Needed? 23
5.7 Limitations and Uncertainties 23
6 Selection of Constituents of Potential Concern 25
7 Phytotoxicity Assessment 26
7.1 Level of Protection 26
7.2 Exposure Pathways 27
7.3 Constituent Data 27
7.4 Use of Background Concentrations 27
7.5 Protection of Plants and Soil Criteria 32
7.6 Background Concentrations Relevant to Barangaroo Central 33
7.7 Surface Water and Groundwater Exposure Pathways 33
8 Protection of Surface Water Ecological Assessment 34
8.1 Determining the Leaching Potential of Inorganic Contaminants 34
8.2 Determining the Leaching Potential of Organic Contaminants 35
8.3 Organic Leachability Data 36
8.4 Determination of EILs for In-Situ Soils Protective of Surface Water 37
8.4.1 Inorganic Constituents 37

8.4.2 Organic Constituents 38
8.4.3 Dilution Attenuation Factor (DAF) 39
8.5 Calculation of EILs Protective of Surface Water Receptors 39
9 Sensitivity Analysis 42
9.1 Sampling Programs 42
9.2 Toxicological Parameters 43
9.3 Land-Use 43
9.4 Assignment of EILs to Soil Types 43
9.5 Conclusion 44
10 Conclusions and Recommendations 45
11 References 48
12 Limitations 50

Figures

Figure 1 Site Location
Figure 2 Barangaroo Central Site Plan
Figure 3 Barangaroo Central Concept Plan – Barangaroo Central Stage 1 Public Domain
Figure 4 Barangaroo Central Concept Plan – Barangaroo Residential / Open Space Development

Appendices

Appendix A – EPA Proposed Protection of Marine Water Criteria
Appendix B – EPA Proposed Terrestrial Soil Criteria
Appendix C – Summary of Leachability Data

List of Abbreviations

A list of the common abbreviations used throughout this report is provided below.

- ACL added contaminant level
- AHD Australian Height Datum
- As Arsenic
- Cd Cadmium
- Cr Chromium
- Cu Copper
- BDA Barangaroo Delivery Authority
- BTEX Benzene, Toluene, Ethylbenzene and Xylenes
- B(a)P Benzo (a) pyrene
- COPCs Constituents of Potential Concerns
- DECCW NSW Department of Environment Climate Change and Water
- DQO Data Quality Objectives
- DP Deposited Plan
- EPA NSW Environment Protection Authority
- HHERA Human Health and Ecological Risk Assessment
- Hg Mercury
- HI Hazard Index
- HIL Health Based Investigation Level
- LOR Limit of Reporting
- LTEMP Long Term Environmental Management Plan
- MAH Monocyclic Aromatic Hydrocarbon
- mbgl metres below ground level
- Ni Nickel
- OCP Organochlorine Pesticide
- OEH NSW Office of Environment and Heritage
- OoW NSW Office of Water
- SAR Site Audit Report
- SAS Site Audit Statement
- PAH Polycyclic Aromatic Hydrocarbons
- Pb Lead
- PIL Phytotoxicity Based Investigation Level
- PCB Polychlorinated Biphenyls
- PQL Practical Quantitation Limit

- PSH Phase Separated Hydrocarbons
- QA/QC Quality Assurance/Quality Control
- REMP Remediation Environmental Management Plan
- RME Reasonably Maximum Exposed
- ROHSMP Remediation Occupational Health and Safety Management Plan
- RPD Relative Percentage Difference
- SWC Sydney Water Corporation
- TEF Toxicity Equivalence Factor
- TPH Total Petroleum Hydrocarbons (C_6-C_9 and C_{10}-C_{36})
- Zn Zinc

Definitions

For the purposes of this document, the following definitions apply:

- "Barangaroo Central" – refers to the central portion of the Barangaroo site comprising part Lots 5 and 6 in DP876514. Located adjoining the southern boundary of the Headland Park Site, adjoining the northern boundary of the Stage 1 development and adjoining the northern and part of the western boundary of the Declaration Area.
- "Barangaroo Project Site" – refers to the Barangaroo Site, as defined in this ERA, and adjoining parts of Sussex Street, Hickson Road and Towns Place.
- "Declaration Area" - refers to the part of the Barangaroo Project Site which is the subject of the declaration of Significantly Contaminated Land by the NSW DECCW under the *Contaminated Land Management Act 1997* (Declaration Number 21122, Area Number 3221, dated 6 May 2009). Inclusive of part Lots 3 and 5 in DP876514.
- "Headland Park Site" – refers to Part Lots 1, 5 & 6 and Lot 4 of DP 876514 located at the northern portion of the Barangaroo Site and includes adjacent parts of Hickson Road and Towns Place.
- "Imported Materials" – refers to fill/soil/rock materials imported onto the Barangaroo Central Site as part of the remediation works, sourced from land other than the Barangaroo Project Site, as defined in this RAP.
- "Overarching RAP" – refers to the Overarching RAP for the whole Barangaroo Project Site, prepared by ERM Australia Pty Ltd.
- "Remediation Consultant" – refers to JBS Environmental Pty Ltd.
- "Risk-based Criteria" – refers to the criteria proposed to be established in the Barangaroo Central HHERA, which will form part of the Site Acceptance Criteria for acceptance of materials to Barangaroo Central.
- "Site Materials" – refers to fill/soil/rock materials sourced from land within the Barangaroo Project Site.
- "Stage 1 Development" – refers to the southern part of the Barangaroo Project Site, which will be developed for commercial/residential/open space uses. This includes Lot 3 and part Lots 5 and 6 in DP876514.

Executive Summary

JBS Environmental Pty Ltd (JBS) was engaged by the Barangaroo Delivery Authority (BDA) to complete an ecological risk assessment for the portion of the Barangaroo Project Site known as the Barangaroo Central Site. The Barangaroo Central Site is proposed to be initially developed as the Barangaroo Central Stage 1 Public Domain, which consists of a range of open space uses and car parking. In the future, the Barangaroo Central Site will be developed for a mixture of high density residential and open space uses.

It is proposed that imported fill materials, anticipated to include site materials from other portions of the Barangaroo Project Site, will be used to form the proposed profile of the Barangaroo Central Stage 1 Public Domain, and be retained in open space areas of the proposed high density residential / open space development of the site. It is estimated that between 80 000 and 150 000 m^3 of materials will be required to develop the proposed final landform of the open space areas.

Imported fill materials will be required to be environmentally suitable to be used on the Barangaroo Central Site. This ecological risk assessment has been undertaken to derive criteria for ecological exposure settings where Regulator provided / endorsed criteria are not available. Ecological assessment criteria have been provided for:

- Criteria for Protection of Plants and Soil; and
- Criteria for Protection of Marine Water Quality.

The risk assessment has considered a range of ecological exposure scenarios for the proposed development of Barangaroo Central. The key facets of the proposed Barangaroo Central development plans that have been considered in the risk assessment include:

- Provision of root zone soils to areas of site plantings designated as lawn areas, shrubs, or large tree plantings;
- Potential leaching of imported fill materials and discharge of leachate through seepage water / groundwater to the marine environment of Darling Harbour.

On the basis of these land-use parameters and the conceptual plans for Barangaroo Central, and with consideration of the limitations provided in **Section 12**, the risk based ecological criteria have been derived for use on the Barangaroo Central Site are summarised in **Table E1**. It is intended that each of the criteria are to be applied as follows:

- Ecological Investigation Level (EIL) Protective of Potential Phytotoxicity Effects – to be applied to soils classified as root zone soils;
- EIL Protective of Surface Water – Saturated Zone – to be applied to imported fill materials that are proposed to be used below the depth of groundwater (assumed to be 1.9 m AHD based on the predicted 2100 high water mark); and
- EIL Protective of Surface Water – Unsaturated Zone – to be applied to imported fill materials used above the depth of groundwater (assumed to be 1.9m AHD).

Table E1: Summary of Ecological Risk Based Criteria for Imported Fill to be Used at Barangaroo Central

Constituent	Ecological Criteria		
	Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Ecological Investigation Level Protective of Surface Water – Saturated Soils	Ecological Investigation Level Protective of Surface Water – Unsaturated Soils
	mg/kg	mg/kg	mg/kg
Arsenic	20	4.6	18
Cadmium	3	0.1	0.2
Chromium (VI)[1]	-	18	70
Chromium (total)	190	-	-
Cobalt	-	1.7	6.7
Copper	60	6.8	27
Lead	1100	46	190
Mercury	1	0.2	0.9
Nickel	30	210	850
Vanadium	-	300	1200
Zinc	200	20	79
Cyanide (free)	0.9	0.4	1.6
Ammonia	20	<LOR	<LOR
Benzene	0.2	0.1	0.3
Toluene	0.3	<LOR	0.1
Ethylbenzene	0.8	<LOR	0.1
Xylene	-	<LOR	0.1
Styrene	-	<LOR	0.4
Acenaphthene	29 (sum)	0.4	1.5
Acenaphthylene		0.7	2.7
Anthracene		<LOR	<LOR
Fluorene		1.2	4.7
Naphthalene		1.6	6.4
Phenanthrene		0.1	0.5
2-methylnaphthalene	-	<LOR	<LOR
Benz(a)anthracene	18 (sum)	-	-
Benzo(a)pyrene		0.2[2]	0.7[2]
Benzo(b)fluoranthene		-	-
Benzo(g,h,i)perylene		-	-
Benzo(k)fluoranthene		-	-
Chrysene		-	-
Dibenz(a,h)anthracene		-	-
Fluoranthene		1.2	4.7
Indeno(1,2,3-c,d)pyrene		-	-
Pyrene		<LOR	0.1
Dibenzofuran	-	<LOR	<LOR
Phenol	3.8	-	-
Cresols	3.8	<LOR	<LOR
2,4-dimethylphenol	3.8	<LOR	<LOR
TPH C_6-C_9	210	<LOR	<LOR
TPH C_{10}-C_{14}	150	<LOR	<LOR
TPH C_{15}-C_{36}	300	-	-

Note: <LOR – below typical laboratory limit of reading

1. Criteria for chromium (VI)
2. To be assessed as per equivalent toxicity equivalence factor (TEF) to benzo(a)pyrene. Sum of carcinogenic PAHs to be summed, with multiplication of TEF, and assessed to benzo(a)pyrene criteria. As per WHO (2003) 'Polynuclear aromatic hydrocarbons in Drinking-water' relative potencies of Benz(a)anthracene – 0.1; Benzo(a)pyrene – 1.0; Benzo(b)fluoranthene – 0.1; Benzo(g,h,i)perylene – 0.01; Benzo(k)fluoranthene – 0.1; Chrysene – 0.01; Dibenz(a,h)anthracene – 1.0; and Indeno(1,2,3-c,d)pyrene – 0.1.

In addition to these ecological risk based criteria for soils, all discharges from the site are required to meet water quality limits to be protective of Darling Harbour. For the majority of constituents, these water quality limits have been provided to the Barangaroo Protection of the Environment Operations Act 1997 Licence Variation Application – EPL 13336. For constituents assessed in the risk assessment that are not listed in the environmental licence, reference has been made to the marine water quality criteria as based on EPA endorsed guidelines and standards and adjusted for some constituents by a mixture modifying factor. Surface water protection criteria are summarised in **Table E2**.

Table E2: Surface Water Protection Criteria for Discharges from Barangaroo Central (µg/L)

Constituent	Protection of Surface Water Quality Criteria
Arsenic	2.3[2]
Cadmium	0.7[2]
Chromium (III)	27[2]
Chromium (VI)	4.4[2]
Cobalt	1[3]
Copper	1.3[2]
Lead	4.4[2]
Mercury	0.1[2]
Nickel	7[2]
Vanadium	100[3]
Zinc	15[2]
Ammonia	910[3]
Cyanide	4[3]
Benzene	500[2]
Toluene	180[2]
Ethylbenzene	80[2]
m&p-Xylene	75[2]
o-Xylene	350[2]
Styrene	72[3]
Acenaphthene	2[1, 2]
Acenaphthylene	2[1, 2]
Anthracene	2[1, 2]
Benzo(a)pyrene	2[1, 2]
Benzo(a)anthracene	2[1, 2]
Benzo(b)fluoranthene	2[1, 2]
Benzo(k)fluoranthene	2[1, 2]
Benzo(g,h,i)perylene	2[1, 2]
Dibenz(a,h)anthracene	2[1, 2]
Fluoranthene	2[1, 2]
Fluorene	2[1, 2]
Indeno(1,2,3-c,d)pyrene	2[1, 2]
Naphthalene	50[2]
Phenanthrene	2[1, 2]
Pyrene	2[1, 2]
2-methylnaphthalene	0.42[3]
Phenol	400[2]
Cresols	4.29[3]
2,4-dimethylphenol	0.66[3]
Dibenzofuran	0.74[3]
TPH C_6-C_9	20[1, 2]
TPH C_{10}-C_{14}	50[1, 2]
TPH C_{15}-C_{28}	100[1, 2]
TPH C_{29}-C_{36}	50[1, 2]

Note: 1. Based on limit of reporting.
2. As per Licence limits.
3. As per EPA provided protection of marine water quality criteria with mixture modifying factors included where appropriate.

JBS Environmental (February 2012) *'Human Health and Ecological Risk Assessment for Proposed Imported Soils Barangaroo Delivery Authority Barangaroo Central'* has also been prepared for Barangaroo soils, detailing human health risk based criteria which are required to be considered for imported fill materials to be used on the site, in addition to the ecological based criteria presented in this document.

1 Introduction

1.1 Introduction and Background

JBS Environmental Pty Ltd (JBS) was engaged by the Barangaroo Delivery Authority (BDA) to complete an ecological risk assessment (ERA) for the portion of the Barangaroo Project Site known as the Barangaroo Central Site. The Barangaroo Central Site is proposed to be initially developed as the Barangaroo Central Stage 1 Public Domain, which consists of a range of open space uses and car parking. In the future, the Barangaroo Central Site will be developed for a mixture of high density residential and open space uses.

It is proposed that imported fill materials, anticipated to include site materials from other portions of the Barangaroo Project Site, will be used to form the proposed profile of the Barangaroo Central Stage 1 Public Domain, and be retained in open space areas of the proposed high density residential / open space development of the site. It is estimated that between 80 000 and 150 000 m^3 of materials will be required to develop the proposed final landform of the open space areas.

Imported fill materials are required to be environmentally suitable to be used on the Barangaroo Central Site. The ERA has been undertaken to derive ecological criteria for ecological exposure settings where Regulator provided / endorsed criteria are not available. Ecological assessment criteria have been provided for:

- Criteria for Protection of Plants and Soil; and
- Criteria for Protection of Marine Water Quality.

Ecological soil criteria have been required to be derived from the Regulator provided criteria, for waters, to set levels of soil constituents that are protective of potential leaching to surface water. Derivation of the soil criteria has been undertaken substantially in accordance with the methodology outlined in Heemsbergen D, Warne M, McLaughlin M and Kookana R CSIRO (October 2009) '*The Australian Methodology to Derive Ecological Investigation Levels in Contaminated Soils*' (CSIRO, 2009). Criteria for the protection of marine receptors have been prepared in substantial accordance with ANZECC/ARMCANZ (2000) '*Australian and New Zealand Guidelines for Fresh and Marine Water Quality*'.

The findings of the risk assessment shall be used to assess suitability of site materials proposed to be used on the Barangaroo Central as fill materials (including use as a growing medium / root zone soils).

1.2 Objectives

The objective of the ERA is to establish environmental standards to assess the ecological suitability of site materials from other parts of the Barangaroo Project Site, proposed to be used as imported fill materials in the development of Barangaroo Central, for ecological exposure pathways not addressed by the Regulator published criteria.

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2 Summary Site Condition / Surrounding Environment

2.1 Site Identification

The Barangaroo Project Site is located at Hickson Road, Millers Point, NSW and is legally referred to as Lots 1, 3, 4, 5 and 6 Deposited Plan (DP) 876514 and includes the adjacent parts of Sussex Street, Hickson Road and Towns Place, as shown in **Figure 1**. The Barangaroo Project Site details are summarised in **Table 2.1** and described in more detail in the following sections.

Table 2.1 Summary Details for the Barangaroo Project Site

Lot/DP	Lots 1, 3, 4, 5 and 6 of Deposited Plan 876514, including adjacent parts of Sussex Street, Hickson Road and Towns Place
Address	Hickson Road Millers Point NSW
Local Government Authority	City of Sydney
Site Zoning	Zone B4 Mixed Use and RE1 Public Recreation
Current Use	Vacant/Roadway
Geographical Co-ordinates, Elevation	Easting – 333643m E, Northing – 6251851m S, 2-3m AHD
Site Area	Approximately 22 ha

The Barangaroo Central Site is located within the central portion of the Barangaroo Project Site. Site details are summarised in **Table 2.2** and described in more detail in the following sections. The extent of the site is shown as **Figure 2**.

Table 2.2 Summary Details for the Barangaroo Central Site

Lot/DP	Part Lots 5 and 6 of Deposited Plan 876514
Address	Hickson Rd Millers Point NSW
Local Government Authority	City of Sydney
Site Zoning	Zone B4 Mixed Use and RE1 Public Recreation
Current Use	Interim Cruise Passenger Terminal and Water Treatment Plant at south-western portion
Geographical Co-ordinates, Elevation	Easting – 333620m E, Northing – 6251850m, 2-3m AHD
Site Area	Approximately 4.3 ha

A formal site survey has not been prepared for the Barangaroo Central Site at the time of preparation of the Imported Soils HHERA. A formal site survey will be prepared prior to the issue of the Data Gap Investigation, being completely separately to the Imported Soils HHERA. The Barangaroo Central Site boundary will be defined as:

- North – The northern boundary of the Barangaroo Central Site is defined by the southern boundary of the Barangaroo Headland Park as defined in *Remedial Action Plan Barangaroo Delivery Authority Barangaroo Headland Park revision 3*, JBS Environmental, 8 November 2011;
- East – The eastern extent of Lot 5 DP876514, apart from the proximity of the Declaration Area. The Barangaroo Central Site eastern boundary in proximity of the Declaration Area is defined by the northern and western extent of the Significantly Contaminated Land as identified by the NSW DECCW under the *Contaminated Land Management Act 1997* (Declaration Number 21122, Area Number 3221, dated 6 May 2009);
- South – The northern boundary of the 'Stage 1' area as shown by the Stage 1 Site plan in the *Part 3A Preliminary Assessment Barangaroo Concept Plan Modification Request for DGRs and PEAR*, prepared by JBA Urban Planning Consultants in February 2010 (JBA 2010), apart from the proximity of the Declaration Area. The Barangaroo Central Site southern boundary in proximity of the Declaration Area is defined by the northern and western extent of the Significantly Contaminated Land as identified by the former NSW DECCW (now EPA) under the *Contaminated*

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Land Management Act 1997 (Declaration Number 21122, Area Number 3221, dated 6 May 2009); and

- West – The western extent of Lot 6 DP876514.

The extent of the Barangaroo Central site boundaries are shown on **Figure 2**.

2.2 Current Site Condition

The Barangaroo Central Site is characterised as being level over the site area and paved. The northern and central portions of the Barangaroo Central Site are currently used as Interim Cruise Passenger Terminal, as per a lease agreement with Sydney Ports Corporation. A large temporary structure is located over the central west portion of the Barangaroo Central Site, comprising the Interim Terminal. The temporary structure is provided with a false floor within the southern and central portions, for use as Passenger waiting area and Customs. The northern portion of the temporary structure is used for luggage handling and does not have temporary flooring. The area to the east of the Interim Terminal is used for car parking and passenger drop off / pick up as associated with the Cruise Ships.

A Water Treatment Plant is located within the southern portion of the Barangaroo Central Site. This is characterised by a series of large above ground storage tanks, filters and associated smaller tanks and shipping containers. The Water Treatment Plant is understood to be used with the current site development works on the Stage 1 Development.

A small Gate House Structure is located adjoining the eastern boundary of the Barangaroo Central Site. Portions of the Foreshore Walk are also present within the Barangaroo Central Site, with a walkway moving in an east-west direction through the southern portion, and extending in a southerly direction along the eastern boundary. The Foreshore Walk areas are delineated on the Barangaroo Central Site by fencing and signage.

2.3 The Proposed Development / Current Design

The Barangaroo Central Site is proposed to be initially developed as the Barangaroo Stage 1 Public Domain. This development is described in more detail in **Section 2.3.1** and is proposed to be undertaken in the near future. This development is proposed as an interim site use prior to the commencement of the proposed long term development.

The Barangaroo Central Site is proposed to be ultimately developed for combined high density residential and open space purposes. This development is described in more detail in **Section 2.3.2**. This development is anticipated to commence in 2015.

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2.3.1 Barangaroo Central Stage 1 Public Domain

JBS has been advised that the Barangaroo Central Site is to be initially developed as 'Barangaroo Stage 1 Public Domain'. This is to facilitate a recreational use of the Barangaroo Central Site prior to anticipated long term development as described in the current Barangaroo concept plan. A concept plan of the 'Barangaroo Stage 1 Public Domain' is provided as **Figure 3**. Characteristics of this development and associated land use are anticipated to include:

- Use of Barangaroo Central Site for recreational purposes, similar to the open areas of the Headland Park Site;
- Landscaping with grasses and some large plantings over approximately 70% of the Barangaroo Central Site;
- Retention of existing site paving and use for Car Parking over approximately 30% of the Barangaroo Central Site as present to the south of the central portion; and
- Importation of between 80 000 and 150 000 m^3 of fill materials to raise the site level and create a slope towards Darling harbour.

It is understood that these works will be the subject of a Project Application to be prepared in the near future. A range of environmental studies are required to support the Project Application.

The Sampling, Analysis and Quality Plan (SAQP), and associated future data gap investigations / environmental assessments, will consider the future use of the Barangaroo Central Site for recreational uses consistent with the 'Barangaroo Stage 1 Public Domain'.

2.3.2 Barangaroo Central Residential / Open Space Development

The Barangaroo Concept Plan identifies that the area of Barangaroo Central will be developed long term as a mixture of high density residential and open space / recreational land uses. The current concept plan for the long term Barangaroo Central site development has been provided as **Figure 4**. From review of **Figure 4**, land-uses can be observed to include:

- Two high density residential developments located in the central and northern portion of the site adjoining the eastern site boundary;
- Part of a basement of an additional high density residential building as located adjoining the eastern part of the southern boundary and the southern part of the eastern boundary. The basement for this building is almost wholly located within the Declaration Area, which has been excluded from the Barangaroo Central Site; and
- Recreational / open space land-uses located within the western portion of the site including areas of large tree and garden plantings, grassed areas as used for playing fields or other events, an open amphitheatre and pathways along the foreshore and throughout the site.

The lateral dimensions of the proposed basements can be observed from **Figure 4**. The basement areas should be assumed to extend between the building outlines as shown on **Figure 4**. No definitive guidance is available as to the anticipated depth of the basements. However by review of a similar basement proposed for the Barangaroo South Site as reported in JBA Planning (November 2010) 'Bulk Excavation and Basement Car

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Parking PA1 (MP10_0023) Barangaroo South', similar sized basements on the southern portion of the site are proposed to extend to a depth of 22m (terminating at approximately -18.5m AHD).

A Cultural Space is also proposed to be constructed with the long term development of the site. Two options are currently proposed for the Cultural Space including:

- Integration of the Cultural Space within the existing Residential Buildings at the eastern portion of the site; or
- Construction of a Cultural Space as a slab on grade structure, potentially partially submerged in sections by contouring of soils at the perimeter, in the proximity of the current 'Amphitheatre Building' as shown on **Figure 4** at the north-west of the Barangaroo Central Site.

2.4 Surrounding Land use

The surrounding uses of land adjacent to the Barangaroo Central Site have been previously reported as follows (ERM 2008b[1]):

- North: Immediately to the north is the proposed Northern Cove, to be constructed with the development of the Headland Park Site.
- East: Immediately to the east is Hickson Road. Residential and commercial areas of the northern part of Sydney are located further east.
- South: Immediately to the south is the Barangaroo South Stage 1 Development. This also comprises the Declaration Area.
- West: Immediately to the west is Darling Harbour.

A former gasworks is known to have operated until the 1920s over part of the Stage 1 Development, located adjoining the south of the Barangaroo Central Site. The former gasworks location is known to continue to the east beneath Hickson Road, and the contaminated gasworks waste material in this area has been identified to contaminate soils and groundwater on the south-eastern portion of the Barangaroo Project Site. This part of the Stage 1 Development, referred to as the Declaration Area in this ERA, has been declared a Remediation Site by the former NSW DECCW (Declaration No. 21122, Area No. 3221) under the CLM Act 1997. The Declaration Area forms part of the eastern and southern boundary of the Barangaroo Central Site. It is understood that environmental assessment programs are being undertaken on the Stage 1 Development in preparation for remediation.

2.5 Proposed Site Condition

The Barangaroo Central Site is proposed to be initially developed as 'Barangaroo Stage 1 Public Domain' and later developed for a combined high density residential / recreational land use. Environmental criteria for imported fill materials are required to be protective of both land-uses.

Potential uses / areas that have been identified with these land-uses as per BDA concept plans (provided as **Figures 3** and **4**) include:

- Landscaped area as located within the central and northern parts of Barangaroo Central Site with the Barangaroo Stage 1 Public Domain. Landscaped areas

[1] *Stage 2 Remedial Action Plan for Barangaroo*, Hickson Road, Sydney, ERM, September 2008 (ERM 2008b)

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confined to the western portion of the site with the subsequent high density residential / recreational development;

- A car parking area located to the south of the central portion of the Barangaroo Central Site and reported to occupy 30% of the Barangaroo Central Site to operate while the site is developed as Barangaroo Stage 1 Public Domain;
- Large basement areas constructed in the eastern portion of the site as associated with the proposed residential building;
- Access corridors throughout the Barangaroo Central Site;
- Pavilions, presumed to be naturally ventilated and marked as being approximately 500 m^2 in area, present adjoining the northern and eastern boundaries; and
- A potential Cultural Space as constructed at the north-west of the Barangaroo Central site as a slab on grade / potentially partially submerged structure.

The landscaping areas for the Barangaroo Stage 1 Public Domain will be formed by the importation and placement of 80 000 to 150 000 m^3 of soils over the site, gently grading towards Darling Harbour. Part of this fill material will potentially be retained in the open spaces areas of the proposed high density residential / recreational land use. The area will be landscaped with grassed areas, small and large plantings. It has been reported by BDA that existing site pavement will be removed from within the proposed landscaped areas.

Site pavement is proposed to be retained on the area of Barangaroo Stage 1 Public Domain where the temporary car parking is proposed. The estimated extent of the proposed future car park is shown on **Figure 3**.

2.6 Topography

The topography of the Barangaroo Central Site is relatively flat, having been filled for its previous use as a stevedoring facility (ERM 2008b).

The topography is proposed to be modified by the importation of fill material to create a sloped surface towards Darling Harbour. It is estimated that 80 000 to 150 000 m^3 of materials will be imported to the Barangaroo Central Site to create the raised site surface for the Barangaroo Stage 1 Public Domain, placed predominantly over the northern and central portions.

2.7 Hydrology

The closest surface water body to the Barangaroo Central Site is Darling Harbour, located immediately adjacent to the western boundary (ERM 2008b). Surface water from the Barangaroo Central Site is collected via a sub-surface drainage network, which generally flows toward the Harbour.

Hydrology on the proposed adjacent Headland Park will be potentially modified with the amended topography. However, it is proposed at this stage that any future drainage system provided to the Barangaroo Central Site will also discharge to Darling Harbour.

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2.8 Geology

2.8.1 Current Site Geology

According to the 1:100 000 Geological Survey of NSW (Sydney) Sheet 9130 (Ed 1) 1983, the Barangaroo Central Site is generally underlain by man-made fill that has been placed over marine sands over Hawkesbury Sandstone, which is described as follows (ERM 2008b):

- Man-made fill may consist of "dredged estuarine sand and mud, demolition rubble, industrial and household waste"; and
- Hawkesbury Sandstone is characterised as "medium to coarse-grained quartz sandstone with very minor shale and laminite lenses".

The general geological profile observed at the Barangaroo Central Site, as reported by previous investigations, is summarised in **Table 2.3**.

Table 2.3: Summary of Observed Site Geology

Lithological Unit	Description	Depth (mbgl)
Hardstanding	Asphalt, bitumen or concrete, generally in good condition with no staining.	0 – 0.46
Road base fill	Very dark grey, dry, loose, medium grained sand to fine gravel, poorly sorted, sub angular, no odours or staining noted.	0 – 0.5
Fill	A range of materials have been reported as being present as fill, including silty clay, clayey sand, sand, sandy gravel, sandy gravelly clay, sandy clay and gravelly sand. Sandstone floaters have also been reported as occurring in fill materials. Anthropogenic materials have also been reported in fill material including building rubble, bricks and concrete.	Surface depth to 4 – 18.3
Marine Clay/Sand	Interbedded clayey sand and sandy clay, dark greyish brown, saturated, some shell fragments and organic matter. Sandy clay – soft, high plasticity. Clayey Sandy – loose to dense, fine to coarse sand, low to no plasticity.	Below 4 – 18.4
Bedrock	Weathered sandstone, white, light yellowish brown, olive brown and reddish brown, wet, fine to coarse grained, some fracturing noted.	Below 9.5 - 38

It is estimated that 560 000 m^3 of fill material is present within the Barangaroo Central Site. An additional 80 000 to 150 000 m^3 of fill materials will be placed on the site with the development of Barangaroo Stage 1 Public Domain. Where materials are sourced from the Barangaroo Project Site, soil descriptions would be anticipated to be similar to those described for the Barangaroo Central Site.

2.8.2 Proposed Site Geology

Of most relevance to the ecological risk assessment, open space areas are proposed to be incorporated across the majority of the Barangaroo site within the Barangaroo Stage 1 Public Domain development, and within the western portion of the site with the proposed high density residential / open space development. Vegetated areas will be established within the open space areas including turfed areas, shrubs and larger plants.

Root zone soils will be required at upper depths in the open space areas to support proposed landscaping. JBS Environmental (August 2011) *Ecological Risk Assessment Barangaroo Headland Park and Northern Cove Hickson Road, Sydney, NSW* (JBS 2011) identified the likely depths of root zone soils on the Headland Park, as summarised in **Table 2.4** following. Similar depths of root zone soils would be anticipated for growing horizons on the Barangaroo Central site.

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Table 2.4: Proposed Headland Park Soil Layer Depths in Growing Areas – Root Zone Soils (mm)

Item	Total Soil Depth including Drainage Layer	Topsoil Depth	Subsoil Depth	Drainage Layer
Large Trees (Figs, Palms and Park Trees)	1500	400	1100	200
Lawn areas	500	200	300	200

JBS (2011) further advises that the lateral extent of the 'large trees' zone soils requires to exceed the 'drip line' of the trees.

The topsoil is described in JBS (2011) as containing nutrients and organic matter. The subsoil is described as being porous and root friendly so as to provide anchorage and mechanical stability for plants. The 'topsoil' and 'subsoil' are required to be environmentally suitable for use as growing medium.

Fill materials underlying root zone soils are anticipated to be compacted to prevent root penetration into underlying saline soils / groundwater. Other provisions may potentially be incorporated to prevent tree roots extending into these potentially saline materials.

2.9 Hydrogeology

As previously reported (ERM 2008b), information obtained from the Department of Natural Resources (DNR) indicated that 33 registered groundwater bores were situated within a 4 kilometre (km) radius of the Barangaroo Central Site. Review of the groundwater bore information indicated that the bores were used for the following purposes: recreation (8), irrigation (3), and monitoring (22). None of the listed bores were reported to be registered for drinking water purposes. No registered groundwater bores have been reported to be present on or adjacent to the Barangaroo Central Site, apart from monitoring bores.

The quality of groundwater on the Barangaroo Central Site has been reported to have been assessed via a network of monitoring wells installed across the Site (ERM 2008b). Hydrological data indicated that groundwater on the Headland Park Site was strongly influenced by tidal fluctuations, suggesting a hydraulic connection with the Harbour.

The hydrological data suggest that much of the Barangaroo Central Site is likely to be subject to significant seawater flushing, as consistent with the extent of filling undertaken on the site. Under typical conditions there is reported to be a likely net groundwater flux towards the Harbour, at a velocity of up to 7.6 m/day (ERM 2008b).

It is not anticipated that the current hydrogeological regime would change substantially with the proposed development. The removal of site pavement from the majority of the Barangaroo Central Site has the potential to cause greater levels of surface infiltration to occur. The installation of deep basements will potentially cause local variations in groundwater flow patterns in close proximity.

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2.10 Meteorology

The Sydney area has a humid to temperate climate with a seasonal rainfall maximum during the summer and autumn months. Annual mean rainfall recorded at Sydney (Observatory Hill) is 1212 mm (BOM 2010)[2].

The area has a history of droughts, which are broken by periods of heavy rainfall resulting in significant recharges to groundwater resources. The 1940s and 1980s and the current decade are observed to be dry periods, while the early 1970s and 1990s were wet periods.

Summer winds are predominantly northeasterly with southerly thunderstorms common. Winter winds are predominantly westerly.

[2] http://www.bom.gov.au/climate/averages/tables/cw_066062.shtml visited 7th May 2010 (BOM 2010)

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3 Summary Site History / Previous Assessments

3.1 Barangaroo Project Site

The Barangaroo Project Site was a large precinct occupied by shipping and related merchants over the 1900s. A gasworks operated by The Australian Gas Light Company (AGL) over the period of 1840 to 1925 was located on part of the Barangaroo Project Site, within the Stage 1 Development, and extended across what is now Hickson Road. During the use of the Barangaroo Project Site for these purposes, the original shoreline was altered to enable the construction of a number of finger wharves and associated activities, with these reclaimed over the period spanning the 1950s to 1970s. Over the past 20 years, the Barangaroo Project Site was used for principally stevedoring purposes until the majority of buildings were demolished and the land prepared for redevelopment in the past 5 years.

3.2 Barangaroo Central

A summary of the Barangaroo Project Site history has been provided in the previous reports (ERM 2006[3]), and was based on review of historical title deeds, historical aerial photographs, and a previous Contamination Assessment conducted by URS (2001) on the 'Darling Harbour Berths 3 – 8'.

Considerable detail was provided in ERM 2006 relating to the operation of a gasworks on Lot 3 DP 876514, which is currently referred to as the 'Declaration Area' and is located outside the boundaries of the Barangaroo Central Site. With respect to Lot 3, it was reported that the gasworks were operation from 1841 to 1921. Decommissioning was reported to occur between 1922 and 1925, comprising the demolition of gas holders and purifiers and backfilling of holding tanks.

With respect to the Barangaroo Project Site external to Lot 3, ERM (2006) states that "*The exact history of the remainder of the site is unclear. Originally the remainder of the site consisted of finger wharfs. These wharves were changed over time and then removed, and the site was filled in.*" No evidence was provided in ERM (2006) to suggest that the Barangaroo Central Site was used as part of the Lot 3 gasworks operation, or that operational gasworks waste or rubble generated during decommissioning were placed within the boundaries of the Barangaroo Central Site.

A chronological summary of the findings of the ERM 2006 historical review pertinent to activities on the Barangaroo Central Site is provided below:

- 1840 to 1910: The Barangaroo Central Site was owned by merchants, compositors, manufacturers and various shipping companies and was also used for ship berthing and associated activities. Ownership was largely transferred to Sydney Harbour Trust Commissioners (SHTC) in approximately 1910.
- 1910 to 1936: The majority of the Barangaroo Central Site continued to be owned by the SHTC and was used for ship berthing and associated activities such as workshops and stores.
- 1936 to 1998: Ownership transferred to the Maritime Services Board of NSW and subject to various commercial leases. Part of the Barangaroo Central Site initially consisted of finger wharves, which were removed over time with a significant

[3] *East Darling Harbour Geotechnical and Environmental Investigations: Summary of Findings*, ERM, September 2006 (ERM 2006)

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portion of land reclaimed from the Harbour with unclassified fill between 1951 and 1972. The following was noted on the historical aerial images viewed from this period:

  - 1951 – Barangaroo Central Site Central used as part of a shipping berthing / dock facility with the site area comprising finger wharves and submerged areas; and
  - 1972 – Significant reclamation earthworks occurring on the Barangaroo Central Site;

- 1998: Sydney Ports Corporation was proprietor of Lot 5. Maritime Ministerial Holding Corporation became proprietor of Lot 6;
- 1996-2007: A number of environmental investigations were conducted on the Barangaroo Central Site; and
- 2007 - 2008: The Barangaroo Central Site was vacated by Patrick Stevedores Operations. The warehouses were demolished and the land predominantly cleared and leveled in preparation for future redevelopment; and
- 2011: The Interim Cruise Ship Passenger Terminal was established on the Barangaroo Central Site and commenced operations.

In order to verify the ERM (2006) assessment, the 1943 historical aerial image of the Barangaroo Central Site was obtained from the NSW Land and Property Management Authority (LPMA 2012[4]) online database and reviewed. The 1943 image shows the majority of the Barangaroo Central Site as being inundated. Finger wharves can be observed to be regularly spaced, extending from the eastern boundary. Shed structures, consistent with the structures on the finger wharves, can also be observed adjoining the eastern boundary, along Hickson Rd.

This is consistent with the historical detail provided in ERM (2006), stating that between 1936 and 1998 the Barangaroo Central Site was used for various commercial purposes and as finger wharves. Buildings and finger wharves are visible in the Lot 3 area, and no gasworks infrastructure is visible. It is therefore unlikely that large volumes of gasworks waste/demolition material, if any, were used as fill material during reclamation works on the Barangaroo Central Site.

[4] http://imagery.maps.nsw.gov.au/ as viewed on 23 January 2012 (LPMA 2012)

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3.3 Previous Site Assessments

A number of previous site investigations have been undertaken which provide relevant environmental data for remediation planning. Environmental Assessments that have been made available to JBS include:

- ERM (June 2007) '*Environmental Site Assessment, East Darling Harbour, Sydney, NSW*' (ERM 2007);
- ERM, (July 2008) '*Additional Investigation Works at Barangaroo, Hickson Road, Millers Point, NSW*' (ERM 2008a);
- ERM (September 2008) '*Draft Stage 2 Remedial Action Plan for Barangaroo, Hickson Road, Sydney*' (ERM 2008b);
- Douglas Partners (14 May 2010) '*Barangaroo Draft Factual Environmental Site Investigation Report*' (DP 2010a);
- AECOM Australia (27 May 2010) '*Data Gap Investigation, Other Remediation Works (South) Area Hickson Road, Millers Point NSW*' (AECOM 2010a);
- AECOM (23 September 2010) '*Data Gap Investigation EPA Declaration Area (Parts of Barangaroo Site and Hickson Road), Millers Point, NSW*' (AECOM 2010b); and
- AECOM (20 October 2010) '*Data Gap Investigation Other Remediation Works North, Hickson Road, Millers Point, NSW*' (AECOM 2010c).
- AECOM (3 November 2010) '*Groundwater Discharge Study Stage 1 Barangaroo Development*' (AECOM 2010d);
- Douglas Partners (17 December 2010) '*Factual Report – Pre Early Works Additional Environmental Assessment – Soils Barangaroo Headland Park*' (DP 2010b); and
- JBS Environmental (January 2012) 'Data Gap Investigation and Prevalidation Sampling Report Barangaroo Headland Park and Northern Cove'.

The works and findings of each of these assessments are summarised following.

3.3.1 Environmental Site Assessment (ERM 2007)

This investigation (ERM 2007[5]) comprised a desktop study of existing and previous land uses, the placement of 161 soil sample locations across the site and the assessment of groundwater from 25 groundwater monitoring wells.

The investigations reported encountering a layer of silty / gravelly sand fill in all boreholes, raging in thickness from 0.5 to 21 m. Boreholes drilled in the northern and eastern portion of the Barangaroo Project Site were reported as being generally devoid of a layer of natural sediment, with fill underlain by the sandstone bedrock. In the central portion of the Barangaroo Project Site the fill layer was found to be underlain by natural marine sediments generally comprising silty clays underlain by sandstone. An underground storage tank (UST) was identified at the north-eastern corner of the Barangaroo Project Site.

[5] *Environmental Site Assessment, East Darling Harbour*, Sydney, NSW, ERM, June 2007 (ERM 2007)

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Soils were reported to be sampled and analysed for a wide range of contaminants commonly associated with former gasworks and industrial sites including heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn), cyanides, sulphates, total petroleum hydrocarbons (TPH), monocyclic aromatic hydrocarbons (including benzene, toluene, ethylbenzene and xylene – collectively referred to as BTEX), polycyclic aromatic hydrocarbons (PAHs), phenols, polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs) and organophosphorus pesticides (OPPs).

Two primary areas were identified which had levels of contaminants above the adopted investigation criteria. These areas were described as being located in the proximity of the former gasworks and in the north-western portion of the site adjacent to Warehouse 3. The primary COPCs were identified as copper, lead, PAHs, TPH, BTEX and sulphates.

Isolated areas of soil impact were also identified including the western portion of Wharf 8, the eastern boundary north of Warehouse 5 and the western edge of Warehouse 4. Impact at these locations was found to consist of PAHs including benzo(a)pyrene and lead. Impact was found to occur within a fill layer present to a maximum reported depth of 3.5 m bgl.

Widespread elevated levels of heavy metals were also reported across the Barangaroo Project Site. The potential for asbestos containing materials (ACM) to be present was also identified across the Barangaroo Project Site. However, the consultant (ERM 2007) noted that the sampling methods employed as part of the assessment were not considered appropriate to identify ACM.

Groundwater underlying the Barangaroo Project Site was found to be subject to strong tidal influence. Groundwater impact was identified as consistent with the constituents identified as soil impact. The majority of groundwater impact was identified in the proximity of the former gasworks, with localised impact in other areas of the Barangaroo Project Site, such as in the proximity of the UST. Groundwater constituents identified at elevated levels included PAHs, TPH, BTEX cadmium, copper, lead, zinc and free cyanide.

3.3.2 Additional Investigation Works (ERM 2008a)

This additional investigation (ERM 2008a) consisted of additional soil and groundwater assessment to address perceived data gaps in the initial site assessment (ERM 2007).

A total of 55 soil sample locations were placed across the Barangaroo Project Site, consisting of 34 grid based locations and 21 targeted locations. Sandstone bedrock was additionally cored at 13 locations. A total of 23 existing wells and 13 newly installed wells were assessed across the site.

Soil and groundwater were analysed for the COPCs identified in the initial site assessment (ERM 2007). The following results were reported (ERM 2008a):

- Localised levels of lead, TPH, BTEX, PAHs and sulphate exceeded the adopted assessment criteria. The highest levels were located within the area of the former gasworks;
- The highest levels of groundwater impact, occurring as TPH, BTEX and PAHs were located within the area of the former gasworks. Groundwater impact was identified in this area as occurring in fill materials, natural clayey sands and sandstone;
- Groundwater was found to be substantially influenced by tidal movements with very high hydraulic conductivities recorded for the fill material. It was considered

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that substantial tidal flushing of the aquifer had occurred which had resulted in a relatively small migration of impact from the area of the former gasworks; and

- Phase separated hydrocarbon (PSH) impact was identified at monitoring well MW204D in the area of the former gasworks.

The same limitations with the sampling methodology to identify ACM were present in both ERM 2007 and ERM 2008a investigations.

3.3.3 Stage 2 Remedial Action Plan (ERM 2008b)

A remedial strategy for the whole of the Barangaroo Project Site was prepared in ERM (2008b). The preferred remedial approach for the former gasworks portion of the site, currently subject to the EPA regulation and proposed for future mixed use, was determined to be source removal via either excavation and off-site treatment and disposal (for the most heavily impacted materials) or excavation and on-site stabilisation / reuse (for less heavily impacted materials). Re-use of materials was proposed to occur in any appropriate area of the site, including the proposed Headland Park.

The remaining areas of the Barangaroo Project Site (including the area of the Headland Park) were proposed to be made suitable for the proposed developments by on-site management involving capping of impacted materials and hotspot removal of materials exceeding risk based clean-up levels.

3.3.4 AECOM Data Gap Investigation Remediation Works (South) Area (AECOM 2010a)

Targeted sampling and analysis was completed by AECOM in the area of Blocks 1, 2 and 3 within Stage 1 of the Barangaroo Project Site. The investigations were undertaken to obtain additional contaminant data in these areas. The works comprised the placement of 35 soil sample locations, seven groundwater monitoring wells, four soil vapour wells and additional sampling and analysis of selected existing groundwater monitoring wells.

Hot-spots of environmental impact were recorded throughout the fill materials and in the proximity of the former gasworks on the site. Constituents identified included lead, total petroleum hydrocarbons, benzene, xylenes, polycyclic aromatic hydrocarbons and sulphate.

Of the limited number of soils analysis for acid sulphate soils, potential acid sulphate soils were generally recorded in the natural soils.

3.3.5 AECOM Data Gap Investigation EPA Declaration Area (AECOM 2010b)

Targeted sampling and analysis was undertaken by AECOM in the area of Blocks 3, 4 and 5 of the Barangaroo Project Site, part of the proposed Southern Cove and part of Hickson Rd adjacent to the Barangaroo Site. The investigations were undertaken to obtain additional contaminant data in these areas. The works comprised the placement of 25 soil sample locations, nine groundwater monitoring wells, seven soil vapour wells and additional sampling and analysis of selected existing groundwater monitoring wells.

The additional sampling and analysis confirmed the findings of previous assessments that substantial environmental impact is present in the proximity of the former gasworks infrastructure. Soil vapour, principally consisting of naphthalene, was identified in the proximity of the former gasworks.

Of two samples analysed for acid sulphate soils, one sample consisting of clayey sand from a depth of 7.3-7.5 m recorded potential acid sulphate soils. The other sample consisting of sandy gravelly clay fill did not report acid sulphate soils

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Samples submitted for 'neutral water leach' (by ASLP leaching) reported some potentially leachable levels of lighter PAHs and heavy metals.

3.3.6 AECOM Data Gap Investigation Remediation Works (North) Area (AECOM 2010c)

Targeted sampling and analysis was undertaken by AECOM in the area of the proposed Blocks 4, 5, Southern Cove and the Public Domain of the Barangaroo Project Site. The investigations were undertaken to obtain additional contaminant data in these areas. The works comprised the placement of 13 soil sample locations, five groundwater monitoring wells, one soil vapour well and additional sampling and analysis of selected existing groundwater monitoring wells.

Elevated levels of hydrocarbon constituents were identified at some sample locations, including monocyclic aromatic hydrocarbons and polycyclic aromatic hydrocarbons. The highest levels of soil impact were identified in Blocks 4 and 5 in close proximity of the former gasworks. Naphthalene was identified in soil vapour. Some elevated levels of heavy metals were identified in groundwater, with the highest levels being recorded in wells screened at deeper depths.

Samples submitted for 'neutral water leach' (by ASLP leaching) reported some potentially leachable levels of lighter PAHs and heavy metals.

3.3.7 AECOM Additional Analysis

Limited additional analysis of AECOM samples was undertaken by JBS to assist with the interpretation of the leachability data.

3.3.8 AECOM Intertidal Study (AECOM 2010d)

AECOM undertook a study of groundwater discharge from the Barangaroo Central and South Sites. It was found that an attenuation factor of five could be applied to groundwater constituents present in groundwater underlying the site when it discharged to Darling Harbour. This factor is intended to be applied to predict the dilution of leachate in saturated soil to the receiving environment (i.e. Darling Harbour). AECOM have advised JBS that the results of the study are applicable to groundwater discharge on the Headland Park site.

3.3.9 Douglas Partners Sampling and Analysis

Targeted sampling and analysis works were completed by Douglas Partners (DP2010a & 2010b) across the majority of the Barangaroo Project Site in April, May, November and December 2010. Soil analyses included analysis of total and ASLP leachable concentrations.

A comparison of total and leachable levels of constituents as generated by the completion of the DP (2010a & 2010b) works has been provided in JBS Environmental (10 January 2011) '*Summary of Results of Soil Analysis of Chemical Constituent Leachability Barangaroo*'.

Two additional groundwater monitoring wells were also installed within the Headland Park site during the November and December 2010 works and all monitoring wells (new and existing) within the Headland Park site were sampled and analysed.

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3.3.10 JBS Data Gap Investigation (JBS 2012)

Grid based soil sampling was undertaken across the area of the proposed Headland Park and Northern Cove in JBS (2012). Existing and additional groundwater monitoring were installed and/or sampled at the boundary of the proposed Headland Park. Soil and groundwater samples were analysed for a range of analytes consistent with environmental constituents historically recorded on the Barangaroo Project Site.

A localised tar hot-spot was identified in near surface soils at the southern extent of the proposed Headland Park. No other areas of gross contamination were identified throughout the soils. Areas of localised elevated heavy metal and PAH impacted soils were identified on the site, consistent with the findings of previous investigations of sites in other areas of the site (apart from the Decralation Area). Site works undertaken at the Headland Park at the same time as the JBS investigations also identified the occurrence of asbestos containing materials (ACM) in fill materials.

Slightly elevated concentrations of copper, lead, and zinc were recorded in groundwater at some monitoring wells marginally exceeded the adopted water quality criteria but were consistent with previous monitoring rounds. Ammonia was reported at levels exceeding groundwater assessment criterion, though no specific source of ammonia could be identified during the soil and groundwater investigations. The reported concentrations of the constituents were not considered to pose a risk to the receiving environment.

3.3.11 Data Quality

Each of the respective assessments identified in **Sections 3.3.1** to **3.3.10** have concluded that the data presented are adequately reliable to be used in decision making on the Barangaroo site. JBS has undertaken no further assessment of the data and it is assumed that all data are reliable for use in the HHERA.

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4 Conceptual Site Model

A conceptual site model (CSM) has been prepared to document the constituents of potential concern (COPCs), sources of COPCs, pathways, and potential receptors. The CSM is considered to be an essential pre-requisite prior to the consideration of the scope of the ERA.

It is noted that the CSM has not focussed extensively on existing pathways or contaminant distribution. A program of earthworks is proposed for the Barangaroo Central Site which will initially result in the emplacement of imported fill materials across the site, and later the substantial excavation and construction of basements for residential buildings. The CSM has instead focussed on potential interactions with soils with the future development of the site, focussed to imported materials as delivered to Barangaroo Central.

4.1 Geology

As described in detail in **Section 2.8** the proposed Barangaroo Central geology in the areas of the site where landscaping will occur can be described as:

- Soils in accessible parts of the site from a minimum depth of 0.5m to a maximum depth of 1.5 m consisting of root zone soils. These are characterised as being top soils as upper depths and drainage layer soils at lower depths; and
- Compaction of underlying soils to prevent root penetration to depths of saline soils / groundwater.

Limited analysis of geological parameters of existing soils on the Barangaroo Site has been undertaken in AECOM (2010a and 2010b), DP (2010a) and/or the additional analysis of AECOM (2010) samples. Levels of organic carbon in site soils have been found to range from 0.15% to 2.8%.

On this basis, for the purposes of the ecological risk assessment, there are considered to be two distinct soil types that will be present in the majority of the open space area of Barangaroo Central:

- Soils present at near surface depths (reported to be 0.5-1.5 m bgs dependent on plant life being supported) to be used as root-zone soils; and
- Underlying compacted general fill soils. These soils will be compacted above the depth of the groundwater table. Existing fill materials extend well into the depth of the saturated zone.

Imported fill materials are anticipated to be used as root zone soils, and as underlying compacted general fill materials. It is more than likely that imported fill materials will be restricted to unsaturated horizons. However, for the purposes of the ecological risk assessment, the potential that imported fill materials will also be placed below the depth of the water table, or below the potential future depth of the water table as may occur by sea level rise (consequent of an anticipated 2100 high tide mark of 1.9m AHD) has also been assessed. The 2100 high tide mark has been considered to be an indicator of the groundwater level on the Barangaroo Central site based on the recorded extent of tidal influence in groundwater currently present on the site.

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4.2 Hydrogeology and Water Balance

Groundwater underlying the site is reported to be tidally influenced, being present at a depth consistent with the tidal range in Darling Harbour. This is not anticipated to substantially change with the proposed development of Barangaroo Central.

Basements are proposed to be constructed with the residential buildings that extend substantially below the current depth of groundwater. Users of the basement will be potentially exposed to infiltrating seepage water. Seepage water will potentially infiltrate from areas hydrogeologically downgradient of the basement, as well as areas hydrogeologically up- and cross-gradient. There is potential for the basement to cause a localised depression in the water table, drawing in groundwater / seepage water. However, it is not considered that this would be overly significant, as if the basement design were to permit significant quantities of seepage water to discharge into the basement, then the purpose of the basement would be compromised. The basement will be constructed as a tanked design, effectively excluding seepage water inflow. The potential influence of discharge to the basement would extend a minor distance outwards form the basement, if at all.

Surface water infiltration on the site is currently restricted by the extent of site structures and pavement. The majority of this pavement will be removed with the Barangaroo Stage 1 Public Domain Development. The western portion of the site will be predominantly unpaved open space with the proposed high density residential / open space development of the site. There will be an increased application of surface water to these areas of the site, as necessary to main flora. With this, it is anticipated that increased levels of surface water infiltration will occur to groundwater in the future. Surface water will infiltrate through imported fill materials used on the site.

4.3 Constituents of Potential Concern (COPCs)

COPCs identified as adversely impacting soils and/or groundwater on the Barangaroo Project Site have been found to include:

- Heavy metals including copper, lead, and zinc;
- Total petroleum hydrocarbons (TPH);
- Monocyclic aromatic hydrocarbons (MAHs) including benzene, toluene, ethylbenzene and xylenes (collectively referred to as BTEX);
- Polycyclic aromatic hydrocarbons (PAHs);
- Phenols;
- Cyanides;
- Ammonia;
- Sulphates; and
- Asbestos.

Other COPCs that may also be present that have not been previously tested for include other volatile organic compounds (VOCs), particularly other monocyclic aromatic hydrocarbons (e.g. trimethylbenzenes).

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4.4 Existing Environmental Data

Surplus soils to be re-used on the Barangaroo Central Site will be potentially generated from the Barangaroo Central and Stage 1 Development Sites. Environmental data available for the Headland Park and Northern Cove portion of the Barangaroo Project Site have not been considered, as a deficit of soil is present on these areas of the site. It is not reasonably anticipated that surplus soils from these areas of the Barangaroo Project Site will be used as imported fill on Barangaroo Central.

Soil and groundwater data are available for the Barangaroo Central and Stage 1 Development Sites as previously collected by ERM (2007 and 2008a) and AECOM (2010a, 2010b and 2010c).

The highest levels of impact, consisting of PAHs, TPH, heavy metals, phenolics and cyanide, have been identified within the Declaration Area. Generally speaking, impact in other areas of the site is restricted to elevated levels of PAHs and some heavy metals generally occurring as hot-spots within fill materials.

4.5 Potential Off-Site Sources of COPCs

The most potentially significant off-site source of environmental impact is the Declaration Area present adjoining the south-eastern portion of the Barangaroo Central Site. The northern portion of the Declaration Area is found to be hydrogeologically upgradient of the southern portion of the Barangaroo Central Site. However the majority of the Declaration Area, including the area which contains the former gasworks infrastructure, is hydrogeologically cross-gradient from much of the Barangaroo Central Site.

Several gasworks contaminants are reported to be mobile in the environment and it is considered highly likely that at least low levels of gasworks based contaminants have migrated onto the Barangaroo Central Site.

Environmental impact is understood to be present in Hickson Rd, as associated with the former gasworks and associated Declaration Area. The highest levels of impact are understood to be present to the south and hydrogeologically cross gradient of the Barangaroo Central Site.

4.6 Preferential Pathways

For the purpose of this assessment, preferential pathways have been identified as natural and/or manmade pathways that result in the preferential migration of COPCs as either liquids or gasses.

Man-made preferential pathways are present throughout the Barangaroo Central Site, generally associated with extensive sand and gravel based fill materials. As indicated by estimates of hydraulic conductivity and extent of tidal influence observed in groundwater monitoring wells on the site, these fill materials have high permeability.

Preferential pathways are also important in the assessment of potential off-site sources of COPCs. Preferential pathways are potentially present in Hickson Rd associated with service easements, typically running in a north-south direction along the length of the roadway. Preferential pathways could cause known environmental impact in Hickson Rd to migrate to the extent of the Barangaroo Central Site.

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4.7 Potential Leaching of Environmental Impact

Environmental impact within soils underlying the Barangaroo Central Site may be leachable. Estimates of leachability for similar soils in other areas of the Barangaroo Project Site, as reported in *Human Health and Ecological Risk Assessment Barangaroo Delivery Authority Barangaroo Headland Park Hickson Road, Sydney*, NSW, JBS Environmental, August 2011 (JBS 2011a), have found that at least heavy metals and light PAHs are leachable. Relatively similar levels of leachability have been recorded for fill based soils across the Barangaroo Project Site. This facilitated an approach in JBS (2011a) of using total levels of constituents in fill based soils to characterise the potential leachability of these materials.

Likely surface water infiltration through unsaturated soils is anticipated for the Barangaroo Central site. This could potentially cause leachate to be transported to the depth of groundwater and potentially discharge to Darling Harbour.

Imported soils are not anticipated to be placed below the depth of groundwater, and potential leaching of impact would therefore be restricted to surface water percolation throughout the soils. However, as noted earlier, ecological risk calculations have been undertaken for soils used as imported fill in the unsaturated zone, as well as the saturated zone. The saturated zone has been considered with predicted future sea level rises to be at a depth below 1.9m AHD.

4.8 Exposure Pathways

The ecological exposure pathways considered to be potentially complete include:

- Contaminant uptake by vegetation proposed to be established in the open space areas of Barangaroo Central. Root zones of plantings are proposed to be contained within soils defined as 'root zone soils' and occur at depths ranging between 0.5-1.5 m in depth. Contaminant intake will occur through soils and shallow leachate / seepage water as present in soils; and
- Exposure of ecological receptors within Darling Harbour to potential leachate from imported fill materials migrating through seepage water / groundwater flows to the extent of the Harbour.

4.9 Receptors

Potential ecological receptors of COPCs include:

- Flora species to be established on the open space areas of Barangaroo Central including grasses, shrubs and trees potentially including large fig plantings; and
- The marine water ecosystem of Darling Harbour and Port Jackson by the leaching of environmental impact.

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5 Issue Identification

Issue identification is the first step of the risk assessment process.

5.1 Issue Identification

Issue identification determines whether risk assessment is useful, and establishes a context for the risk assessment by a process of identifying the concerns the risk assessment needs to address. Issue identification draws on all relevant lines of information.

Issue identification comprises several phases:

1. Identification of environmental health issues (or an individual issue) and determining whether they are hazards amenable to risk assessment. This will involve demarcating 'hazards' from 'issues' and may require environmental sampling;
2. Putting the hazards into their environmental health context (clarification and prioritising of problems and hazards);
3. Identification of potential interactions between agents; and
4. Stating clearly why risk assessment is needed and the scope and objectives of the risk assessment. This will involve identifying problems for which information is, or can be, available to undertake adequate risk assessments and problems which risk assessment cannot assist.

5.2 Identification of Environmental Hazards

Environmental health hazards may be caused by physical, chemical, biological or social factors in the environment. Physical factors include heat, cold, noise, mechanical hazards etc. Chemical factors include synthetic and naturally occurring substances. Biological factors include viruses, prions, bacteria, parasites and vermin.

The proposed Barangaroo Central Site is the subject of this assessment. Environmental impact is currently present in isolated areas of the Barangaroo Project Site, reported to be consequent of historical placement of fill materials associated with the former industrial use of the site and surrounding area.

Surplus materials from the remainder of the Barangaroo Project Site will potentially be used as fill materials in the development of Barangaroo Central. A range of industrial uses and associated filling activities have occurred across the Barangaroo Project Site, most significantly a former gasworks operated within the southern portion. A range of environmental contaminants have been identified within soil and groundwater in the proximity of the former gasworks including heavy metals, petroleum hydrocarbons, MAHs, PAHs, cyanides and phenols. The highest levels of these constituents have generally been associated with observations of tar within soils and groundwater.

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5.3 Environmental Sampling and Analysis

Environmental sampling and analysis are a key factor in identifying the agents that may be present, their concentrations and distributions. Environmental sampling and analysis must be targeted to address the identified potential environmental hazards.

Environmental sampling and analysis have been detailed in the previous investigations listed in **Section 3**. Across the area of the Barangaroo Project Site, from where fill materials may potentially be sourced to create the proposed landform of Barangaroo Central, significantly elevated levels of heavy metals, petroleum hydrocarbons, MAHs, PAHs, cyanides and phenols have been reported in soils and/or groundwater, in particular, associated with tar impacted materials identified in the proximity of the former gasworks.

5.4 Putting Hazards into their Environmental Health Context

Putting the hazards into their environmental context entails a consideration of:

- Whether the hazard has single or multiple sources;
- Whether the type of environmental impact affects multiple environmental media;
- How stakeholders perceive the problem including the consideration of different groups; and
- How the hazards compare to other environmental hazards affecting the community.

The environmental hazards across the Barangaroo Project Site may have multiple sources arising from the former commercial / industrial processes undertaken (including operation of a gasworks) and the anticipated significant generation and potential on-site placement of waste materials / by-products. These materials may also pose potential ecological impacts, particularly in locations where leaching of impact may enter waterways, or in soils used as growing media.

The risk assessment requires consideration of use of imported fill materials in the redevelopment of Barangaroo Central. Potential ecological receptors within the open waters of Darling Harbour, and flora to be used in the open space areas of Barangaroo Central (including large tree plantings) may be exposed to this impact.

As the environmental hazards present on the Barangaroo Project Site are related to commonly occurring commercial / industrial contaminants, including heavy metals, petroleum hydrocarbons, monocyclic hydrocarbons and polycyclic hydrocarbons, that previously had widespread use throughout Australia, it can be assumed that the environmental hazard does not pose a unique hazard to the community. However, the presence of these contaminants in uncontrolled locations, potentially accessed by sensitive populations, may serve to increase the exposure of the community and/or the environment to the environmental hazard.

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5.5 Identification of Potential Interactions between Agents

There may be interactions between the physical, chemical, biological and social hazards that require identification and consideration as part of a risk assessment. There are several potential types of interactions between hazardous agents which include: additive effects; synergistic effects; potentiation effects; and antagonistic effects.

It is widely acknowledged that activities such as smoking can increase the susceptibility of a person to the potential effects of some carcinogens. To this effect, it will be required to be ensured that conservatively derived data are used as the basis for any risk assessment.

5.6 Why is Risk Assessment Needed?

The occurrence of environmental hazards in a site sub-surface is unique for every site and location. Further, the particular populations exposed to an environmental hazard are unique for every occurrence of the environmental hazard. Regulatory authorities within NSW do not provide comprehensive guidance for the assessment as an environmental hazard of the range of contaminants identified within the Barangaroo Project Site, where fill materials to develop Barangaroo Central may be sourced. The limited guidance available is considered unsuitable to be solely applied to the development of the proposed Barangaroo Central.

The requirement, and method, for remediation/management of an environmental hazard needs to be determined. The extent of this potential requirement must be determined by the assessment of the presence of an environmental hazard; the degree of potential harm posed by the environmental hazard (in an isolated environment); and the likely exposure of the environment to the environmental hazard. Only through the assessment of all these factors can the true impact of the environmental hazard be assessed. The risk assessment process is designed to include all of these factors to determine a site specific requirement and associated acceptance criteria for a range of environmental constituents, which may be present in soils and/or seepage water and/or groundwater which will occur on the Barangaroo Central Site.

5.7 Limitations and Uncertainties

Potential limitations and uncertainties that may occur in the risk assessment process include:

- Information gaps, e.g. effects of mixtures, low level and variable exposures over time, etc;
- Poor exposure information, e.g. complex mixtures of hazards with complex behaviours in the environment or limited knowledge about the actual or potential sub-population;
- Complexity, e.g. large numbers of combinations of hazards and exposures;
- Confidentiality of health and commercial information;
- Charged atmosphere of fear, antagonism and distrust; and
- Value conflicts.

The risk assessment requires a thorough sensitivity analysis subsequent to the provision of the risk outcomes. The sensitivity analysis will be required to take these matters into

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account, testing the outcome of the risk assessment of reasonable upper and lower bounds of each. Sensitivity analysis of all assumptions has been undertaken throughout the risk assessment. Risk assessment outcomes may require modification where sensitive parameters are observed to have large reasonable potential deviations.

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6 Selection of Constituents of Potential Concern

A screening assessment is required to select constituents of potential concern (COPCs) so as to distinguish between chemical constituents which pose little or no risk to the environment, and those constituents which may present a risk. COPC's and associated ecological assessment criteria have been previously provided by the EPA for the Barangaroo site for the protection of plants, soil, and marine water quality. On this basis, all constituents which have been identified in site soils and for which published criteria are available have been selected as COPCs. No formal risk assessment is required for these constituents as the EPA endorsed or the ANZECC / ARMCANZ (2000) published criteria have simply been adopted. This has been described in **Section 7** for soils.

Based on the extent of project specific criteria available, and observing the remaining potential exposure pathways on the site conceptual model, ecological risk assessment is required for levels of soil constituents that will allow levels of leachate entering marine environments in the proximity of the site to meet the water quality criteria.

This exposure pathway requires an assessment of the potential levels of leachate that may be generated from imported materials to be used as fill on Barangaroo Central. COPCs as selected to be assessed for this exposure pathway have been set as consistent with the extent of COPCs nominated by EPA for phytotoxicity criteria. COPCs are summarised following in **Table 6.1**.

Table 6.1: Summary of COPCs for Ecological Risk Assessment

COPC
Arsenic
Cadmium
Chromium
Copper
Lead
Mercury
Nickel
Zinc
Ammonia
Cyanide
Benzene
Toluene
Ethylbenzene
Total Petroleum Hydrocarbons
Acenaphthene
Acenaphthylene
Anthracene
Fluorene
Naphthalene
Phenanthrene
Benz(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Chrysene
Dibenz(a,h)anthracene
Fluoranthene
Indeno(1,2,3-c,d)pyrene
Pyrene
Phenol
Cresols
2,4-dimethylphenol

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7 Phytotoxicity Assessment

Substantial vegetation plantings are proposed with the open space / recreational areas within the proposed Barangaroo Central development. This includes a number of garden areas with a range of shrubs, and importantly a number of mature / large tree plantings. Soils which are defined as root zone soils, which are accessible to the root network of the proposed plantings, are required to be suitable from a phytotoxicity perspective to be used as root zone soils. As per **Section 2.8.2**, it has been identified that soils classified as a root zone soils will be present:

- To a depth of 0.5 m in lawn areas (i.e. grass plantings);
- To a depth of 1.5 m in the proximity of large tree plantings (i.e. Figs, Palms and Park Trees).

It has been reported that tree roots will not extend vertically beyond the defined growing zones, as controlled by engineered controls and fill materials underlying the root zone soils as also described in **Section 2.8.2**. The phytotoxicity assessment for soils applies to soils proposed to be used as 'root zone soils' within the open space / recreational areas of Barangaroo Central.

Heemsbergen D, Warne M, McLaughlin M and Kookana R CSIRO (October 2009) '*The Australian Methodology to Derive Ecological Investigation Levels in Contaminated Soils*' (CSIRO, 2009) provide a methodology for the assessment of ecological impacts to soils. It is reported in CSIRO (2009) that the methodology presented in the document is the basis of the revised ecological criteria proposed in the revision of the National Environment Protection (Assessment of Site Contamination) Measure. This is described in the following sections.

7.1 Level of Protection

The proposed Headland Park is classified as 'Urban residential and public open space' as per the definitions provided to CSIRO (2009). These are described as "*…not pristine, rather extensively modified, but retaining important functions and species. These land-uses are expected to maintain plant growth of both introduced and native species*". Microorganisms and soil invertebrates are nominated as requiring protection for these land-uses.

It is recommended in CSIRO (2009) that 80% of species and soil microbial processes are protected for this land-use, increasing to 85% for constituents that have a potential for biomagnification.

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7.2 Exposure Pathways

The following exposure pathways are required to be addressed for the site soils, as per CSIRO (2009):

- Soil – organism (via ingestion, organisms include herbivores and soil dwellers);
- Soil – soil organism (passive absorption);
- Soil – soil organisms – soil predators including the potential for biomagnification for contaminants having biomagnification potential;
- Soil – plants;
- Soil – plant – herbivores – carnivores for contaminants having biomagnification potential;
- Soil – soil organisms and/or soil predators – terrestrial predators for contaminants having biomagnification potential;
- Soil – groundwater – surface water – aquatic organisms – aquatic predators for contaminants having biomagnification potential; and
- Soil – surface water – aquatic organisms as the site of the Headland Park is proposed to slope significantly to Darling Harbour.

7.3 Constituent Data

A range of constituent data is identified in CSIRO (2009) as requiring to be assessed for the COPCs. This includes constituent half life in the environment, Henry's Law constant, octanol-water partition co-efficients and organic carbon-water coefficients.

This data are summarised in **Table 7.1** for each of the COPCs.

CSIRO (2009) further nominates ecological considerations that are required in the assessment of each of the COPCs. These have been summarised in **Table 7.2**.

7.4 Use of Background Concentrations

It is advised in CSIRO (2009) that naturally occurring concentrations must be considered when deriving ecological investigation levels (EILs) for soils. This is based on the 'added risk approach'. This approach assumes that the availability of the ambient background concentration (ABC) of a contaminant is zero or sufficiently close that it makes no practical difference. It assumes that the background has resulted in the biodiversity of ecosystems or serves to fulfil the needs for micronutrients for the organisms in the environment. This approach views only the effect of added contaminants to the environment as adverse.

Though Barangaroo Central is proposed to consist of new plantings, these plantings are anticipated to be consistent with plant species that are present throughout similar parks in the Sydney region (e.g. Mrs Macquarie's Chair) and those proposed for the Barangaroo Headland Park. Though the specific plants may not have been exposed to specific background concentrations on the actual Barangaroo Central site, it is reasonable to assume that actual species are present in other areas of Sydney at least partially consequent of background levels of environmental constituents in soils.

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Table 7.1: Summary of Data for COPCs

COPC	Half-life (days)	K_H	K_{OW}	K_{OC}	Comments / Source
Arsenic	-	-	-	-	No half life for elements. Physical properties from Risk Assessment Information System.
Cadmium	-	-	-	-	No half life for elements. Physical properties from Risk Assessment Information System.
Chromium	-	-	-	-	No half life for elements. Physical properties from Risk Assessment Information System.
Cobalt	-	-	-	-	No half life for elements. Physical properties from Risk Assessment Information System.
Copper	-	-	-	-	No half life for elements. Physical properties from Risk Assessment Information System.
Lead	-	-	-	-	No half life for elements. Physical properties from Risk Assessment Information System.
Mercury	-	-	-	-	No half life for elements. Physical properties from Risk Assessment Information System.
Nickel	-	-	-	-	No half life for elements. Physical properties from Risk Assessment Information System.
Vanadium	-	-	-	-	No half life for elements. Physical properties from Risk Assessment Information System.
Zinc	-	-	-	-	No half life for elements. Physical properties from Risk Assessment Information System.
Cyanide	$1 * 10^8$	$5.44*10^{-3}$	$10^{-0.25}$	9.9	Half life data not available. Maximum value used for inorganics from California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document' adopted. Physical properties from Risk Assessment Information System, based on free cyanide.
Ammonia	100	$6.58*10^{-4}$	0	$10^{1.155}$	Half life based Page ER (2009) 'The location and persistence of ammonia (aqueous, anhydrous and anhydrous + 'N-serve') injected into a sandy loam soil, as shown by changes in concentrations of ammonium and nitrate ions' in The Journal of Agricultural Science. K_H from Risk Assessment Information System, based on ammonia. K_{OW} from published value for ammonia in Montgomery (2007) 'Groundwater Chemicals Desk Reference. K_{OC} as per ATSDR (2004) 'Toxicological Profile for Ammonia'
TPH C_6-C_9	-	50-80	-	$10^{3.6}$-$10^{4.5}$	No data for half life. Physical properties as reported in TPHCWG (1997) 'Volume 3 Selection of Representative TPH Fractions Based on Fate and Transport Considerations'. Based on aliphatic fractions in C_6-C_9 range.
TPH C_{10}-C_{14}	-	0.14-120	-	$10^{3.4}$-$10^{5.4}$	No data for half life. Physical properties as reported in TPHCWG (1997) 'Volume 3 Selection of Representative TPH Fractions Based on Fate and Transport Considerations'. Based on aliphatic and aromatic fractions in C_{10}-C_{14} range.
TPH C_{15}-C_{28}	-	$1.3*10^{-2}$ – 4,900	-	$10^{3.7}$-$10^{8.8}$	No data for half life. Physical properties as reported in TPHCWG (1997) 'Volume 3 Selection of Representative TPH Fractions Based on Fate and Transport Considerations'. Based on aliphatic and aromatic fractions in C_{15}-C_{28} range.
TPH C_{29}-C_{36}	-	$6.7*10^{-4}$	-	$10^{5.1}$	No data for half life. Physical properties as reported in TPHCWG (1997) 'Volume 3 Selection of Representative TPH Fractions Based on Fate and Transport Considerations'. Based on aliphatic and aromatic fractions in C_{29}-C_{36} range.
Benzene	190	0.227	$10^{2.13}$	$1.46*10^2$	Half life from University of California (Dec 1994) 'Intermedia Transfer Factors for Contaminants Found at Hazardous Waste Sites Benzene'. Physical properties from Risk Assessment Information System.

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COPC	Half-life (days)	K_H	K_{OW}	K_{OC}	Comments / Source
Toluene	90	0.271	$10^{2.73}$	$2.34*10^2$	Half life from UK Environment Agency (2009) 'Soil Guideline Values for toluene in soil'. Physical properties from Risk Assessment Information System.
Ethylbenzene	1,155	0.322	$10^{3.15}$	$4.46*10^2$	Maximum value of half lives from UK Environment Agency (2009) 'Soil Guideline Values for ethylbenzene in soil'. Physical properties from Risk Assessment Information System.
Xylenes	510	0.212	$10^{3.12}$	$3.83*10^2$	Maximum value of half lives from UK Environment Agency (2009) 'Soil Guideline Values for xylene in soil'. Physical properties from Risk Assessment Information System.
Acenaphthene	570	$7.5*10^{-3}$	$10^{3.92}$	$5.03*10^3$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Acenaphthylene	570	$4.66*10^{-3}$	$10^{3.94}$	$5.03*10^3$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Anthracene	570	$2.27*10^{-3}$	$10^{4.45}$	$1.64*10^4$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Benz(a)anthracene	570	$4.91*10^{-4}$	$10^{5.76}$	$1.77*10^5$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Benzo(a)pyrene	570	$1.87*10^{-5}$	$10^{6.13}$	$5.87*10^5$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Benzo(b)fluoranthene	570	$2.69*10^{-5}$	$10^{5.78}$	$5.99*10^5$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Benzo(g,h,i)perylene	570	$1.35*10^{-5}$	$10^{6.63}$	$1.95*10^6$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Benzo(k)fluoranthene	570	$2.39*10^{-5}$	$10^{6.11}$	$5.87*10^5$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Chrysene	570	$2.14*10^{-4}$	$10^{5.81}$	$1.81*10^5$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Dibenz(a,h)anthracene	570	$5.76*10^{-6}$	$10^{6.75}$	$1.91*10^6$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'.

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COPC	Half-life (days)	K_H	K_{OW}	K_{OC}	Comments / Source
					Physical properties from Risk Assessment Information System.
Fluorene	570	$3.93*10^{-3}$	$10^{4.18}$	$9.16*10^{3}$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Fluoranthene	570	$3.62*10^{-4}$	$10^{5.16}$	$5.55*10^{4}$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Indeno(1,2,3-c,d)pyrene	570	$1.42*10^{-5}$	$10^{6.7}$	$1.95*10^{6}$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Naphthalene	108	$1.80*10^{-2}$	$10^{3.3}$	$1.54*10^{3}$	Half life from US EPA (1991) 'Drinking Water Health Advisory Volatile Organic Compounds'. Physical properties from Risk Assessment Information System.
Phenanthrene	570	$1.73*10^{-3}$	$10^{4.46}$	$1.67*10^{4}$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Pyrene	570	$4.87*10^{-4}$	$10^{4.88}$	$5.43*10^{4}$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Phenol	5	$1.36*10^{-5}$	$10^{1.46}$	$1.87*10^{2}$	Half life as reported for sub-surface soils in Howard P (1989) 'Handbook of environmental fate and exposure data for organic chemicals'. Physical properties from Risk Assessment Information System.
Cresols	8	$4.91*10^{-5}$	$10^{1.95}$	$3.07*10^{2}$	Time for complete degradation reported in Howard P (1989) 'Handbook of environmental fate and exposure data for organic chemicals'. Physical properties from Risk Assessment Information System.
2,4-dimethylphenol	4	$3.89*10^{-5}$	$10^{2.3}$	$4.92*10^{2}$	Time for complete degradation reported in Howard P (1989) 'Handbook of environmental fate and exposure data for organic chemicals'. Physical properties from Risk Assessment Information System.
Dibenzofuran	570	$8.71*10^{-3}$	$10^{4.12}$	$9.16*10^{3}$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
2-methylnaphthalene	570	$2.12*10^{-2}$	$10^{3.86}$	$2.48*10^{3}$	Half life from recommended value for PAHs in California Office of Environmental Health Hazard Assessment (2000) 'Air Toxics Hotspots Program Risk Assessment Guidelines Part IV: Exposure Assessment and Stochastic Analysis Technical Support Document'. Physical properties from Risk Assessment Information System.
Styrene	-	0.112	$10^{2.95}$	$4.46*10^{2}$	No data for half life. Physical properties from Risk Assessment Information System.

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Table 7.2: Summary of Ecological Exposure Routes Requiring Consideration

COPC	Primary Exposure Route	Secondary Exposure Route	Comments
Arsenic	Biomagnification	Direct toxicity	Known to biomagnify as per CSIRO (2009)
Cadmium	Biomagnification	Direct toxicity	Known to biomagnify as per CSIRO (2009)
Chromium	Biomagnification	Direct toxicity	Unknown biomagnifier
Cobalt	Biomagnification	Direct toxicity	Unknown biomagnifier
Copper	Direct toxicity	-	Known to not biomagnify as per CSIRO (2009)
Lead	Biomagnification	Direct toxicity	Known to biomagnify as per CSIRO (2009)
Mercury	Biomagnification	Direct toxicity	Known to biomagnify as per CSIRO (2009)
Nickel	Biomagnification	Direct toxicity	Unknown biomagnifier
Vanadium	Biomagnification	Direct toxicity	Unknown biomagnifier
Zinc	Direct toxicity	-	Known to not biomagnify as per CSIRO (2009)
Ammonia	Direct toxicity	Metabolites	
Cyanide	Biomagnification	Direct toxicity	Unknown biomagnifier
TPH C_6-C_9	Direct toxicity	Metabolites	
TPH C_{10}-C_{14}	Direct toxicity	Metabolites	
TPH C_{15}-C_{28}	Direct toxicity	Metabolites	
TPH C_{29}-C_{36}	Direct toxicity	Metabolites	
Benzene	Direct toxicity	Metabolites	
Toluene	Direct toxicity	Metabolites	
Ethylbenzene	Direct toxicity	Metabolites	
Xylenes	Direct toxicity	Metabolites	
Acenaphthene	Direct toxicity	Metabolites	
Acenaphthylene	Direct toxicity	Metabolites	
Anthracene	Direct toxicity	Biomagnification	
Benz(a)anthracene	Direct toxicity	Biomagnification	
Benzo(a)pyrene	Direct toxicity	Biomagnification	
Benzo(b)fluoranthene	Direct toxicity	Biomagnification	
Benzo(g,h,i)perylene	Direct toxicity	Biomagnification	
Benzo(k)fluoranthene	Direct toxicity	Biomagnification	
Chrysene	Direct toxicity	Biomagnification	
Dibenz(a,h)anthracene	Direct toxicity	Biomagnification	
Fluorene	Direct toxicity	Biomagnification	
Fluoranthene	Direct toxicity	Biomagnification	
Indeno(1,2,3-c,d)pyrene	Direct toxicity	Biomagnification	
Naphthalene	Direct toxicity	Metabolites	
Phenanthrene	Direct toxicity	Biomagnification	
Pyrene	Direct toxicity	Biomagnification	
2-methylnaphthalene	Direct toxicity	Biomagnification	
Dibenzofuran	Direct toxicity	Metabolites	
Cresols	Direct toxicity	Metabolites	
2,4-dimethylphenol	Direct toxicity	Metabolites	
Styrene	Direct toxicity	Metabolites	Unknown half-life, based on other monocyclic aromatic hydrocarbons

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Background concentrations of COPCs in soils have been determined by review of soils concentrations as reported in Olszowy H, Torr P, Imray P (1995) '*Trace Element Concentrations in Soils from Rural and Urban Areas of Australia*'. These are summarised in **Table 7.3** as based on the values reported for 'old suburbs high traffic' in NSW.

Table 7.3: Measured Background Concentrations of Heavy Metals in Soils (mg/kg)

COPC	Arithmetic Mean	50th Percentile
Arsenic	7	6
Cadmium	0.31	0.25
Chromium	15	15
Copper	52	42
Lead	379	225
Mercury	1.9	0.1
Nickel	7	6
Zinc	230	183

Limited data are available on background levels of organic COPCs in Sydney soils. It is likely that these are very low, and for the purposes of this assessment will be assumed to be equal to zero.

7.5 Protection of Plants and Soil Criteria

Protection of plants and soil criteria have been provided by EPA, as reported in JBS (2011), which are reported to be protective of each of the soil-organism, soil-soil organism and soil-plant exposure pathways identified in **Section 7.2**. A summary table of these criteria and the associated basis for derivation is provided as **Appendix B**. The criteria are summarised in **Table 7.4** following for each constituent identified by EPA.

Table 7.4: Summary of Phytotoxicity / Protection of Soil Criteria

COPC	Adopted Phytotoxicity / Protection of Soil Criteria (mg/kg)
Arsenic	20
Cadmium	3
Chromium (total)	190
Copper	60
Lead	1100
Mercury	1
Nickel	30
Zinc	200
Ammonia	0.2[1]
Cyanide (free)	0.9
Benzene	0.2
Toluene	0.3
Ethylbenzene	0.8
TPH C_6-C_9	210
TPH C_{10}-C_{14}	150
TPH C_{15}-C_{36}	300
Acenaphthene	29 (sum)
Acenaphthylene	
Anthracene	
Fluorene	
Naphthalene	
Phenanthrene	
Benz(a)anthracene	18 (sum)
Benzo(a)pyrene	
Benzo(b)fluoranthene	
Benzo(g,h,i)perylene	
Benzo(k)fluoranthene	
Chrysene	
Dibenz(a,h)anthracene	
Fluoranthene	
Indeno(1,2,3-c,d)pyrene	
Pyrene	

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COPC	Adopted Phytotoxicity / Protection of Soil Criteria (mg/kg)
Phenol	3.8
Cresols	3.8
2,4-dimethylphenol	3.8

Note: 1. Calculated as based on irrigation water guideline of 5 mg/L using a K_D of 0.043 l/kg as calculated based on the k_{OC} of $10^{1.155}$ l/kg and the f_{OC} of 0.3%. It is noted that the analytical detection limit of ammonia (as n) of 20mg/kg will be required to be adopted.

7.6 Background Concentrations Relevant to Barangaroo Central

As discussed in Section 7.4, CSIRO (2009) advises an 'added risk approach' to be adopted for the derivation of ecological criteria.

Though this approach has not been adopted for development of ecological criteria for the Barangaroo Central site, in keeping with the limitations of the OEH issued phytotoxicity criteria that have been provided, the conservatism of the proposed heavy metals criteria can be assessed by a comparison of each of the adopted phytotoxicity criteria to the background level of the heavy metal in soils.

Background concentrations of COPCs in soils in the proximity of the Barangaroo Central Site have been determined by review of soils concentrations as reported in Olszowy H, Torr P, Imray P (1995) '*Trace Element Concentrations in Soils from Rural and Urban Areas of Australia*'. These are summarised in **Table 7.3** previous as based on the values reported for 'old suburbs high traffic' in NSW.

Limited data are available on background levels of organic COPCs in Sydney soils. It is likely that these are very low, and can most likely be assumed to be equal to zero.

The background concentrations can be observed to be similar to several of the adopted protection of soil criteria in **Table 7.4**. This confirms that the criteria are conservative.

7.7 Surface Water and Groundwater Exposure Pathways

Potential surface water and groundwater exposure pathways have also been identified for the soils on the proposed Barangaroo Central Site in **Section 7.2**.

The 'Soil – groundwater – surface water – aquatic organisms – aquatic predators for contaminants having biomagnification potential' pathway is relevant to the potential leaching of imported fill materials soils as placed on Barangaroo Central.

The 'Soil – surface water – aquatic organisms' is potentially relevant to surface run-off that generated within the site as surface flows, and runs-off directly into Darling Harbour.

Assessment is required of the leaching potential of the soils and the potential dilution of leachate prior to exposure to surface water receptors identified by the exposure route, to determine soil criteria for these exposure pathways. It is noted that the dilution factors for site leachate have been provided with the EPA protection of marine water criteria, based on the future location of the soils within Barangaroo Central (as base don placement in the unsaturated or saturated zones). The EPA issued protection of marine water criteria are summarised in **Appendix A**. The derivation of criteria to be protective of surface water and marine receptors is summarised in **Section 8**.

It is considered that the total soil criteria as derived for the root zone soils as detailed in **Table 7.4** will not generate levels of leachate that will be potentially toxic to plants. No further assessment is required of the leaching potential of these soils from a phytotoxicity perpective.

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8 Protection of Surface Water Ecological Assessment

Groundwater is currently present under the Barangaroo Central site in a shallow, tidally influenced aquifer. ERM (2008 and 2009) have reported that substantial tidal mixing occurs within this subsurface groundwater. Leachate from imported fill materials may potentially impact underlying shallow groundwater.

CSIRO (2009) advises an approach to derive soil criteria that protect aquatic ecosystems from potential leachate. These criteria are required for imported soils to control the potential risk of leaching of imported fill materials to the marine environment of the adjoining Darling Harbour (by the leaching of soils, generation of seepage, migration of seepage to groundwater and discharge of groundwater to Darling Harbour).

Leaching factors are required to be used in the derivation of protection of surface water Ecological Investigation Levels (EILs) as a measure of the potential for imported fill based soils to leach COPCs. Any EILs derived on the basis of protection of surface water receptors will be directly related to the actual leaching potential of the COPC from the imported fill.

8.1 Determining the Leaching Potential of Inorganic Contaminants

All available leachability data collected from the Barangaroo Project Site (excluding the Declaration Area) has been summarised in **Appendix C**. Data from the Declaration Area has been excluded as soils in this portion of the Barangaroo Project Site can be reasonably anticipated to be remediated. These soils would not be anticipated to exhibit the same leaching characteristics subsequent to alteration by remediation.

A comparison of total and Australian Standard Leaching Procedure (ASLP) leachable concentrations has been undertaken. These are summarised in **Table 8.1** following for inorganic constituents where data is available.

Table 8.1: Summary of Measured Median ASLP Leachabilities Values for Inorganic Constituents

Inorganic COPC	Median Leachability (mg/l / mg/kg)
Arsenic	$5.0*10^{-4}$
Cadmium	No data
Chromium (total)	$2.5*10^{-4}$
Cobalt	$6.0*10^{-4}$
Copper	$1.9*10^{-4}$
Lead	$9.5*10^{-5}$
Mercury	$4.6*10^{-4}$
Nickel	$3.3*10^{-4}$
Vanadium	$3.3*10^{-4}$
Zinc	$7.6*10^{-4}$
Cyanide (free)	No data
Ammonia (as N)	No data

Field estimates of leachability are available for all constituents apart from cadmium, cyanide and ammonia across the Barangaroo site.

A theoretical approach to the estimation of the leaching potential of inorganic constituents in soils to groundwater is provided in CSIRO (2009). The approach is based on the soil-water partition coefficient (K_d) of the constituent. This is the ratio of the concentration of a contaminant bound to soil, to the dissolved total in soil pore water, at equilibrium. It is related to the aqueous solubility of the particular contaminant.

CSIRO (2009) advises that inorganic constituents with a Log K_d of less than 3 have a high potential to leach. Log K_d values for each of the inorganic COPCs where no field data are available are listed in **Table 8.2** following. It is noted that Ammonia is not provided in

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Table 8.2 as a theoretical value has been derived on the basis of organic type parameters, as detailed in **Table 8.4**.

Table 8.2: Summary of Log K_d Values for Inorganic Constituents

COPC	Log K_d	Source
Cadmium	1.88	Risk Assessment Information System value for cadmium
Cyanide (free)	1.00	Risk Assessment Information System value for cyanide (CN^-)
Ammonia	-	Assessed as per K_{OC} approach as per guidance of ANZECC / ARMCANZ (2000)

CSIRO instructs that contaminant leaching for the purposes of deriving EILs is required to be addressed for all constituents with a Log K_d less than 3. This includes each of the COPCs in **Table 8.2**.

Table 8.3 following summarises the theoretical leachabilities estimated for the inorganic COPCs.

Table 8.3: Theoretical Estimate of Potential Leaching of Inorganic Constituents

Constituent	Theoretical Leaching Factor (mg/l / 1 mg/kg)
Cadmium	0.013
Cyanide	0.01

It is noted that the theoretical estimates are likely to be highly conservative.

8.2 Determining the Leaching Potential of Organic Contaminants

As discussed for inorganic constituents, data are also presented in **Appendix C** for field measured estimates of organic constituent leachability, as prepared for data collected from the Headland Park and Barangaroo South and Central sites. These are summarised in **Table 8.4** following for available organic constituents.

Table 8.4: Summary of Measured Median ASLP Leachabilities Values for Organic Constituents

Organic COPC	Median Leachability (mg/l / mg/kg)
Benzene	No data
Toluene	No data
Ethylbenzene	No data
Xylenes	No data
Acenaphthene	$3.0*10^{-3}$
Acenaphthylene	$1.7*10^{-3}$
Anthracene	$5.9*10^{-4}$
Benz(a)anthracene	No data
Benzo(a)pyrene	No data
Benzo(b)fluoranthene	No data
Benzo(g,h,i)perylene	No data
Benzo(k)fluoranthene	No data
Chrysene	No data
Dibenz(a,h)anthracene	No data
Fluorene	$2.6*10^{-3}$
Fluoranthene	$1.7*10^{-4}$
Indeno(1,2,3-c,d)pyrene	No data
Naphthalene	$8.7*10^{-3}$
Phenanthrene	$1.0*10^{-3}$
Pyrene	$1.5*10^{-4}$
Phenol	No data
Cresols (2,3&4-methylphenol)	No data
2,4-dimethylphenol	No data
TPH C_6-C_9 (aliphatic)	No data
TPH C_{10}-C_{14} (aliphatic)	No data
TPH C_{10}-C_{14} (aromatic)	No data
Dibenzofuran	No data
2-methylnaphthalene	No data
Styrene	No data

Field estimates of leachability are available for lighter PAHs only, including naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene and pyrene.

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A theoretical approach to the estimation of the leaching potential of organic constituents in soils to groundwater is provided in CSIRO (2009). The approach is based on two partition co-efficients related to leaching of organic constituents including the:

- Octanol-water coefficient (K_{OW}) which is used as a surrogate to estimate the potential for contaminants to accumulate in tissue; and
- Carbon-water partition co-efficient (K_{OC}).

K_{OW} and K_{OC} values for site contaminants were provided in **Table 7.1**. The mobility of potential contaminants is defined by CSIRO (2009) as:

- Log K_{OW} <2 / Log K_{OC} < 2.4 – mobile;
- Log K_{OW} 2-2.7 / Log K_{OC} 2.4-3.05 – medium mobility;
- Log K_{OW} 2.7-3.7 / Log K_{OC} 3.05-3.95 – low mobility; and
- Log K_{OW} >3.7 / Log K_{OC} >3.95 – immobile.

It is recommended that organic constituents with a large half life (>45 days, summarised in **Table 7.1**) and a Log K_{OC} <4 (K_{OC} < 10,000) or Log K_{OW} < 4 will be required to be assessed for contaminant leaching in the derivation of EILs as protective of surface water receptors.

By review of **Table 7.1** this includes TPH (C_6-C_9 and C_{10}-C_{14}), benzene, toluene, ethylbenzene, xylenes, acenaphthene, acenaphthylene, fluorene, naphthalene, 2-methylnaphthalene and styrene. Several additional PAHs, to those identified by the CSIRO (2009) screening process, have been previously recorded in historical groundwater underlying the Barangaroo Project Site, indicating likely leachability. These PAHs are also found to generally have low ecological assessment criteria (**Appendix A**).

EILs for the protection of surface water have been derived for each of the remaining PAHs where historical groundwater data from other areas of the Barangaroo Project Site predict potential leachability. Phenanthrene, anthracene, fluoranthene and pyrene have also been assessed. As per **Table 8.2**, ammonia leachability has been assessed through a K_{OC} approach.

8.3 Organic Leachability Data

As for heavy metals, theoretical leachabilities of organic constituents have been calculated for constituents requiring derivation of ecological criteria where no field data is available. Geological properties for a dry sand, as adopted in JBS Environmental (February 2012) '*Human Health Risk Assessment Barangaroo Delivery Authority Barangaroo, Barangaroo Central*', have been adopted for the calculations undertaken here including a water filled porosity of 0.053, a total porosity of 0.375, a density of 1.66 tonnes/m^3 and an organic carbon fraction of 0.3%.

This is summarised in **Table 8.5**.

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Table 8.5: Theoretical Estimate of Potential Leaching of Organic Constituents and Ammonia (as N)

Constituent	Theoretical Leaching Factor (mg/l / mg/kg)
Benzene	1.95
Toluene	1.24
Ethylbenzene	0.70
Xylenes	0.82
Benzo(a)pyrene	$5.68*10^{-4}$
Cresols (2,3 & 4-methylphenol)	1.05
2,4-dimethylphenol	0.66
TPH C_6-C_9 (aliphatic)	$9.1*10^{-3}$
TPH C_{10}-C_{14} (aliphatic)	$1.29*10^{-3}$
TPH C_{10}-C_{14} (aromatic)	0.13
Dibenzofuran	$3.63*10^{-2}$
2-methylnaphthalene	0.13
Styrene	0.72
Ammonia[1]	13

Note: 1. Ammonia is technically an inorganic compound, however calculations for the purposes of leachability have been undertaken using a k_{OC}.

As noted in the derivation of the theoretical estimates of inorganic constituent leachability, the estimates of organic constituent leachability are likely to be highly conservative.

8.4 Determination of EILs for In-Situ Soils Protective of Surface Water

8.4.1 Inorganic Constituents

The following relationship has been provided in CSIRO (2009) to estimate EIL's on the basis of soil leaching for inorganic constituents:

$$EIL = C_w.[K_d + (\theta_W + \theta_a.H') / \rho_b)].DAF$$

Where: EIL – ecological investigation level (mg/kg);

C_w – target leachate concentration, set equal to ANZECC/ARMCANZ 95% protection marine value unless use of 99% advised (mg/l);

K_d – soil to water partition coefficient (L/kg);

θ_a – air filled porosity;

θ_w – water filled porosity;

H' – Henry's Law Constant (unitless);

ρ_b – soil bulk density (kg/l); and

DAF – dilution attenuation factor including dilution from catchment and tidal dilution at discharge

Within this equation the component $[K_d + (\theta_W + \theta_a.H') / \rho_b)]$ is an estimate of the leachability of the constituent. These have been detailed for inorganic constituents in **Tables 8.1** and **8.3**, generally by site specific data as collected from the Barangaroo Project Site.

The criteria C_w requires to be adopted as per the water quality criteria summarised in **Appendix A**.

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8.4.2 Organic Constituents

The following relationship has been provided in CSIRO (2009) to estimate EIL's on the basis of soil leaching for organic constituents:

$EIL = C_w.[(K_{OC}.f_{OC}) + (\theta_W + \theta_a.H') / \rho_b)].DAF$

Where: EIL – ecological investigation level (mg/kg);

C_w – target leachate concentration, set equal to ANZECC/ARMCANZ 95% protection marine value unless use of 99% advised (mg/l);

K_{OC} – organic carbon to water partition coefficient (L/kg);

f_{OC} – fraction of organic carbon (g/g)

θ_a – air filled porosity;

θ_w – water filled porosity;

H' – Henry's Law Constant (unitless);

ρ_b – soil bulk density (kg/l); and

DAF – dilution attenuation factor including dilution from catchment and tidal dilution at discharge.

Within this equation the component $[(K_{OC}.f_{OC}) + (\theta_W + \theta_a.H') / \rho_b)]$ is an estimate of the leachability of the constituent. These have been detailed for organic constituents in **Tables 8.4** and **8.5**, generally by site specific data for the lighter PAHs, and some theoretical relationship for other constituents.

The criteria C_w requires to be adopted as per **Appendix A**. It is noted that potential additive effects may occur where mixture of hydrocarbon constituents occurs. Previous assessment in JBS (2011) advised mixture modifying factors to be applied to each of the COPCs as per the table of marine water criteria provided as **Appendix A**. The mixture modifying factors are summarised in **Table 8.6** and are required to be used as a multiplicative factor with the water quality criteria.

Table 8.6: Summary of Mixture Modifying Multiplicative Factor for Organic Constituents

Constituent	Mixture Modifying Factor
Benzene	0.25
Toluene	0.25
Ethylbenzene	0.25
Xylenes	0.25
TPH C_6-C_9	0.25
TPH C_{10}-C_{14}	0.25
Acenaphthene	0.2
Acenaphthylene	0.2
Anthracene	0.2
Fluoranthene	0.2
Fluorene	0.2
Naphthalene	0.2
Phenanthrene	0.2
Pyrene	0.2
Phenol	1
Cresols (2,3 & 4-methylphenol)	0.33
2,4-dimethylphenol	0.33
2-methylnaphthalene	0.2
Styrene	1

In addition to the mixture modifying factors, benzo(a)pyrene requires to be assessed by a toxicity equivalency factor (TEF) approach. This requires the addition of each of the carcinogenic PAHs incorporating an adjustment factor for each PAH constituent as per

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WHO (2003) '*Polynuclear aromatic hydrocarbons in Drinking-water*', giving relative potencies of Benz(a)anthracene – 0.1; Benzo(a)pyrene – 1.0; Benzo(b)fluoranthene – 0.1; Benzo(g,h,i)perylene – 0.01; Benzo(k)fluoranthene – 0.1; Chrysene – 0.01; Dibenz(a,h)anthracene – 1.0; and Indeno(1,2,3-c,d)pyrene – 0.1.

8.4.3 Dilution Attenuation Factor (DAF)

CSIRO (2009) notes that groundwater catchments typically contain both contaminated and uncontaminated soils. This is considered to be the case for the Barangaroo Project Site, where it would be reasonably assumed that existing hydrogeologically upgradient land area to the east of the site, and the developed Headland Park to the north is uncontaminated. Consequent of this, the pore water concentrations of constituents will not necessarily be equal to the seepage water concentrations as may discharge into Darling Harbour, or infiltrate into underlying tidally influenced groundwater. A dilution attenuation factor (DAF) is recommended to be used to take this into account. The following equation is provided by CSIRO (2009):

DAF = 100 / percent of contaminated soil in catchment.

No dilution has been assumed for the Barangaroo Central site, based on the assumption that the whole of the site sub-surface where potentially leachable soils may occur being reported to be potentially subject to significant tidal mixing. It is further noted that no dilution of impact is available where soils are potentially placed adjoining a surface water interface.

AECOM (30 July 2010) '*Human Health and Ecological Risk Assessment*' nominates that a dilution factor of four be applied to leachate as generated in soils present in the unsaturated zone, interpreted as being above the current depth of groundwater. This factor is presumably to account for additional dilution during vertical migration to the saturated zone. This factor is adopted in the EPA issued advice in **Appendix A** and is understood to be intended to be applied to soils within the unsaturated zone.

On this basis a dilution attenuation factor of 1 (no dilution) has been adopted for imported fill material to be placed below the depth of groundwater (considered to be saturated soils) and a dilution attenuation factor of 4 has been adopted for imported fill to be placed above the depth of groundwater (unsaturated soils), as consistent with the guidance in **Appendix A**. The vertical delineation between unsaturated and saturate horizons has been assumed to occur at 1.9m AHD, as consistent with advice of mean high water levels with predicted sea level rise.

8.5 Calculation of EILs Protective of Surface Water Receptors

The calculation of EIL's protective of surface waters is summarised in **Table 8.7** for imported fills to be used in the saturated zone on Barangaroo Central. The dilution factors identified in **Section 8.4.3** have been incorporated into these calculations.

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Table 8.7: Calculation of EILs for Potential Leaching of COPCs in Saturated Zone

Constituent	Target Conc. C_w (mg/l)[1]	Mixture Modifying factor	Leaching Factor (mg/l / mg/kg)	EIL Protective of Surface Water (mg/kg)
Arsenic	0.0023	1	0.0005	4.6
Cadmium	0.0007	1	0.013	0.1
Chromium (VI)	0.0044	1	0.00025	18
Cobalt	0.001	1	0.0006	1.7
Copper	0.0013	1	0.00019	6.8
Lead	0.0044	1	0.000095	46
Mercury	0.0001	1	0.00046	0.2
Nickel	0.07	1	0.00033	210
Vanadium	0.1	1	0.00033	300
Zinc	0.015	1	0.00076	20
Cyanide	0.004	1	0.01	0.4
Ammonia	0.91	1	13	<LOR
Benzene	0.5	0.25	1.95	0.1
Toluene	0.18	0.25	1.24	<LOR
Ethylbenzene	0.08	0.25	0.70	<LOR
Xylene	0.075	0.25	0.82	<LOR
Styrene	0.072	1	0.72	<LOR
Acenaphthene	0.0058	0.2	0.003	0.4
Acenaphthylene	0.0058	0.2	0.0017	0.7
Anthracene	0.00001	0.2	0.00059	<LOR
Fluoranthene	0.001	0.2	0.00017	1.2
Fluorene	0.003	0.2	0.0026	0.2
Naphthalene	0.07	0.2	0.0087	1.6
Phenanthrene	0.0006	0.2	0.001	0.1
Pyrene	0.000025	0.2	0.00015	<LOR
2-methylnaphthalene	0.0021	0.2	0.13	<LOR
Benzo(a)pyrene	0.0001	1	0.00057	0.2[3]
Dibenzofuran	0.0037	0.2	0.0363	<LOR
Cresols	0.013	0.33	1.05	<LOR
2,4-dimethylphenol	0.002	0.33	0.66	<LOR
TPH C_6-C_9	0.0144	0.25	0.0091	<LOR
TPH C_{10}-C_{14}	0.00015	0.25	0.0024[2]	<LOR

Note: 1. As per Appendix A

2. Calculated as per inverse weighted means, assuming equal proportion of aliphatic and aromatic constituents.

3. To be assessed as per equivalent toxicity equivalence factor (TEF) to benzo(a)pyrene. Sum of carcinogenic PAHs to be summed, with multiplication of TEF, and assessed to benzo(a)pyrene criteria. As per WHO (2003) 'Polynuclear aromatic hydrocarbons in Drinking-water' relative potencies of Benz(a)anthracene – 0.1; Benzo(a)pyrene – 1.0; Benzo(b)fluoranthene – 0.1; Benzo(g,h,i)perylene – 0.01; Benzo(k)fluoranthene – 0.1; Chrysene – 0.01; Dibenz(a,h)anthracene – 1.0; and Indeno(1,2,3-c,d)pyrene – 0.1.

< LOR – below typical laboratory limit of reporting, Ammonia as N LOR = 20mg/kg.

The calculation of EIL's protective of surface waters is summarised in **Table 8.8** for imported fill materials to be used in the unsaturated zone on Barangaroo Central. The dilution factor of 4 has been incorporated into these calculations.

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Table 8.8: Calculation of EILs for Potential Leaching of COPCs in Unsaturated Zone

Constituent	EIL Protective of Surface Water – Unsaturated Soils(mg/kg)
Arsenic	18
Cadmium	0.2
Chromium (VI)	70
Cobalt	6.7
Copper	27
Lead	190
Mercury	0.9
Nickel	850
Vanadium	1200
Zinc	79
Cyanide	1.6
Ammonia	<LOR
Benzene	0.3
Toluene	0.1
Ethylbenzene	0.1
Xylene	0.1
Styrene	0.4
Acenaphthene	1.5
Acenaphthylene	2.7
Anthracene	<LOR
Fluoranthene	4.7
Fluorene	0.9
Naphthalene	6.4
Phenanthrene	0.5
Pyrene	0.1
2-methylnaphthalene	<LOR
Benzo(a)pyrene	0.7[2]
Dibenzofuran	<LOR
Cresols	<LOR
2,4-dimethylphenol	<LOR
TPH C_6-C_9	<LOR
TPH C_{10}-C_{14}	<LOR

Note: 1. To be assessed as per equivalent toxicity equivalence factor (TEF) to benzo(a)pyrene. Sum of carcinogenic PAHs to be summed, with multiplication of TEF, and assessed to benzo(a)pyrene criteria. As per WHO (2003) 'Polynuclear aromatic hydrocarbons in Drinking-water' relative potencies of Benz(a)anthracene – 0.1; Benzo(a)pyrene – 1.0; Benzo(b)fluoranthene – 0.1; Benzo(g,h,i)perylene – 0.01; Benzo(k)fluoranthene – 0.1; Chrysene – 0.01; Dibenz(a,h)anthracene – 1.0; and Indeno(1,2,3-c,d)pyrene – 0.1. < LOR – below typical laboratory limit of reporting

<LOR, limit of reading

These EILs are required to be considered for all imported fill materials to be used on the site below a depth of 1.9m AHD, and for imported fills used above a depth of 1.9m AHD where structures are not in place to prevent surface water infiltration.

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9 Sensitivity Analysis

An assessment has been required to be undertaken of the sensitivity of the risk assessment outcomes. Risk assessment calculations can be observed to have been based on:

- Levels of COPCs as estimated by soil and soil leachability sampling programs completed on the site;
- Ecotoxicological parameters used to characterise COPCs;
- Physical properties used to characterise COPCs;
- Anticipated and assessed current and future land-uses;
- Ecological exposure parameters used to characterise future ecological exposures on the site and surrounding environment; and
- Equations and related relationships used to estimate levels of COPCs from reported levels in soils and groundwater to points of exposure.

Each of these is discussed further following.

9.1 Sampling Programs

Soil and soil leachability data used for the risk assessment have been obtained from sampling programs previously completed by ERM, AECOM, Douglas Partners and JBS. Soil and soil leachability data have been used in the derivation of protection of surface water criteria. Where site data is not available, theoretical relationships have been used to estimate potential leachability of soils. Comparison of theoretical estimates to field data for constituents where field data is available indicates that theoretical estimates are highly conservative.

It is also noted that a potentially limited analytical suite has been undertaken with the analyses. This has included analysis for a limited range of monocyclic aromatic hydrocarbons (MAHs) and semi-volatile organic compounds (SVOCs). It is noted that other monocyclic aromatic hydrocarbons will most likely also be present with site contamination, potentially including trimethylbenzenes, propyl benzenes etc. This is confirmed by observation of results of extended analytical suites performed on samples on the Barangaroo Central and South sites, as reported in AECOM (2010a, 2010b and 2010c). On the basis of the extent of constituents considered for ecological criteria, it is considered that other constituents which may have been excluded will be appropriately accounted for by the extent of constituents and criteria provided herein.

This potential under-representation of the full extent of all hydrocarbon constituents is considered to have been at least partially accounted for by the inclusion of assessment for TPH fractions. It is also noted that regulators in Australia commonly only provide speciated criteria and advise assessment for the limited range of hydrocarbon constituents, as assessed by this risk assessment.

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9.2 Toxicological Parameters

Ecotoxicological data where used in the risk assessment have been based on:

- Terrestrial soil criteria as provided by the EPA;
- Protection of marine water criteria as substantially based on ANZECC/ARMCANZ (2000) as supplemented by international sources where required and adjusted by mixture modifying factors.

These criteria have generally been derived from conservative sources. The terrestrial soil criteria are generally based on the lower of the published criteria provided to the current NEPC (1999) '*National Environment Protection (Assessment of Site Contamination) Measure*' and the draft NEPC (2010) '*National Environment Protection (Assessment of Site Contamination) Measure*'. An assessment of conservatism of these criteria can be observed by the comparison of the background levels of COPCs in **Section 7.6**.

Marine water criteria are found to be conservative, generally being based on ANZECC/ARMCANZ (2000) 95% protection levels. 99% protection levels have been adopted for constituents which potentially bioaccumulate. In addition, potential additive effects have been considered for the majority of the organic constituents, adding a further conservative factor to the calculations.

On this basis, it is considered that the ecotoxicological criteria adopted for the risk assessment are suitably conservative to allow confidence in the risk assessment findings.

9.3 Land-Use

The risk assessment outcomes are only valid for the assumed future land-use of the site. Potentially sensitive land-uses such as the use of Barangaroo Central open space / recreational areas for agricultural purposes associated with the production of edible produce have not been considered. The risk assessment would be required to be revised where the site ecological profile was to differ substantially from that described in the ERA.

9.4 Assignment of EILs to Soil Types

Protection of surface water criteria are required to be assigned to all materials used as imported fill. Phytotoxicity / protection of soil criteria are proposed for root zone soils only. These criteria are not proposed to be applied to underlying compacted general fill materials. There is a potential that tree roots may contact the surface of this material. There is also a risk that where tree roots extend beyond root zone depths, that they may contact underlying saline water horizons / soils. It is considered that the provisions put in place in the landscape design to prevent the potential extension of root zones out of root zone soils into saline materials will be sufficient to also control any potential ecotoxicological risk of root zones contacting underlying fill materials.

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9.5 Conclusion

There are several factors which may have caused the criteria derived in this risk assessment to be underestimated. However, it is more than likely that any underestimation caused by the risk assessment process and limitations of available data and modelling techniques has been overcome by the use of conservative assumptions throughout the assessment.

It is concluded that the risk estimates provided are overestimates of actual ecological risk levels and can be used for future decision making for the site.

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10 Conclusions and Recommendations

An ecological risk assessment has been completed for imported fill materials proposed to be used in the development of Barangaroo Central. The risk assessment has considered a range of ecological exposure scenarios for the proposed development of Barangaroo Central. The key facets of the proposed Barangaroo Central development plans that have been considered in the risk assessment include:

- Provision of root zone soils to areas of site plantings designated as lawn areas, shrubs, or large tree plantings; and
- Potential leaching of imported fill materials and discharge of leachate through seepage water / groundwater to the marine environment of Darling Harbour.

On the basis of these land-use parameters and the conceptual plans for Barangaroo Central and with consideration of the limitations provided in **Section 12**, the following risk based ecological criteria have been derived for use on the site as summarised in **Table 10.1**. It is intended that each of the criteria are to be applied as follows:

- Ecological Investigation Level (EIL) Protective of Potential Phytotoxicity Effects – to be applied to soils classified as root zone soils;
- EIL Protective of Surface Water – Saturated Zone – to be applied to imported fill materials that are proposed to be used below the depth of groundwater (assumed to be 1.9 m AHD based on the predicted 2100 high water mark); and
- EIL Protective of Surface Water – Unsaturated Zone – to be applied to imported fill materials used above the depth of groundwater (assumed to be 1.9m AHD).

Table 10.1: Summary of Ecological Risk Based Criteria for Imported Fill to be Used at Barangaroo Central

Constituent	Ecological Criteria		
	Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Ecological Investigation Level Protective of Surface Water – Saturated Soils	Ecological Investigation Level Protective of Surface Water – Unsaturated Soils
	mg/kg	mg/kg	mg/kg
Arsenic	20	4.6	18
Cadmium	3	0.1	0.2
Chromium (VI)[1]	-	18	70
Chromium (total)	190	-	-
Cobalt	-	1.7	6.7
Copper	60	6.8	27
Lead	1100	46	190
Mercury	1	0.2	0.9
Nickel	30	210	850
Vanadium	-	300	1200
Zinc	200	20	79
Cyanide (free)	0.9	0.4	1.6
Ammonia	20	<LOR	<LOR
Benzene	0.2	0.1	0.3
Toluene	0.3	<LOR	0.1
Ethylbenzene	0.8	<LOR	0.1
Xylene	-	<LOR	0.1
Styrene	-	<LOR	0.4
Acenaphthene	29 (sum)	0.4	1.5
Acenaphthylene		0.7	2.7
Anthracene		<LOR	<LOR
Fluorene		1.2	4.7
Naphthalene		1.6	6.4
Phenanthrene		0.1	0.5
2-methylnaphthalene	-	<LOR	<LOR
Benz(a)anthracene	18 (sum)	-	-
Benzo(a)pyrene		0.2[2]	0.7[2]
Benzo(b)fluoranthene		-	-

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Constituent	Ecological Criteria		
	Ecological Investigation Level Protective of Potential Phytotoxicity Effects	Ecological Investigation Level Protective of Surface Water – Saturated Soils	Ecological Investigation Level Protective of Surface Water – Unsaturated Soils
	mg/kg	mg/kg	mg/kg
Benzo(g,h,i)perylene		-	-
Benzo(k)fluoranthene		-	-
Chrysene		-	-
Dibenz(a,h)anthracene		-	-
Fluoranthene		1.2	4.7
Indeno(1,2,3-c,d)pyrene		-	-
Pyrene		<LOR	0.1
Dibenzofuran	-	<LOR	<LOR
Phenol	3.8	-	-
Cresols	3.8	<LOR	<LOR
2,4-dimethylphenol	3.8	<LOR	<LOR
TPH C_6-C_9	210	<LOR	<LOR
TPH C_{10}-C_{14}	150	<LOR	<LOR
TPH C_{15}-C_{36}	300	-	-

Note: <LOR – below typical laboratory limit of reading

1. Criteria for chromium (VI)
2. To be assessed as per equivalent toxicity equivalence factor (TEF) to benzo(a)pyrene. Sum of carcinogenic PAHs to be summed, with multiplication of TEF, and assessed to benzo(a)pyrene criteria. As per WHO (2003) 'Polynuclear aromatic hydrocarbons in Drinking-water' relative potencies of Benz(a)anthracene – 0.1; Benzo(a)pyrene – 1.0; Benzo(b)fluoranthene – 0.1; Benzo(g,h,i)perylene – 0.01; Benzo(k)fluoranthene – 0.1; Chrysene – 0.01; Dibenz(a,h)anthracene – 1.0; and Indeno(1,2,3-c,d)pyrene – 0.1.

In addition to these risk based criteria for soils, all discharges from the site are required to meet water quality limits to be protective of Darling Harbour. For the majority of constituents, these water quality limits have been provided to the Barangaroo Protection of the Environment Operations Act 1997 Licence Variation Application – EPL 13336. For constituents assessed in the risk assessment that are not listed in the environmental licence, reference has been made to the marine water quality criteria adopted during the ecological risk assessment, as based on EPA endorsed guidelines and standards and adjusted for some constituents by a mixture modifying factor. Surface water protection criteria are summarised in **Table 10.2**.

Table 10.2: Surface Water Protection Criteria for Discharges from Barangaroo Central (µg/L)

Constituent	Protection of Surface Water Quality Criteria
Arsenic	2.3[2]
Cadmium	0.7[2]
Chromium (III)	27[2]
Chromium (VI)	4.4[2]
Cobalt	1[3]
Copper	1.3[2]
Lead	4.4[2]
Mercury	0.1[2]
Nickel	7[2]
Vanadium	100[3]
Zinc	15[2]
Ammonia	910[3]
Cyanide	4[3]
Benzene	500[2]
Toluene	180[2]
Ethylbenzene	80[2]
m&p-Xylene	75[2]
o-Xylene	350[2]
Styrene	72[3]
Acenaphthene	2[1, 2]
Acenaphthylene	2[1, 2]
Anthracene	2[1, 2]
Benzo(a)pyrene	2[1, 2]
Benzo(a)anthracene	2[1, 2]
Benzo(b)fluoranthene	2[1, 2]

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Constituent	Protection of Surface Water Quality Criteria
Benzo(k)fluoranthene	2[1, 2]
Benzo(g,h,i)perylene	2[1, 2]
Dibenz(a,h)anthracene	2[1, 2]
Fluoranthene	2[1, 2]
Fluorene	2[1, 2]
Indeno(1,2,3-c,d)pyrene	2[1, 2]
Naphthalene	50[2]
Phenanthrene	2[1, 2]
Pyrene	2[1, 2]
2-methylnaphthalene	0.42[3]
Phenol	400[2]
Cresols	4.29[3]
2,4-dimethylphenol	0.66[3]
Dibenzofuran	0.74[3]
TPH C_6-C_9	20[1, 2]
TPH C_{10}-C_{14}	50[1, 2]
TPH C_{15}-C_{28}	100[1, 2]
TPH C_{29}-C_{36}	50[1, 2]

Note: 1. Based on limit of reporting.
2. As per Licence limits.
3. As per OHE provided protection of marine water quality criteria with mixture modifying factors included where appropriate.

JBS Environmental (February 2012) *'Human Health and Ecological Risk Assessment for Proposed Imported Soils Barangaroo Delivery Authority Barangaroo Central'* has also been prepared for Barangaroo Soil which details human health based criteria required to be considered for imported fill materials to be used on the site in addition to the ecological based criteria presented in this document.

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12 Limitations

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Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements and site history, not on sampling and analysis of all media at all locations for all potential contaminants.

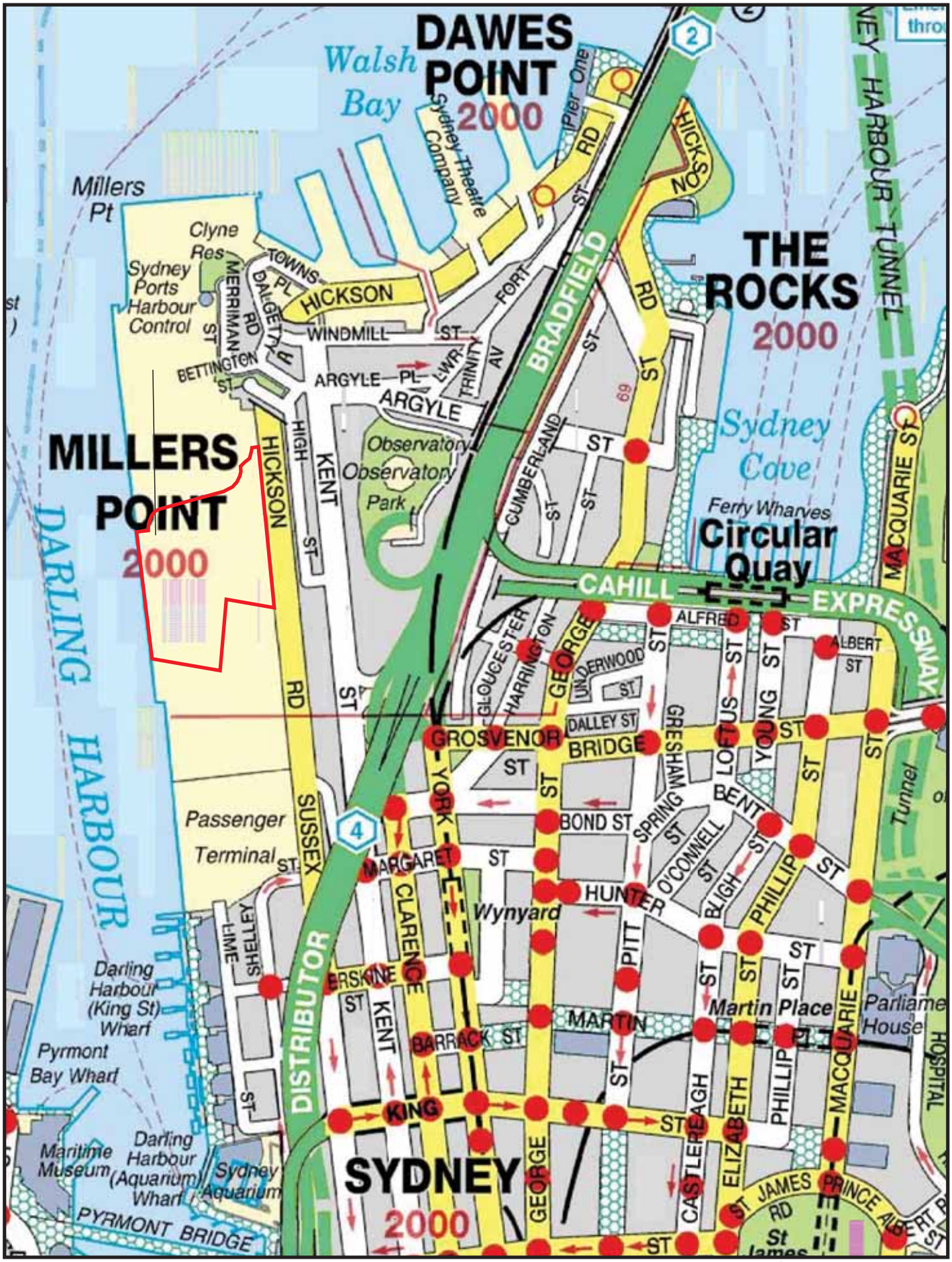
Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS Environmental Pty Ltd reserves the right to review the report in the context of the additional information.

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Figures

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0 75 125 250 m

Scale: Approximate

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date
A4			
A	Issue - R01	RF	27-1-2012

Legend:

Approximate Boundary - Barangaroo Central

JBS ENVIRONMENTAL

Figure 1: Site Location

Client: Barangaroo Delivery Authority

Project: Barangaroo Central

Job No: 42021 File Name: 42021_01



Source: Base Image www.nearmap.com (23-10-2011)

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0 15 30 60 m

Scale: 1:1,500

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
B	Original Issue - R01	RF	21-2-2012

Legend:

- Approximate Site Boundary - Barangaroo Central
- Inaccessible for soil and groundwater sampling

JBS ENVIRONMENTAL

Figure 2: Barangaroo Central Site Plan

Client: Barangaroo Delivery Authority

Project: Barangaroo - Central

Job No: 42021 File Name: 42021_02



Source: Base Image www.nearmap.com (23-10-2011)

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0 20 40 80 m

Scale: 1:2,200

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
B	Original Issue - R01	RF	21-2-2012

Legend:

- Approximate Site Boundary - Barangaroo Central
- DECCW Declared Area
- Approximate 500m2 Pavillion
- Consider 50m floating connection
- Provide area for temporary car parking
- Provide flat areas for events
- View and Access Corridors

JBS ENVIRONMENTAL

Figure 3: Barangaroo Central Concept Plan - Barangaroo Central Stage 1 Public Domain

Client: Barangaroo Delivery Authority

Project: Barangaroo - Central

Job No: 42021 File Name: 42021_03



Source: JPW / PWP 110712_Outline Design Plan (11-07-2011)

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0 20 40 80 m

Scale: 1:2,200

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
B	Original Issue - R01	RF	21-2-2012

Legend:

- Approximate Site Boundary - Barangaroo Central
- DECCW Declared Area
- Approximate 500m2 Pavillion
- Consider 50m floating connection
- Residential Building Basements / Carparks
- Provide area for temporary car parking
- Provide flat areas for events

JBS ENVIRONMENTAL

Figure 4: Barangaroo Central Concept Plan - Barangaroo Residential / Open Space Development

Client: Barangaroo Delivery Authority

Project: Barangaroo - Central

Job No: 42021 File Name: 42021_04



Source: JPW / PWP 110712_Outline Design Plan (11-07-2011)

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0 20 40 80 m

Scale: 1:2,200

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
A	Original Issue - R02	RF	28-2-2012

Legend:

- Approximate Site Boundary - Barangaroo Central
- Assumed Cultural Space
- Area A
- Area B (<10m from Cultural Space)
- Area C (10 to 30m from Cultural Space
- Area D (<10m from Residential Building Basements/Carparks)
- Area E (10 to 30m from Residential Building Basements/Carparks)
- Declared Area
- Residential Building Basements / Carparks

JBS ENVIRONMENTAL

Figure 5: Barangaroo Central Concept Plan - Barangaroo Residential / Open Space Development Proposed Application of Risk Criteria

Client: Barangaroo Delivery Authority

Project: Barangaroo - Central

Job No: 42021 File Name: 42021_05

Appendix A

Proposed Protection of Marine Water Criteria

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Summary of Marine Water Quality Criteria (µg/L)

Based on 95% protection for most compounds and 99% for bioaccumulative compounds

Compound	Bioaccumulative?	Marine Water Criteria	Source	Mixture Modifying Factor	Criteria relevant to tidal exchange prism		Criteria relevant to areas upgradient of tidal prism	
					Criteria assuming mixtures - DAF = 1	Criteria assuming mixtures - DAF = 4	Criteria assuming mixtures - DAF = 5	Criteria assuming mixtures - DAF = 20
Metals and Inorganics								
arsenic		2.3	ANZECC (2000) low reliability for As(III)	1	2.3	9.2	11.5	46
cadmium	y	0.7	ANZECC (2000) 99% protection	1	0.7	2.8	3.5	14
chromium (VI)		4.4	ANZECC (2000) 95% protection	1	4.4	17.6	22	88
cobalt		1	ANZECC (2000) 95% protection	1	1	4	5	20
copper		1.3	ANZECC (2000) 95% protection	1	1.3	5.2	6.5	26
lead		4.4	ANZECC (2000) 95% protection	1	4.4	17.6	22	88
mercury	y	0.1	ANZECC (2000) 99% protection	1	0.1	0.4	0.5	2
nickel		70	ANZECC (2000) 95% protection	1	70	280	350	1400
vanadium		100	ANZECC (2000) 95% protection	1	100	400	500	2000
zinc		15	ANZECC (2000) 95% protection	1	15	60	75	300
ammonia		910	ANZECC (2000) 95% protection for total ammonia-N based on pH 8	1	910	3640	4550	18200
cyanide (total)		4	ANZECC (2000) 95% protection for un-ionised HCN (calculated from free cyanide data)	1	4	16	20	80
Petroleum Hydrocarbons								
benzene		500	ANZECC (2000) 95% protection moderate reliability	0.25	125	500	625	2500
toluene		180	ANZECC (2000) 95% protection low reliability	0.25	45	180	225	900
ethylbenzene		80	ANZECC (2000) 95% protection for fresh water, more appropriate than marine water guideline	0.25	20	80	100	400
xylenes (total)		75	ANZECC (2000) 95% protection low reliability for m-xylene	0.25	18.75	75	93.75	375
TPH C6-C9		14.4	CCME (2008) benchmark, based on C8-C10 assuming 50:50 aromatic:aliphatic split	0.25	3.6	14.4	18	72
TPH C10-C14		0.15	CCME (2008) benchmark, based on C12-C16 assuming 50:50 aromatic:aliphatic split	0.25	0.0375	0.15	0.1875	0.75
TPH C15-C28			No guideline available - toxicity may be higher than solubility					
TPH C29-C36			No guideline available - toxicity may be higher than solubility					
Polycyclic Aromatic Hydrocarbons								
acenaphthene		5.8	CCME (1999) freshwater guideline	0.2	1.16	4.64	5.8	23.2
acenaphthylene		5.8	Adopt criteria for acenaphthene as surrogate	0.2	1.16	4.64	5.8	23.2
anthracene	y	0.01	ANZECC (2000) 99% protection - ANZECC note this PAH has potential to bioaccumulate	0.2	0.002	0.008	0.01	0.04
fluoranthene	y	1	ANZECC (2000) 99% protection - ANZECC note this PAH has potential to bioaccumulate	0.2	0.2	0.8	1	4
fluorene		3	CCME (1999) freshwater guideline	0.2	0.6	2.4	3	12
naphthalene		70	ANZECC (2000) 95% protection moderate reliability	0.2	14	56	70	280
phenanthrene	y	0.6	ANZECC (2000) 99% protection - ANZECC note this PAH has potential to bioaccumulate	0.2	0.12	0.48	0.6	2.4
pyrene		0.025	CCME (1999) freshwater guideline	0.2	0.005	0.02	0.025	0.1
carcinogenic PAHs as BaP TEF	y	0.1	ANZECC (2000) 99% protection - ANZECC note these PAHs have the potential to bioaccumulate	1	0.1	0.4	0.5	2
benzo(a)anthracene	y		addressed as BaP TEF					
benzo(b)fluoranthene	y		addressed as BaP TEF					
benzo(g,h,i)perylene	y		addressed as BaP TEF					
benzo(k)fluoranthene	y		addressed as BaP TEF					
chrysene	y		addressed as BaP TEF					
dibenz(a,h)anthracene	y		addressed as BaP TEF					
indeno(1,2,3-c,d)pyrene	y		addressed as BaP TEF					
Other Organics								
aniline			no guideline available - likely to be addressed with PAHs					
carbazole			no guideline available - likely to be addressed with PAHs					
dibenzofuran		3.7	Oak Ridge Secondary Chronic Value (1997), compound similar to PAHs	0.2	0.74	2.96	3.7	14.8
2,4-dimethylphenol		2	ANZECC (2000) low reliability	0.33	0.66	2.64	3.3	13.2
2-methylphenol (o-cresol)		13	Oak Ridge Secondary Chronic Value (1997)	0.33	4.29	17.16	21.45	85.8
3&4-methylphenol(m&p-cresol)		13	Adopt value for 2-methylphenol as surrogate	0.33	4.29	17.16	21.45	85.8
2-methylnaphthalene		2.1	Oak Ridge Secondary Chronic Value (1997) for 1-methylnaphthalene	0.2	0.42	1.68	2.1	8.4
styrene		72	CCME (1999) freshwater guideline	1	72	288	360	1440
1,2,4-trimethylbenzene			no guideline available - likely to be addressed with TPH					

Appendix B

Proposed Terrestrial Soil Criteria

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Terrestrial Soil Criteria to be Adopted (mg/kg)

		Sources of data from which criteria have been selected				
Key Chemical	**Criteria for Protection of Plants and Soil**	**NEPM (1999) - Ineterim Urban**	**NEPM (draft) EILs - Public open spacen - aged**	**USEPA Eco SSLs**	**CCME (coase soil)**	**EU PNEC for soil**
arsenic	20	20	100	18	12	
cadmium	3	3		32	10	
chromium	190	400	190-400		64	
copper	60	100	60-230	70	63	
lead	1100	600	1100	120		
mercury	1	1			6.6	
nickel	30	60	30-560	38	50	
zinc	200	200	70-1300	160	200	
sulfate		2000				
cyanide (if free)	0.9				0.9	
ammonia	Calculate based on irrigation guideline of 5 mg/L as N (based on protection of plants)					
TPH						
C6-C9	210				210	
C10-C14	150				150	
C15-C28						
C29-C36	300 as sum				300	
benzene	0.2				31	0.2
toluene	0.3				55	0.3
ethylbenzene	0.8				75	0.8
xylenes	Addressed with benzene, toluene and ethylbenzene				95	
Low MWT PAHs						
acenaphthene					1	0.038
acenaphthylene					1	0.29
anthracene					2.5	0.13
fluorene					1	1
naphthalene			170		0.013	1
phenanthrene	sum - 29mg/kg			sum - 29mg/kg	0.046	1.8
High MWT PAHs						
benzo[a]anthracene					1	0.079
benzo[a]pyrene					20	0.053
benzo[b]fluoranthene					1	0.28
benzo[k]fluoranthene					1	0.27
benzo[ghi]perylene					1	0.17
chrysene					1	0.55
dibenz[ah]anthracene					1	0.054
fluoranthene					50	1.5
indeno[123cd]pyrene					1	0.13
pyrene	sum - 18mg/kg			sum - 18mg/kg	10	1
phenol	3.8				3.8	0.14
2,4dimethylphenol	3.8				3.8	
2-methylphenol	3.8				3.8	
3&4-methylphenol	3.8				3.8	

Appendix C

Summary of Leachability Data

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Table A - Soil Sample Register with Analysis of Total and Leachable Levels
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

Sample ID	Sample Date	Geology	Analytes	Lab / Report Reference
JBS1/2.0	10/05/2010	silty sand with some sandstone	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs, TPH and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs and TPH)	40811
JBS1/2.7	10/05/2010	silty sand with some sandstone	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs, TPH and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs and TPH)	40811
JBS1/6.0	10/05/2010	silty sand with some sandstone	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn)	40811
JBS2/1.8	10/05/2010	clayey sand with some sandstone	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn and PAHs)	40811
JBS2/4.0	10/05/2010	Sand	PAHs, TPH and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs and TPH)	40811
JBS3/0.2	10/05/2010	clayey sand with some sandstone	PAHs, TPH and ASLP (PAHs and TPH)	40811
JBS3/1.2	10/05/2010	clayey sand with some sandstone	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs, TPH and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs and TPH)	40811
JBS4/0.5	10/05/2010	silty gravelly clayey sand	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn and PAHs)	40811
JBS4/2.0	10/05/2010	gravelly sand	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn and PAHs)	40811
JBS4/7.5	10/05/2010	clayey sand	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn)	40811
JBS4/10.5	10/05/2010	clayey sand (alluvium)	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn)	40811
300/6.0	2/12/2010	silty sand and sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	49527
300/15.8	2/12/2010	marine clay	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	49527

Table A - Soil Sample Register with Analysis of Total and Leachable Levels
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

Sample ID	Sample Date	Geology	Analytes	Lab / Report Reference
314/9.0	3/12/2010	silty clay	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	49527
329A/7.0	3/12/2010	gravelly clay	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	49527
301/2.0	24/11/2010	crushed sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	49067
301/14.0	24/11/2010	marine clay	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48779 & 49067
303A/5.0	24/11/2010	clay and crushed sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48779 & 49067
304/3.0	22/11/2010	sand and sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48618 & 49067
305/8.0	22/11/2010	sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48618 & 49067
306/0.5	18/11/2010	silty sand with gravel and sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48539 & 49067
306/1.0	18/11/2010	clayey silty sand and sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48539 & 49067
306/5.0	18/11/2010	clayey sand	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48539 & 49067
307/2.0	18/11/2010	sandy clay	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48539 & 49067

Table A - Soil Sample Register with Analysis of Total and Leachable Levels
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

Sample ID	Sample Date	Geology	Analytes	Lab / Report Reference
309/1.0	23/11/2010	crushed sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48776 & 49067
315/6.0	26/11/2010	sandy clay	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48920 & 49067
317/2.0	22/11/2010	sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48618 & 49067
320A/1.0	22/11/2010	clayey sand and sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	49067
323/3.0	19/11/2010	silty clay	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48581 & 49067
324/3.0	26/11/2010	crushed sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48920 & 49067
325/1.0	22/11/2010	silty clay and crushed sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	49067
325C/5.0	23/11/2010	sandy silt	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48776 & 49067
327/5.0	19/11/2010	sand with gravel and sandstone	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	48581 & 49067
BH02 14.5-14.6	4/12/2009		As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn)	AECOM (2010a)
BH07 7.4-7.56	8/12/2009	Gravelly clayey sand fill	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn)	AECOM (2010a)
BH11 2.6-2.7	5/02/2010	Sandy clay fill	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn and PAHs)	AECOM (2010a)

Table A - Soil Sample Register with Analysis of Total and Leachable Levels
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

Sample ID	Sample Date	Geology	Analytes	Lab / Report Reference
BH13 2.4-2.6	5/02/2010	Sand fill	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn)	AECOM (2010a)
BH13 7.2-7.4	5/02/2010	Gravelly sand fill	PAHs and ASLP (PAHs)	AECOM (2010a)
BH15 2.0-2.2	9/02/2010	Clayey silty gravelly sand fill	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn and PAHs)	AECOM (2010a)
BH20 11-11.2	11/02/2010	Clayey sand (natural)	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn and PAHs)	AECOM (2010a)
BH21 12-12.2	11/02/2010	Clayey sand (natural)	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn)	AECOM (2010a)
BH23 4.7-4.9	5/02/2010	Sandy gravel (fill)	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn)	AECOM (2010b)
BH37 5.5-5.7	18/02/2010	Gravelly clayey sand fill	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V and Zn)	AECOM (2010a)
BH40_17.8-18.0	18/02/2010	Sandy clay (natural)	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH41 1.0-1.4	4/03/2010	Sandy clayey gravel fill	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH41 17.5-17.7	8/03/2010	Sandstone (natural)	PAHs and ASLP (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn and PAHs)	AECOM (2010c)
BH46-19.0-19.2	23/02/2010	Clayey sand (natural)	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, C, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH48 14.5-14.7	23/02/2010	no log available	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH56 7.0-7.2	4/03/2010	Silty clayey sand fill	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH57 7.0-7.2	25/02/2010	Clayey sandy gravel fill	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)

Table A - Soil Sample Register with Analysis of Total and Leachable Levels
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

Sample ID	Sample Date	Geology	Analytes	Lab / Report Reference
BH60 20.5-20.9	2/03/2010	Sand (natural)	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH63 13.0-13.3	1/03/2010	Sandy clay (natural)	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH69 1.0-1.5	26/02/2010	Sand fill	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH70 2.5-2.7	8/03/2010	Sand fill	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH71 2.5-2.7	4/03/2010	Clayey sandy gravel fill	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH71 10-10.2	4/03/2010	Gravelly sand fill	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH72 1.0-1.2	3/03/2010	Gravelly sandy clay fill	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH73 17.5-17.7	2/03/2010	Clayey sand (natural)	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)
BH74 8.5-8.8	3/03/2010	Silty sand fill	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, PAHs and ASLP (PAHs)	AECOM (2010c)
BH75 16.0-16.2	2/03/2010	Clay (natural)	As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn, PAHs and ASLP (As, Cd, Cr, Co, Cu, Pb, Hg, Ni, V, Zn and PAHs)	AECOM (2010c)

Table B - Soil Total and ASLP Leachable Heavy Metals Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

			Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Nickel	Vanadium	Zinc
Sample ID	**Type and Units**	**Sample Date**										
JBS1/2.0	Total, mg/kg	10/05/2010	<4	0.6	9	-	12	55	<0.1	5		61
	ASLP, ug/l		2	<0.1	<1	-	2	1	<0.5	<1		23
	ASLP / Total						*0.166666667*	*0.018181818*				*0.37704918*
JBS1/2.7	Total, mg/kg	10/05/2010	<4	<0.5	13	-	22	73	0.1	10		120
	ASLP, ug/l		3	<0.1	<1	-	2	<1	<0.5	<1		26
	ASLP / Total						*0.090909091*					*0.216666667*
JBS1/6.0	Total, mg/kg	10/05/2010	<4	<0.5	22	-	14	170	<0.1	7		66
	ASLP, ug/l		1	<0.1	<1	-	3	<1	<0.5	<1		57
	ASLP / Total						*0.214285714*					*0.863636364*
JBS2/1.8	Total, mg/kg	10/05/2010	<4	<0.5	11	-	38	210	<0.1	24		290
	ASLP, ug/l		2	<0.1	1	-	4	1	<0.5	<1		24
	ASLP / Total				*0.090909091*		*0.105263158*	*0.004761905*				*0.082758621*
JBS3/1.2	Total, mg/kg	10/05/2010	4	<0.5	10	-	150	120	0.7	11		72
	ASLP, ug/l		4	<0.1	<1	-	21	17	<0.5	<1		39
	ASLP / Total		*1*				*0.14*	*0.141666667*				*0.541666667*
JBS4/0.5	Total, mg/kg	10/05/2010	<4	<0.5	15	-	37	110	0.3	15		100
	ASLP, ug/l		2	<0.1	<1	-	5	3	<0.5	<1		20
	ASLP / Total						*0.135135135*	*0.027272727*				*0.2*
JBS4/2.0	Total, mg/kg	10/05/2010	11	<0.5	11	-	76	170	0.2	3		62
	ASLP, ug/l		2	<0.1	2	-	8	13	<0.5	<1		61
	ASLP / Total		*0.181818182*		*0.181818182*		*0.105263158*	*0.076470588*				*0.983870968*
JBS4/7.5	Total, mg/kg	10/05/2010	5	<0.5	10	-	72	230	0.9	9		70
	ASLP, ug/l		3	<0.1	<1	-	16	5	<0.5	<1		110
	ASLP / Total		*0.6*				*0.222222222*	*0.02173913*				*1.571428571*
JBS4/10.5	Total, mg/kg	10/05/2010	<4	<0.5	15	-	14	75	0.2	3		39
	ASLP, ug/l		1	0.2	6	-	20	2	<0.5	1		190
	ASLP / Total				*0.4*		*1.428571429*	*0.026666667*		*0.333333333*		*4.871794872*
300/6.0	Total, mg/kg	2/12/2010	<4	<0.5	13	3	17	71	0.1	7	15	51
	ASLP, ug/l		2	<0.1	<1	<1	4	1	<0.5	<1	6.3	63
	ASLP / Total						*0.235294118*	*0.014084507*			*0.42*	*1.235294118*
300/15.8	Total, mg/kg	2/12/2010	<4	<0.5	9	5	4	19	<0.1	7	17	55
	ASLP, ug/l		3	<0.1	4	1	6	52	<0.5	2	9.3	46

Table B - Soil Total and ASLP Leachable Heavy Metals Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

			Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Nickel	Vanadium	Zinc
Sample ID	**Type and Units**	**Sample Date**										
	ASLP / Total				*0.444444444*	*0.2*	*1.5*	*2.736842105*		*0.285714286*	*0.547058824*	*0.836363636*
314/9.0	Total, mg/kg	3/12/2010	4	<0.5	10	3	69	170	0.9	5	20	120
	ASLP, ug/l		7	0.1	2	<1	20	31	<0.5	<1	14.3	71
	ASLP / Total		*1.75*		*0.2*		*0.289855072*	*0.182352941*			*0.715*	*0.591666667*
329A/7.0	Total, mg/kg	3/12/2010	4	<0.5	19	7	29	73	0.2	11	17	66
	ASLP, ug/l		2	<0.1	<1	<1	4	<1	<0.5	<1	1	15
	ASLP / Total		*0.5*				*0.137931034*				*0.058823529*	*0.227272727*
301/2.0	Total, mg/kg	24/11/2010	<4	<0.5	6	2	2	18	<0.1	2	8	21
	ASLP, ug/l		<1	<0.1	<1	<1	5	6	<0.5	<1	<1	12
	ASLP / Total						*2.5*	*0.333333333*				*0.571428571*
301/14.0	Total, mg/kg	24/11/2010	11	<0.5	28	7	58	180	0.8	13	33	240
	ASLP, ug/l		4	<0.1	<1	<1	4	3	<0.5	<1	6.2	29
	ASLP / Total		*0.363636364*				*0.068965517*	*0.016666667*			*0.187878788*	*0.120833333*
303A/5.0	Total, mg/kg	24/11/2010	<4	<0.5	12	1	43	55	0.4	3	14	47
	ASLP, ug/l		<1	<0.1	<1	<1	3	<1	<0.5	<1	1.7	19
	ASLP / Total						*0.069767442*				*0.121428571*	*0.404255319*
304/3.0	Total, mg/kg	22/11/2010	36	0.6	59	10	3200	260	16	31	26	440
	ASLP, ug/l		3	<0.1	<1	<1	25	3	<0.5	<1	<1	31
	ASLP / Total		*0.083333333*				*0.0078125*	*0.011538462*				*0.070454545*
305/8.0	Total, mg/kg	22/11/2010	<4	<0.5	15	<1	7	46	<0.1	1	18	13
	ASLP, ug/l		<1	<0.1	<1	<1	5	1	<0.5	<1	3.7	24
	ASLP / Total						*0.714285714*	*0.02173913*			*0.205555556*	*1.846153846*
306/0.5	Total, mg/kg	18/11/2010	<4	<0.5	14	3	94	270	0.4	37	23	120
	ASLP, ug/l		4	0.3	5	1.8	41	120	<0.5	7	30.1	190
	ASLP / Total				*0.357142857*	*0.6*	*0.436170213*	*0.444444444*		*0.189189189*	*1.308695652*	*1.583333333*
306/1.0	Total, mg/kg	18/11/2010	<4	<0.5	13	3	280	300	1.2	8	14	100
	ASLP, ug/l		3	<0.1	3	<1	47	86	<0.5	2	8.2	76
	ASLP / Total				*0.230769231*		*0.167857143*	*0.286666667*		*0.25*	*0.585714286*	*0.76*
306/5.0	Total, mg/kg	18/11/2010	6	<0.5	11	3	2	8	<0.1	2	23	10
	ASLP, ug/l		1	<0.1	<1	<1	45	13	<0.5	2	2.9	76
	ASLP / Total		*0.166666667*				*22.5*	*1.625*		*1*	*0.126086957*	*7.6*

Table B - Soil Total and ASLP Leachable Heavy Metals Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

			Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Nickel	Vanadium	Zinc
Sample ID	**Type and Units**	**Sample Date**										
307/2.0	Total, mg/kg	18/11/2010	<4	<0.5	23	2	18	65	0.2	6	15	34
	ASLP, ug/l		2	<0.1	<1	<1	11	12	<0.5	<1	3.8	33
	ASLP / Total						*0.611111111*	*0.184615385*			*0.253333333*	*0.970588235*
309/1.0	Total, mg/kg	23/11/2010	5	<0.5	6	3	15	40	0.1	6	15	50
	ASLP, ug/l		5	0.3	<1	<1	16	20	<0.5	2	9.9	38
	ASLP / Total		*1*				*1.066666667*	*0.5*		*0.333333333*	*0.66*	*0.76*
315/6.0	Total, mg/kg	26/11/2010	<4	<0.5	9	2	41	110	0.3	7	12	54
	ASLP, ug/l		5	0.6	4	7.7	44	1580	<0.5	17	3.2	1000
	ASLP / Total				*0.444444444*	*3.85*	*1.073170732*	*14.36363636*		*2.428571429*	*0.266666667*	*18.51851852*
317/2.0	Total, mg/kg	22/11/2010	<4	<0.5	18	24	3	14	<0.1	6	12	15
	ASLP, ug/l		3	<0.1	2	16.2	6	5	<0.5	1	2.6	43
	ASLP / Total				*0.111111111*	*0.675*	*2*	*0.357142857*		*0.166666667*	*0.216666667*	*2.866666667*
320A/1.0	Total, mg/kg	22/11/2010	4	<0.5	9	1	830	34	<0.1	2	20	15
	ASLP, ug/l		12	0.1	<1	<1	17	100	<0.5	1	4.3	140
	ASLP / Total		*3*				*0.020481928*	*2.941176471*		*0.5*	*0.215*	*9.333333333*
323/3.0	Total, mg/kg	19/11/2010	17	<0.5	13	16	160	480	2	34	27	180
	ASLP, ug/l		1	<0.1	<1	<1	9	7	<0.5	2	1.1	17
	ASLP / Total		*0.058823529*				*0.05625*	*0.014583333*		*0.058823529*	*0.040740741*	*0.094444444*
324/3.0	Total, mg/kg	26/11/2010	4	<0.5	10	4	38	120	0.2	8	17	83
	ASLP, ug/l		6	<0.1	<1	<1	14	41	<0.5	<1	17.8	34
	ASLP / Total		*1.5*				*0.368421053*	*0.341666667*			*1.047058824*	*0.409638554*
325/1.0	Total, mg/kg	22/11/2010	<4	<0.5	5	2	14	51	<0.1	3	9	52
	ASLP, ug/l		4	<0.1	<1	<1	12	13	<0.5	2	10.3	69
	ASLP / Total						*0.857142857*	*0.254901961*		*0.666666667*	*1.144444444*	*1.326923077*
325C/5.0	Total, mg/kg	23/11/2010	4	<0.5	10	3	32	130	0.4	7	18	100
	ASLP, ug/l		2	<0.1	<1	<1	2	2	<0.5	<1	3.6	37
	ASLP / Total		*0.5*				*0.0625*	*0.015384615*			*0.2*	*0.37*
327/5.0	Total, mg/kg	19/11/2010	6	<0.5	7	2	18	94	0.3	3	13	72
	ASLP, ug/l		2	<0.1	<1	<1	2	2	<0.5	<1	5.1	37
	ASLP / Total		*0.333333333*				*0.111111111*	*0.021276596*			*0.392307692*	*0.513888889*
BH21 12-12.2	Total, mg/kg	11/02/2010	11	<1	16	<2	52	183	1.1	4	24	200
	ASLP, mg/l		0.005	0.0002	0.011	-	0.034	0.112	0.0005	0.002	-	0.477

Table B - Soil Total and ASLP Leachable Heavy Metals Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

			Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Nickel	Vanadium	Zinc
Sample ID	**Type and Units**	**Sample Date**										
	ASLP / Total		*0.000454545*		*0.0006875*		*0.000653846*	*0.000612022*	*0.000454545*	*0.0005*		*0.002385*
BH23 4.7-4.9	Total, mg/kg	5/02/2010	<5	<1	8	8	35	39	<0.1	20	24	40
	ASLP, mg/l		<0.001	<0.0001	0.002	-	0.001	0.003	<0.0001	0.003	-	0.111
	ASLP / Total				*0.00025*		*2.85714E-05*	*7.69231E-05*		*0.00015*		*0.002775*
BH32 14.5-14.7	Total, mg/kg	12/02/2010	19	1	23	3	124	826	5.2	10	30	483
	ASLP, mg/l		0.002	<0.0001	<0.002	-	<0.005	0.017	<0.0001	<0.001	-	0.117
	ASLP / Total		*0.000105263*					*2.05811E-05*				*0.000242236*
BH37 5.5-5.7	Total, mg/kg	18/02/2010	<0.1	<5	<1	3	8	3	20	5	15	28
	ASLP, mg/l		<0.0001	0.001	<0.0001	0.003	<0.001	0.002	0.001	0.007	<0.01	0.038
	ASLP / Total					*0.001*		*0.000666667*	*0.00005*	*0.0014*		*0.001357143*
BH48 14.5-14.7	Total, mg/kg	23/02/2010	<5	<1	4	<2	23	12	0.3	<2	8	27
	ASLP, mg/l		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.01	0.059
	ASLP / Total											*0.002185185*
BH40_17.8-18.	Total, mg/kg	18/02/2010	<5	<1	5	<2	<5	6	<0.1	<2	6	<5
	ASLP, mg/l		<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.01	0.04
	ASLP / Total											
BH41 1.0-1.4	Total, mg/kg	4/03/2010	7	<1	11	13	11	17	<0.1	21	22	94
	ASLP, mg/l		0.009	<0.0001	0.003	0.003	0.003	0.000006	<0.0001	0.005	<0.01	0.345
	ASLP / Total		*0.001285714*		*0.000272727*	*0.000230769*	*0.000272727*	*3.52941E-07*		*0.000238095*		*0.003670213*
BH41 17.5-17.7	Total, mg/kg	8/03/2010	-	-	-	-	-	-	-	-	-	-
	ASLP, mg/l		<1	<0.0001	0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.01	0.049
	ASLP / Total											
BH46-19.0-19.2	Total, mg/kg	23/02/2010	<5	<1	5	<2	<5	6	<0.1	<2	<5	<5
	ASLP, mg/l		<0.001	0.0001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.01	0.045
	ASLP / Total											
BH56 7.0-7.2	Total, mg/kg	4/03/2010	<5	<1	<0.5	2	11	66	<0.1	<2	14	33
	ASLP, mg/l		0.001	<0.0001	<0.001	<0.001	<0.001	0.016	<0.0001	<0.001	<0.01	0.034
	ASLP / Total							*0.000242424*				*0.001030303*
BH57 7.0-7.2	Total, mg/kg	25/02/2010	8	<1	-	-	-	318	0.3	4	-	-
	ASLP, mg/l		0.016	0.001	0.015	0.002	0.057	0.735	0.0006	0.004	0.05	1.16
	ASLP / Total		*0.002*					*0.002311321*	*0.002*	*0.001*		

Table B - Soil Total and ASLP Leachable Heavy Metals Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

			Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Nickel	Vanadium	Zinc
Sample ID	**Type and Units**	**Sample Date**										
BH60 20.5-20.9	Total, mg/kg	2/03/2010	<5	<1	<0.5	<2	<5	<5	<0.1	<2	<5	<5
	ASLP, mg/l		<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.01	0.05
	ASLP / Total											
BH63 13.0-13.3	Total, mg/kg	1/03/2010	36	<1	<0.5	<2	<5	14	<0.1	<2	85	5
	ASLP, mg/l		<0.001	<0.0001	0.002	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.01	0.04
	ASLP / Total											*0.008*
BH69 1.0-1.5	Total, mg/kg	26/02/2010	<5	<1	10	3	24	104	0.1	8	14	79
	ASLP, mg/l		0.003	<0.0001	0.001	<0.001	0.004	<0.001	<0.0001	<0.001	0.02	0.013
	ASLP / Total				*0.0001*		*0.000166667*				*0.001428571*	*0.000164557*
BH70 2.5-2.7	Total, mg/kg	8/03/2010	<5	<1	<0.5	5	94	74	<0.1	4	64	80
	ASLP, mg/l		0.011	0.0006	0.001	0.001	0.01	0.07	<0.0001	0.002	<0.01	0.059
	ASLP / Total					*0.0002*	*0.000106383*	*0.000945946*		*0.0005*		*0.0007375*
BH71 2.5-2.7	Total, mg/kg	4/03/2010	6	<1	10	<2	23	93	1.1	5	15	180
	ASLP, mg/l		0.002	<0.0001	<0.001	<0.001	<0.001	0.003	<0.0001	<0.001	<0.01	0.037
	ASLP / Total		*0.000333333*					*3.22581E-05*				*0.000205556*
BH71 10-10.2	Total, mg/kg	4/03/2010	<5	<1	7	<2	11	63	0.1	<2	12	45
	ASLP, mg/l		0.005	<0.0001	<1	<0.001	0.003	0.006	<0.0001	<0.001	0.03	0.023
	ASLP / Total						*0.000272727*	*9.52381E-05*			*0.0025*	*0.000511111*
BH72 1.0-1.2	Total, mg/kg	3/03/2010	<5	<1	9	4	14	446	<0.1	6	18	165
	ASLP, mg/l		0.002	<0.0001	0.001	<0.001	0.002	0.039	<0.0001	<0.001	<0.01	0.063
	ASLP / Total				*0.000111111*		*0.000142857*	*8.74439E-05*				*0.000381818*
BH73 17.5-17.7	Total, mg/kg	2/03/2010	33	<1	39	<2	5	15	<0.1	<2	62	9
	ASLP, mg/l		<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.01	0.134
	ASLP / Total											*0.014888889*
BH75 16.0-16.2	Total, mg/kg	2/03/2010	<5	<1	8	<2	<5	11	<0.1	<2	7	<5
	ASLP, mg/l		<0.001	<0.0001	0.002	<0.001	<0.001	0.001	<0.0001	<0.001	<0.01	0.044
	ASLP / Total				*0.00025*			*9.09091E-05*				
Summary of ASLP / Total Values (ug/l / mg/kg)			0.058823529		0.090909091	0.2	0.0078125	0.000352941	0.05	0.058823529	0.040740741	0.070454545
			0.083333333		0.1	0.2	0.020481928	0.004761905	0.454545455	0.15	0.058823529	0.082758621
			0.105263158		0.111111111	0.230769231	0.028571429	0.011538462	2	0.166666667	0.121428571	0.094444444
			0.166666667		0.111111111	0.6	0.05625	0.014084507		0.189189189	0.126086957	0.120833333

Table B - Soil Total and ASLP Leachable Heavy Metals Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

Sample ID	Type and Units	Sample Date	Arsenic	Cadmium	Chromium	Cobalt	Copper	Lead	Mercury	Nickel	Vanadium	Zinc
			0.181818182		0.181818182	0.675	0.0625	0.014583333		0.238095238	0.187878788	0.164556962
			0.333333333		0.2	1	0.068965517	0.015384615		0.25	0.2	0.2
			0.333333333		0.230769231	3.85	0.069767442	0.016666667		0.285714286	0.205555556	0.205555556
			0.363636364		0.25		0.090909091	0.018181818		0.333333333	0.215	0.216666667
			0.454545455		0.25		0.105263158	0.020581114		0.333333333	0.216666667	0.227272727
			0.5		0.272727273		0.105263158	0.021276596		0.5	0.253333333	0.242236025
			0.5		0.357142857		0.106382979	0.02173913		0.5	0.266666667	0.37
			0.6		0.4		0.111111111	0.02173913		0.5	0.392307692	0.37704918
			1		0.6875		0.135135135	0.026666667		0.666666667	0.42	0.381818182
			1		444.4444444		0.137931034	0.027272727		1	0.547058824	0.404255319
			1.285714286		444.4444444		0.14	0.032258065		1	0.585714286	0.409638554
			1.5				0.142857143	0.076470588		1.4	0.66	0.511111111
			1.75				0.166666667	0.076923077		2.428571429	0.715	0.513888889
			2				0.166666667	0.087443946			1.047058824	0.541666667
			3				0.167857143	0.090909091			1.144444444	0.571428571
							0.214285714	0.095238095			1.308695652	0.591666667
							0.222222222	0.141666667			1.428571429	0.7375
							0.235294118	0.182352941			2.5	0.76
							0.272727273	0.184615385				0.76
							0.272727273	0.242424242				0.836363636
							0.289855072	0.254901961				0.863636364
							0.368421053	0.286666667				0.970588235
							0.436170213	0.333333333				0.983870968
							0.611111111	0.341666667				1.03030303
							0.653846154	0.357142857				1.235294118
							0.714285714	0.444444444				1.326923077
							0.857142857	0.5				1.357142857
							1.066666667	0.612021858				1.571428571
							1.073170732	0.666666667				1.583333333

Table C - Soil Total and Leachable PAH Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

all units in ug/l

			Polycyclic Aromatic Hydrocarbons															
			Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b&k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3,cd)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene
Sample ID	**Type and Units**	**Sample Date**																
JBS1/2.0	Total, mg/kg	10/05/2010		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
	ASLP, mg/l			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0001	<0.0001
	ASLP / Total																	
JBS1/2.7	Total, mg/kg	10/05/2010		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	0.07	<0.1	<0.1	<0.1
	ASLP, mg/l			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0001	<0.0001
	ASLP / Total																	
JBS2/1.8	Total, mg/kg	10/05/2010		1.1	1	0.2	0.6	3.2	0.7	2.8	2.4	1.1	1.1	2.2	1.7	1	0.2	<0.1
	ASLP, mg/l			0.0006	0.0003	0.0001	0.0013	0.0038	0.0004	0.0011	0.0008	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0001	<0.0001
	ASLP / Total			*0.00055*	*0.0003*	*0.0005*	*0.00217*	*0.00119*	*0.00057*	*0.00039*	*0.00033*							
JBS2/4.0	Total, mg/kg	10/05/2010		<0.1	0.2	<0.1	0.1	1.1	0.3	2.3	2.5	1.2	1.2	2	1.6	0.6	0.1	0.7
	ASLP, mg/l			0.002	<0.0001	0.0003	0.0002	0.0006	0.0001	0.0004	0.0003	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0001	<0.0001
	ASLP / Total						*0.002*	*0.00055*	*0.00033*	*0.00017*	*0.00012*							
JBS3/0.2	Total, mg/kg	10/05/2010		<0.1	<0.1	<0.1	<0.1	0.2	<0.1	<0.1	0.1	<0.1	0.1	<0.2	<0.05	<0.1	<0.1	<0.1
	ASLP, mg/l			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0001	<0.0001
	ASLP / Total																	
JBS3/1.2	Total, mg/kg	10/05/2010		0.1	0.2	<0.1	0.1	2	0.5	4.4	4.2	1.7	1.8	3	2.3	1	0.2	1
	ASLP, mg/l			0.0001	0.0002	0.0001	0.0005	0.0027	0.0003	0.0007	0.0006	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0001	<0.0001
	ASLP / Total			*0.001*	*0.001*		*0.005*	*0.00135*	*0.0006*	*0.00016*	*0.00014*							
JBS4/0.5	Total, mg/kg	10/05/2010		0.1	0.3	0.3	0.2	4.7	1	10	9.9	3.7	3.7	6.9	5.6	2.7	0.4	2.9
	ASLP, mg/l			0.0001	<0.0001	0.0009	0.0006	0.0034	0.0005	0.0009	0.0007	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0001	<0.0001
	ASLP / Total			*0.001*		*0.003*	*0.003*	*0.00072*	*0.0005*	*0.00009*	*7.1E-05*							
JBS4/2.0	Total, mg/kg	10/05/2010		0.2	0.5	<0.1	0.1	2	0.5	5.2	5.3	2.4	2.3	3.7	3	1.2	0.2	1.1
	ASLP, mg/l			<0.0001	<0.0001	<0.0001	<0.0001	0.0005	<0.0001	0.0003	0.0002	<0.0001	<0.0001	<0.0001	<0.0002	<0.0001	<0.0001	<0.0001
	ASLP / Total							*0.00025*		*5.8E-05*	*3.8E-05*							
300/6.0	Total, mg/kg	2/12/2010		1.1	0.6	0.4	1	6.7	1.4	6.2	6.1	2.8	2.4	3.7	3	1.5	0.2	1.1
	ASLP, mg/l			0.015	0.001	0.004	0.006	0.016	0.003	0.002	0.002	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total			*0.01364*	*0.00167*	*0.01*	*0.006*	*0.00239*	*0.00214*	*0.00032*	*0.00033*							

Table C - Soil Total and Leachable PAH Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

all units in ug/l

			Polycyclic Aromatic Hydrocarbons															
			Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b&k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3,cd)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene
300/15.8	Total, mg/kg	2/12/2010		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
314/9.0	Total, mg/kg	3/12/2010		<0.1	0.1	<0.1	<0.1	1	0.2	2.2	2.3	1.1	1	1.8	1.3	0.7	<0.1	0.5
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
329A/7.0	Total, mg/kg	3/12/2010		<0.1	<0.1	<0.1	<0.1	0.5	<0.1	0.6	0.6	0.3	0.3	0.4	0.2	0.1	<0.1	0.1
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
301/2.0	Total, mg/kg	24/11/2010		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.2	0.1	<0.1	<0.2	0.1	<0.1	<0.1	<0.1
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
301/14.0	Total, mg/kg	24/11/2010		<0.1	0.1	<0.1	<0.1	0.3	0.1	0.8	1	0.5	0.4	0.9	0.6	0.4	<0.1	0.3
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
303A/5.0	Total, mg/kg	24/11/2010		<0.1	<0.1	<0.1	<0.1	0.6	0.2	1.1	1.6	0.6	0.6	0.8	0.6	0.3	<0.1	0.3
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
304/3.0	Total, mg/kg	22/11/2010		0.3	0.2	0.2	0.3	2.4	0.7	3.3	3.9	1.7	1.8	5.9	3.9	2.1	0.3	2.1
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
305/8.0	Total, mg/kg	22/11/2010		<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.3	0.3	0.2	0.2	0.5	0.3	0.2	<0.1	0.2
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
306/0.5	Total, mg/kg	18/11/2010		<0.1	<0.1	<0.1	<0.1	0.9	0.2	1.3	1.4	0.7	0.8	1.4	1	0.7	<0.1	0.5
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
306/1.0	Total, mg/kg	18/11/2010		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	<0.2	0.09	<0.1	<0.1	<0.1

Table C - Soil Total and Leachable PAH Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

all units in ug/l

			Polycyclic Aromatic Hydrocarbons														
			Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b&k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3,cd)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
306/5.0	Total, mg/kg	18/11/2010		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
307/2.0	Total, mg/kg	18/11/2010		<0.1	<0.1	<0.1	<0.1	1	0.3	2.2	1.7	1.1	0.9	1.3	0.8	0.4	<0.1	0.3
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
309/1.0	Total, mg/kg	23/11/2010		<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.3	0.3	0.2	0.2	0.5	0.4	0.2	<0.1	0.2
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
315/6.0	Total, mg/kg	26/11/2010		<0.1	<0.1	<0.1	<0.1	0.3	<0.1	0.7	0.7	0.4	0.4	0.6	0.4	0.2	<0.1	0.2
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
317/2.0	Total, mg/kg	22/11/2010		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.05	<0.1	<0.1	<0.1
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
320A/1.0	Total, mg/kg	22/11/2010		<0.1	0.1	<0.1	<0.1	0.4	0.1	1.3	1.2	0.9	0.7	1.5	1	0.5	<0.1	0.3
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
323/3.0	Total, mg/kg	19/11/2010		0.1	0.3	<0.1	<0.1	1.8	0.4	6	6.3	3.9	3.3	4.9	3.7	1.7	0.3	1.4
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
324/3.0	Total, mg/kg	26/11/2010		1	0.2	0.7	0.7	4.5	1	6.9	6.8	2.6	2.7	5.3	4.1	2.7	0.3	2.8
	ASLP, mg/l			0.002	<0.001	0.002	0.001	0.004	0.001	0.001	0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total			*0.002*		*0.00286*	*0.00143*	*0.00089*	*0.001*	*0.00014*	*0.00015*							
325/1.0	Total, mg/kg	22/11/2010		0.1	0.2	<0.1	0.2	1.5	0.5	2.6	2.6	1.4	1.2	2.2	1.7	0.7	0.1	0.5
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001

Table C - Soil Total and Leachable PAH Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

all units in ug/l

			Polycyclic Aromatic Hydrocarbons															
			Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b&k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3,cd)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene
	ASLP / Total																	
325C/5.0	Total, mg/kg	23/11/2010		0.7	0.8	0.2	0.9	4.4	1.5	6.1	6.2	2.8	2.4	4.1	3.3	1.7	0.2	1.4
	ASLP, mg/l			0.001	<0.001	<0.001	0.001	0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total			*0.00143*			*0.00111*	*0.00023*		*0.00016*	*0.00016*							
327/5.0	Total, mg/kg	19/11/2010		<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.2	0.1	0.1	<0.2	0.1	<0.1	<0.1	<0.1
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001
	ASLP / Total																	
BH11 2.6-2.7	Total, mg/kg	5/02/2010		<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
	ASLP, mg/l			<0.001	<0.001	0.0022	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total																	
BH13 7.2-7.4	Total, mg/kg	5/02/2010		<0.5	0.9	<0.5	<0.5	0.6	0.8	0.6	<0.5	2.8	1.8	6.7	2.8	1.1	<0.5	1.5
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total																	
BH15 2.0-2.2	Total, mg/kg	9/02/2010		<0.5	<0.5	<0.5	<0.5	1.5	<0.5	1.6	1.5	1	0.9	2.3	1.3	1.7	<0.5	2.2
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total																	
BH20 11-11.2	Total, mg/kg	11/02/2010		<0.5	0.6	<0.5	<0.5	2.4	1.2	4.7	6.2	2.8	2.3	4	2.6	1	<0.5	1
	ASLP, mg/l			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total																	
BH48 14.5-14.7	Total, mg/kg	23/02/2010		517	113	12.9	94.3	215	54	124	101	39.2	30.8	39	31	8.9	2.9	8.4
	ASLP, mg/l			4.04	0.266	0.0395	0.124	0.115	0.0285	0.0097	0.0066	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037
	ASLP / Total			*0.00781*	*0.00235*	*0.00306*	*0.00131*	*0.00053*	*0.00053*	*7.8E-05*	*6.5E-05*							
BH40_17.8-18.0	Total, mg/kg	18/02/2010		1.4	<0.5	<0.5	<0.5	0.8	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5
	ASLP, mg/l			2.54	0.142	0.0284	0.146	0.134	0.0256	0.0141	0.0104	<0.001	<0.001	<0.002	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total			*1.81429*				*0.1675*										
BH41 1.0-1.4	Total, mg/kg	4/03/2010		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
	ASLP, mg/l			0.0101	0.0016	0.001	0.0032	0.0073	0.0017	0.0015	0.0012	<0.001	<0.001	-	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total																	

Table C - Soil Total and Leachable PAH Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

all units in ug/l

			Polycyclic Aromatic Hydrocarbons															
			Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b&k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3,cd)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene
BH41 17.5-17.7	Total, mg/kg	8/03/2010		0.6	<0.5	<0.5	<0.5	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5
	ASLP, mg/l			0.0555	<0.001	0.0016	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total			*0.0925*														
BH46-19.0-19.2	Total, mg/kg	23/02/2010		<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
	ASLP, mg/l			4.3E-06	<0.001	<0.001	1.2E-06	2.4E-06	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total																	
BH56 7.0-7.2	Total, mg/kg	4/03/2010		4.6	2.7	<0.5	3.4	25.2	<0.5	19.8	18	7.5	4.2	-	4.8	1.2	7.5	4
	ASLP, mg/l			0.0524	<0.001	0.0212	0.0214	0.0418	0.0147	0.01	0.0073	<0.001	<0.001	-	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total			*0.01139*			*0.00629*	*0.00166*		*0.00051*	*0.00041*							
BH57 7.0-7.2	Total, mg/kg	25/02/2010		0.5	2.7	<0.5	1.5	20.9	7.3	26.6	22.7	10.5	8.1	-	6.8	2.7	0.7	2.9
	ASLP, mg/l			0.0012	0.002	0.001	0.0027	0.0122	0.0024	0.003	0.0021	<0.001	<0.001	-	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total			*0.0024*	*0.00074*		*0.0018*	*0.00058*	*0.00033*	*0.00011*	*9.3E-05*							
BH60 20.5-20.9	Total, mg/kg	2/03/2010		<0.5	<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
	ASLP, mg/l			0.0027	<0.001	0.001	<0.001	0.0022	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total																	
BH63 13.0-13.3	Total, mg/kg	1/03/2010		2.9	0.7	<0.5	0.7	2	0.7	1.2	1	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
	ASLP, mg/l			0.0446	0.0092	0.0027	0.0161	0.0283	0.0077	0.0061	0.0046	<0.001	<0.001	-	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total			*0.01538*	*0.01314*		*0.023*	*0.01415*	*0.011*	*0.00508*	*0.0046*							
BH69 1.0-1.5	Total, mg/kg	26/02/2010		2.9	2.3	<0.5	1.8	11.3	3.3	11.6	10.8	5.8	4.8	-	3.4	1.4	<0.5	1.9
	ASLP, mg/l			0.045	0.0115	0.0057	0.0163	0.0268	0.006	0.0065	0.005	<0.001	<0.001	<1	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total			*0.01552*	*0.005*		*0.00906*	*0.00237*	*0.00182*	*0.00056*	*0.00046*							
BH70 2.5-2.7	Total, mg/kg	8/03/2010		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	ASLP, mg/l			0.0555	<0.001	0.0016	<0.001	0.0012	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total																	
BH71 2.5-2.7	Total, mg/kg	4/03/2010		<0.5	<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
	ASLP, mg/l			0.0083	<0.001	0.001	<0.001	0.0016	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total																	

Table C - Soil Total and Leachable PAH Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

all units in ug/l

			Polycyclic Aromatic Hydrocarbons														
			Total PAHs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b&k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3,cd)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene
BH71 10-10.2	Total, mg/kg	4/03/2010		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
	ASLP, mg/l			0.0206	0.0035	0.0047	0.0032	0.0073	<0.001	0.0019	0.0015	<0.001	<0.001	-	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total																	
BH72 1.0-1.2	Total, mg/kg	3/03/2010		<0.5	<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
	ASLP, mg/l			0.006	<0.001	0.001	<0.001	0.0019	<0.001	<0.001	<0.001	<0.001	<0.001		<0.0005	<0.001	<0.001	<0.001
	ASLP / Total																	
BH73 17.5-17.7	Total, mg/kg	2/03/2010		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	ASLP, mg/l			0.412	0.0516	0.0141	0.0777	0.0741	0.0193	0.0104	0.0074	<0.001	<0.0019	-	<0.0019	<0.0019	<0.0019	<0.0019
	ASLP / Total																	
BH74 8.5-8.8	Total, mg/kg	3/03/2010		<0.5	<0.5	<0.5	<0.5	1.3	<0.5	1.2	3.1	0.8	0.7	-	0.7	<0.5	<0.5	<0.5
	ASLP, mg/l			0.108	<0.001	0.0315	0.0285	0.0611	0.0155	0.0105	0.0078	<0.001	<0.001	-	<0.0009	<0.001	<0.001	<0.001
	ASLP / Total							*0.047*		*0.00875*	*0.00252*							
BH75 16.0-16.2	Total, mg/kg	2/03/2010		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	<0.5
	ASLP, mg/l			<0.001	<0.001	0.001	<0.001	0.0023	<0.001	<0.001	<0.001	<0.001	<0.001	-	<0.0005	<0.001	<0.001	<0.001
	ASLP / Total																	

Summary of ASLP / Total Values (mg/l / mg/kg)								
	0.000545	0.0003	0.0005	0.001111	0.000227	0.000329	5.77E-05	3.77E-05
	0.001	0.000741	0.002857	0.001315	0.00025	0.000333	7.82E-05	6.53E-05
	0.001	0.001	0.003	0.001429	0.000535	0.0005	0.00009	7.07E-05
	0.001429	0.001667	0.003062	0.0018	0.000545	0.000528	0.000113	9.25E-05
	0.002	0.002354	0.01	0.002	0.000584	0.000571	0.000145	0.00012
	0.0024	0.005		0.002167	0.000723	0.0006	0.000159	0.000143
	0.007814	0.013143		0.003	0.000889	0.001	0.000164	0.000147
	0.0101			0.005	0.001188	0.001818	0.000174	0.000161
	0.011391			0.006	0.00135	0.002143	0.000323	0.000328

Table D - Soil Total and Leachable TPH Results
Barangaroo (apart from Declaration Area)
Hickson Rd Millers Point

Sample ID	Type and Units	Sample Date	TPH C6-C9	TPH C10-C14	TPH C15-C28	TPH C29-C36	TPH (total)
JBS1/2.0	Total, mg/kg	10/05/2010	-	<50	<100	<100	
	ASLP, mg/l		-	<0.05	<0.1	<0.1	
	ASLP / Total						
JBS1/2.7	Total, mg/kg	10/05/2010	-	<50	<100	<100	
	ASLP, mg/l		-	<0.05	<0.1	<0.1	
	ASLP / Total						
JBS2/4.0	Total, mg/kg	10/05/2010	-	<50	130	<100	
	ASLP, mg/l		-	0.07	0.56	<0.1	
	ASLP / Total				*0.004*		
JBS3/0.2	Total, mg/kg	10/05/2010	-	<50	580	1600	
	ASLP, mg/l		-	<0.05	<0.1	<0.1	
	ASLP / Total						
JBS3/1.2	Total, mg/kg	10/05/2010	-	<50	<100	<100	
	ASLP, mg/l		-	<0.05	<0.1	<0.1	
	ASLP / Total						

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C	Matt Parkinson		Draft for client / Auditor review		6/7/2012

Human Health Risk Assessment

Barangaroo Delivery Authority

Barangaroo Central
Hickson Road, Sydney, NSW

July 2012
JBS42021–51170

Table of Contents

List of Abbreviations vii

Definitions viii

Executive Summary ix

1 Introduction 1

1.1 Introduction and Background 1

1.2 Objectives 2

1.3 Risk Assessment Process 2

1.4 The Proposed Development / Current Design 4

1.4.1 Barangaroo Central Stage 1 Public Domain 4

1.4.2 Barangaroo Central Residential / Open Space Development 5

1.5 Barangaroo Central Human Health and Ecological Risk Assessment 5

1.6 Overarching Remedial Action Plan 5

1.7 Site Auditor Engagement 6

2 Summary Site Condition/Surrounding Environment 7

2.1 Site Identification 7

2.2 Current Site Condition 8

2.3 Proposed Site Condition 8

2.4 Surrounding Landuse 9

2.5 Topography 9

2.6 Hydrology 9

2.7 Geology 10

2.8 Hydrogeology 10

2.9 Site History 11

2.10 Previous Investigations 11

2.11 Meteorology 11

3 Contamination Status 12

4 Conceptual Site Model 13

4.1 Constituents of Potential Concern 13

4.2 Exposure Pathways 13

4.3 Receptors 14

4.4 Existing Environmental Data 14

5 Issue Identification 15

5.1 Issue Identification 15

5.2 Identification of Environmental Hazards 15

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5.3 Environmental Sampling and Analysis 15
5.4 Putting Hazards into their Environmental Health Context 15
5.5 Identification of Potential Interactions between Agents 16
5.6 Why is Risk Assessment Needed? 17
5.7 Limitations and Uncertainties 17
6 Selection of Constituents of Potential Concern 18
6.1 Assessment of Total Petroleum Hydrocarbons 19
7 Toxicological Review 20
7.1 Hazard Identification 20
7.2 Dose-Response Assessment 21
7.3 Threshold Approaches 21
7.4 Non-Threshold Approaches 22
7.5 Sources of Toxicological and Tolerable Intake Data 23
7.6 Review of Published Hazard Data 24
7.6.1 Arsenic 24
7.6.2 Lead 26
7.6.3 Nickel 29
7.6.4 Ammonia (as N) 31
7.6.5 Benzene 32
7.6.6 Toluene 35
7.6.7 Ethylbenzene 38
7.6.8 Xylene 40
7.6.9 Trimethylbenzenes 42
7.6.10 Styrene 43
7.6.11 Polycyclic Aromatic Hydrocarbons 44
7.7 Summary and Evaluation of Toxicological Data 53
7.8 Odour Thresholds 57
7.9 Background Concentrations 59
8 Human Exposure Assessment 61
8.1 Exposure Scenario(s) Requiring Risk Assessment 61
8.2 Discussion of Exposure Scenarios 61
8.2.1 Open Space / Recreational Areas 61
8.2.2 Basement Car Park 62
8.2.3 Residential Apartments 62
8.2.4 Other Commercial Structures 62
8.3 Exposure Parameters 63

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8.4 Estimation of Inhalation Exposure 64
8.5 Estimation of Oral and Dermal Exposure 65
8.6 Estimation of Airborne Concentration 66
8.6.1 Vapour from Soil 66
8.6.2 Particulates 66
8.6.3 Volatilised Constituents from Seepage Water in Basement 67
8.7 Use of RISC Modelling Package 67
8.8 Characterisation of Open Space / Recreational Outdoor Areas 68
8.9 Characterisation of Sub-Surface Maintenance Trench/ Excavation 68
8.10 Characterisation of Indoor Spaces 68
8.10.1 Car Park 68
8.10.2 Residential Building 69
8.10.3 Vapour Flow into Buildings 70
8.10.4 Impacts of Soil Types on Vapour Movement into Buildings 71
8.11 Characterisation of Site Geology 71
8.12 Characterisation of Physical and Chemical Properties of COPCs 72
8.13 Models 73
9 Assessment of Human Health Risk 74
9.1 Risk Measurement 74
9.2 Adopted Risk Criteria 75
9.3 Assessment of Background Contributions 75
9.4 Estimation of Risk 76
9.5 Assessment of Aesthetics 76
9.6 Risk Assessment 77
9.7 Derivation of Risk Based Criteria 77
9.7.1 Unsaturated soils 77
9.7.2 Groundwater 77
10 Sensitivity Analysis 79
10.1 Sampling Programs 79
10.2 Toxicological Parameters 80
10.3 Land-Use 80
10.4 Exposure Parameters 80
10.5 Building Parameters 81
10.6 Modelling Equations 81
10.6.1 Application of Johnson & Ettinger Relationships 82
10.6.2 Biodegradation 82

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10.7 Geological Parameters....83
10.8 Conclusion....84
11 Conclusions and Recommendations....85
12 Limitations....86
13 References....87

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Figures

Figure 1 Site Location

Figure 2 Barangaroo Central Site Plan

Figure 3 Barangaroo Central Concept Plan – Barangaroo Central Stage 1 Public Domain

Figure 4 Barangaroo Central Concept Plan – Barangaroo Residential / Open Space Development

Appendices

Appendix A RISC Equations

Appendix B Calculation of Vapour Emissions from Pooled Water in Car Park

Appendix C Risk Model Outputs

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List of Abbreviations

A list of the common abbreviations used throughout this report is provided below.

- As Arsenic
- BDA Barangaroo Delivery Authroity
- BTEX Benzene, Toluene, Ethylbenzene and Xylenes
- B(a)P Benzo (a) pyrene
- Cd Cadmium
- CEMP Construction Environmental Management Plan
- Cr Chromium
- Cu Copper
- DECCW NSW Department of Environment Climate Change and Water
- DoP NSW Department of Planning
- DP Deposited Plan
- DQO Data Quality Objectives
- EPA NSW Environment Protection Authority
- HHERA Human Health and Ecological Risk Assessment
- Hg Mercury
- HIL Health Based Investigation Level
- LOR Limit of Reporting
- LTEMP Long Term Environmental Management Plan
- MAH Monocyclic Aromatic Hydrocarbon
- Ni Nickel
- NOW NSW Office of Water
- OCP Organochlorine Pesticide
- OEH NSW Office of the Environment and Heritage
- OHSMP Occupational Health and Safety Management Plan
- PAH Polycyclic Aromatic Hydrocarbons
- Pb Lead
- PIL Phytotoxicity Based Investigation Level
- PCB Polychlorinated Biphenyls
- PQL Practical Quantitation Limit
- QA/QC Quality Assurance/Quality Control
- SWC Sydney Water Corporation
- TPH Total Petroleum Hydrocarbons (C_6-C_9 and C_{10}-C_{36})
- VOC Volatile Organic Compound
- Zn Zinc

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Definitions

For the purposes of this document, the following definitions apply:

- "Barangaroo Central" – refers to the central portion of the Barangaroo site comprising part Lots 5 and 6 in DP876514. Located adjoining the southern boundary of the Headland Park Site, adjoining the northern boundary of the Stage 1 development and adjoining the northern and part of the western boundary of the Declaration Area.
- "Barangaroo Project Site" – refers to the Barangaroo Site, as defined in this SAQP, and adjoining parts of Sussex Street, Hickson Road and Towns Place.
- "Declaration Area" - refers to the part of the Barangaroo Project Site which is the subject of the declaration of Significantly Contaminated Land by the NSW DECCW under the *Contaminated Land Management Act 1997* (Declaration Number 21122, Area Number 3221, dated 6 May 2009). Inclusive of part Lots 3 and 5 in DP876514.
- "Headland Park Site" – refers to Part Lots 1, 5 & 6 and Lot 4 of DP 876514 located at the northern portion of the Barangaroo Site and includes adjacent parts of Hickson Road and Towns Place.
- "Imported Materials" – refers to fill/soil/rock materials imported onto the Barangaroo Central Site as part of the remediation works, sourced from land other than the Barangaroo Project Site, as defined in this RAP.
- "Overarching RAP" – refers to the Overarching RAP for the whole Barangaroo Project Site, prepared by ERM Australia Pty Ltd.
- "Remediation Consultant" – refers to JBS Environmental Pty Ltd.
- "Risk-based Criteria" – refers to the criteria proposed to be established in the Barangaroo Central HHERA, which will form part of the Site Acceptance Criteria for acceptance of materials to Barangaroo Central.
- "Site Materials" – refers to fill/soil/rock materials sourced from land within the Barangaroo Project Site.
- "Stage 1 Development" – refers to the southern part of the Barangaroo Project Site, which will be developed for commercial/residential/open space uses. This includes Lot 3 and part Lots 5 and 6 in DP876514.

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Executive Summary

JBS Environmental Pty Ltd (JBS) was commissioned by the Barangaroo Delivery Authority (BDA) as "Remediation Consultant" to undertake environmental assessments for soils and groundwater at the Barangaroo Central portion of the Barangaroo Site located at Hickson Road, Sydney. This included the assessment of existing soil, groundwater and leachability data and the collection of substantial additional data.

A human health risk assessment (HHRA) has been completed for the assessment of soils and groundwater located within the Barangaroo Central development site. The HHRA has considered the proposed development of the Barangaroo Central as:

- Barangaroo Central Stage 1 Public Domain; and
- Combined high density residential / recreational development as consistent with the proposed Masterplan for Barangaroo.

The risk assessment has considered a range of human health exposure scenarios for the proposed future uses of the Barangaroo Central site. The key facets of the proposed developments that have been considered in the risk assessment include:

- Construction of basement car park with overlying residential building;
- Recreational / open space areas; and
- Sub-surface services / infrastructure over the open space area of Barangaroo Central typically to a maximum depth of 0.5 m.

On the basis of the risk assessment calculations, the limitations provided as **Section 12**, and considering the recommendations as made within *Data Gap Investigation Barangaroo Central*, JBS Environmental, July 2012 (JBS 2012a) it is concluded:

- The Barangaroo Central site does not pose an unacceptable level of human health risk for a proposed recreational / open space use subject to growing media soils being imported for near surface use in vegetated areas of the site and pavement / surface cover being provided to remaining site areas;
- The site is not considered appropriate from a human health perspective for the proposed residential development with basements where:
    - Soils currently located above the depth of groundwater with a level of benzo(a)pyrene (assessed as a toxicity equivalent factor considering all carcinogenic polycyclic aromatic hydrocarbons) exceeding 1.2 mg/kg are located in sufficiently close proximity of proposed basements that leachate from the soils accumulates in accessible areas of the basements; or
    - Groundwater entering the basements as seepage has a maximum level of benzo(a)pyrene exceeding 0.7 µg/L or an average level of benzene exceeding 0.02 mg/L or an average naphthalene exceeding 0.23 mg/L.

It is recommended that a Remedial Action Plan is prepared to make the site suitable for the proposed residential use.

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1 Introduction

1.1 Introduction and Background

JBS Environmental Pty Ltd (JBS) was commissioned by the Barangaroo Delivery Authority (BDA) as "Remediation Consultant" to undertake environmental assessments for soils and groundwater at the Barangaroo Central portion of the Barangaroo Site located at Hickson Road, Sydney, NSW, 2000 (**Figure 1**).

Barangaroo Central - comprising Part Lots 5 and 6 of DP876514 - is referred to as the "Barangaroo Central Site". The entire Barangaroo Site is referred to as the "Barangaroo Site", whilst the "Barangaroo Project Site" includes the Barangaroo Site and the adjoining parts of Sussex Street, Hickson Road and Towns Place. The "Declaration Area" refers to the part of the Barangaroo Project Site which is the subject of the declaration of Significantly Contaminated Land by the NSW DECCW under the *Contaminated Land Management Act 1997* (Declaration Number 21122, Area Number 3221, dated 6 May 2009 and is inclusive of part Lots 3 and 5 in DP876514. The "Declaration Area" is excluded from the "Barangaroo Central Site". The southern part of the Barangaroo Project Site, referred to as the "Stage 1 Development", will be developed for a mixture of commercial, residential and open space uses. The boundary of the Barangaroo Central Site which is the subject of this DGI is shown on **Figure 2**.

The Barangaroo Central Site is proposed to be initially developed as the Barangaroo Stage 1 Public Domain, which consists of a range of open space uses and car parking. In the future, the Barangaroo Central Site will be developed for a mixture of high density residential and open space uses.

Data Gap Investigation Barangaroo Central, JBS Environmental, July 2012 (JBS 2012a) has been recently completed for the site. Existing and additional soil, groundwater and leachability data was collected and assessed over the Barangaroo Central site. On the basis of the assessment of the data, it was recommended that human health risk assessment is undertaken for the following impacted media and potential exposure pathways:

- Assessment of impacted soils present in the unsaturated zone of the site for potential limited / restricted human exposures as may occur with future / recreational or residential developments of the site; and
- Assessment of potential seepage water migration into basements as proposed with the residential development of the site.

The human health risk assessment (HHRA) is presented here. The HHRA has been undertaken by the methodology outlined in '*Environmental Health Risk Assessment Guidelines for Assessing Human Health Risks from Environmental Hazards*', Department of Health and Ageing and enHealth Council (2002) (enHealth, 2002).

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1.2 Objectives

The objectives of this HHRA are:

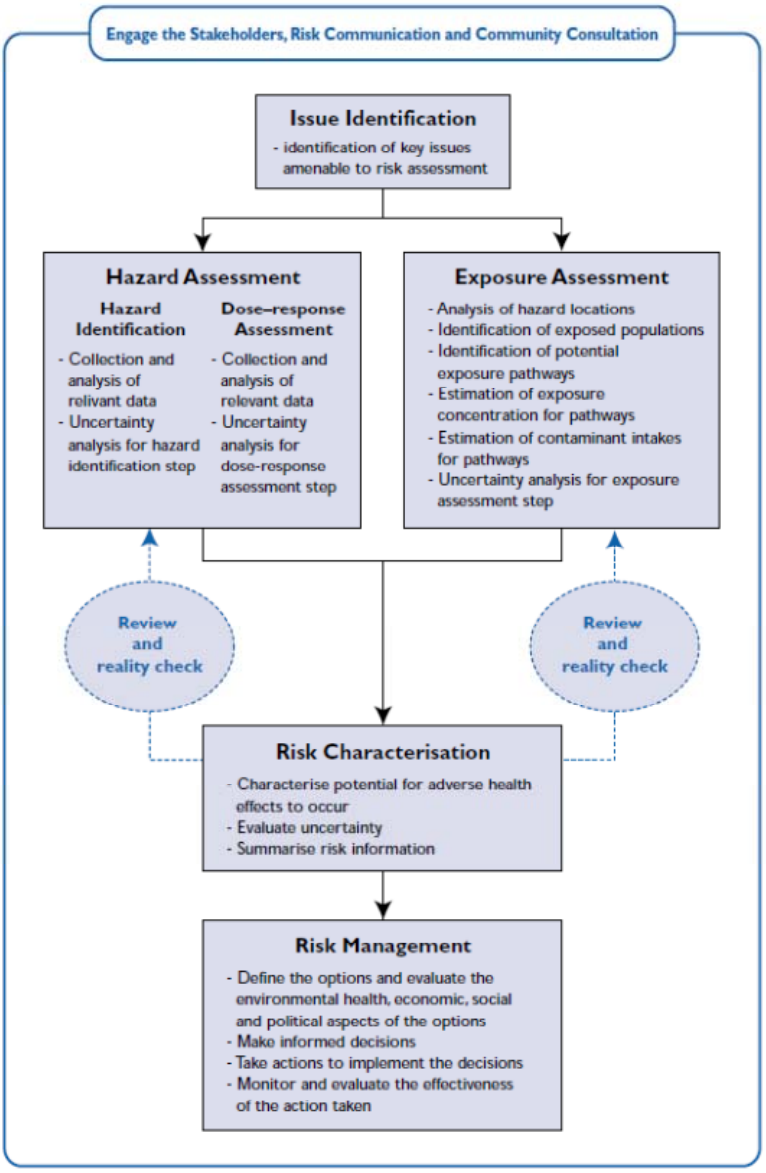
- To determine whether levels of soil impact recorded in unsaturated zone soils on the Barangaroo Central site pose a potential human health risk to human users in areas of the site of restricted exposure;
- To determine whether potential levels of seepage water ingress into future deep basements, as based on measured levels of impact in groundwater, pose a potential human health risk to future users of deep basements; and
- Where an unacceptable level of risk / hazard is identified for any of the assessed exposure scenarios, determine safe levels of constituents to be used as future remediation criteria.

1.3 Risk Assessment Process

Risk assessment is the process of estimating the potential impact of a chemical, physical, microbiological or psychosocial hazard on a specified human population or ecological system under a specific set of conditions and for a certain timeframe. A schematic of the risk assessment process is shown the diagram below (source: enHealth 2004).

- Issue Identification identifies issues amenable to risk assessment and assists in establishing a context for the risk assessment by a process of identifying the problems that the risk assessment needs to address. This includes the selection of Constituents of Potential Concern (COPC's) for the site and each identified potential exposure population.

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- Hazard Assessment including toxicological assessment and dose-response assessment. Toxicological assessment involves determining what types of (adverse) health effects might be caused by the agent; and how quickly the adverse health effects might be experienced and their duration. Dose-response assessment considers both qualitative and quantitative toxicity information to determine 'the incidence of adverse effects occurring in humans at different exposure levels'.
- Exposure Assessment involves the determination of the frequency, extent, duration and character of exposures in the past, currently, and in the future. There is also the identification of exposed populations, particularly sensitive sub populations, and potential exposure pathways.
- Risk Characterisation provides a qualitative and / or quantitative estimate, including attendant uncertainties, of the nature, severity and potential incidence of effects in a given population, based on the hazard identification and exposure assessments.

The human health risk assessment has specifically considered a range of potential human receptors that may use the site in the future. The ecological risk assessment has

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considered a range of potential on-site and off-site ecological receptors, including proposed flora communities on the Barangaroo Central Site and flora and fauna communities within the adjoining Darling Harbour.

1.4 The Proposed Development / Current Design

The Barangaroo Central Site is proposed to be initially developed as the Barangaroo Stage 1 Public Domain. This development is described in more detail in **Section 1.3.1** and is proposed to be undertaken in the near future. This development is proposed as an interim site use prior to the commencement of the proposed long term development. This development is restricted to areas of Barangaroo Central referred to as Separable Portions 4 and 5. This represents the northern and central portions of the overall Barangaroo Central area.

The Barangaroo Central Site is proposed to be ultimately developed for combined high density residential and open space purposes. This development is described in more detail in **Section 1.3.2**. This development is anticipated to commence in 2015.

1.4.1 Barangaroo Central Stage 1 Public Domain

JBS has been advised that the Barangaroo Central Site is to be initially developed as 'Barangaroo Stage 1 Public Domain'. This is to facilitate a recreational use of Barangaroo Central Site prior to anticipated long term development in accordance with the current Barangaroo concept plan. A concept plan of the 'Barangaroo Stage 1 Public Domain' is provided as **Figure 3**. Characteristics of this development and associated land use are anticipated to include:

- Restriction of development to the area of the site referred to as Separable Portions 4 and 5 as shown on **Figure 3**. This consists of the northern and central portions of the Barangaroo Central site;
- Continuing use of the southern portion of the Barangaroo Central site as a 'temporary construction staging area' as associated with the Barangaroo South development works;
- Use of Barangaroo Central Site for recreational purposes, similar to the open areas of the Headland Park Site;
- Landscaping with grasses and some large plantings over approximately 70% of the Barangaroo Central Site;
- Retention of existing site paving and use for Car Parking over approximately 30% of the Barangaroo Central Site as present to the south of the central portion; and
- Importation of between 80 000 and 150 000 m^3 of fill materials to raise the site level and create a slope towards Darling harbour.

It is understood that these works will be the subject of a Project Application to be prepared in the near future. A range of environmental studies are required to support the Project Application.

The data gap investigation / environmental assessment will consider the future use of the Separable Portion 4 and 5 area of the Barangaroo Central Site for recreational uses consistent with the 'Barangaroo Stage 1 Public Domain'.

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1.4.2 Barangaroo Central Residential / Open Space Development

The Barangaroo Concept Plan identifies that the area of Barangaroo Central will be developed long term as a mixture of high density residential and open space / recreational land uses. The current concept plan for the long term Barangaroo Central site development has been provided as **Figure 4**. From review of Figure, land-uses can be observed to include:

- Two high density residential developments located in the central and northern portion of the site adjoining the eastern site boundary;
- Part of a basement of an additional high density residential building as located adjoining the eastern part of the southern boundary and the southern part of the eastern boundary. The basement for this building is almost wholly located within the Declaration Area, which has been excluded from the Barangaroo Central Site; and
- Recreational / open space land-uses located within the western portion of the site including areas of large tree and garden plantings, grassed areas as used for playing fields or other events, an open amphitheatre and pathways along the foreshore and throughout the site.

The lateral dimensions of the proposed basements can be observed from **Figure 4**. The basement areas should be assumed to extend between the building outlines as shown on **Figure 4**. No definitive guidance is available as to the anticipated depth of the basements. However by review of a similar basement proposed for the Barangaroo South Site as reported in JBS Planning (November 2010) 'Bulk Excavation and Basement Car Parking PA1 (MP10_0023) Barangaroo South', similar sized basements on the southern portion of the site are proposed to extent to a depth of -22m RL (approximately -18.5m AHD).

1.5 Barangaroo Central Human Health and Ecological Risk Assessment

It is proposed to receive surplus materials on the Barangaroo Central Site from the Barangaroo Project Site. The suitability of these materials, from a human health and ecological risk perspective, require to be assessed in accordance with *Human Health and Ecological Risk Assessment for Proposed Imported Soils, Barangaroo Central, Hickson Rd, Sydney*, JBS Environmental Pty Ltd, May 2012 (JBS 2012b).

JBS (2012) is distinct from this HHRA in that JBS (2012) is provided assess levels of environmental constituents is soils to be imported to the site, while this HHRA is provided to assess the suitability of soils located on the site.

1.6 Overarching Remedial Action Plan

An Overarching RAP (ERM 2010) has been prepared for the Barangaroo Project Site that outlines the remediation approach for the identified contamination across the entire Barangaroo Project Site. This overarching RAP makes reference to the preparation of individual RAPs and Remedial Work Plans (RWPs) for various elements of the Barangaroo Project Site. Individual RAPs for differentiable portions of the site are required as per the Overarching RAP. The RAP will be prepared for the Barangaroo Central Site on the basis of the findings of this data gap investigation and HHERA as presented herein and will address any areas of soil or groundwater contamination as identified in this report.

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1.7 Site Auditor Engagement

As part of this assessment and likely future remediation works, a Site Auditor accredited by NSW EPA has been engaged to provide endorsement of this HHRA. A Site Audit Statement will be prepared at the completion of the civil and associated remediation works on the Barangaroo Central Site certifying that the Barangaroo Central Site is suitable for the proposed interim uses, potentially subject to implementation of a Long-term Environmental Management Plan (LTEMP) that will be part of the EMP for Headland Park/open space.

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2 Summary Site Condition/Surrounding Environment

2.1 Site Identification

The Barangaroo Project Site is located at Hickson Road, Sydney, NSW and is legally referred to as Lots 1, 3, 5 and 6 Deposited Plan (DP) 876514 and includes the adjacent parts of Sussex Street, Hickson Road and Towns Place, as shown in **Figure 1**. The Barangaroo Project Site details are summarised in **Table 2.1** and described in more detail in the following sections.

Table 2.1 Summary Details for the Barangaroo Project Site

Lot/DP	Lots 1, 3, 5 and 6 of Deposited Plan 876514, including adjacent parts of Sussex Street, Hickson Road and Towns Place
Address	Hickson Road Millers Point NSW
Local Government Authority	City of Sydney
Site Zoning	Zone B4 Mixed Use and RE1 Pubic Recreation
Current Use	Vacant/Roadway
Geographical Co-ordinates, Elevation	Easting – 333643m E, Northing – 6251851m S, 2-3m AHD
Site Area	Approximately 22 ha

The Barangaroo Central Site is located within the central portion of the Barangaroo Project Site. Site details are summarised in **Table 2.2** and described in more detail in the following sections. The extent of the site is shown as **Figure 2**.

Table 2.2 Summary Details for the Barangaroo Central Site

Lot/DP	Part Lots 5 and 6 of Deposited Plan 876514
Address	Hickson Rd Millers Point NSW
Local Government Authority	City of Sydney
Site Zoning	Zone B4 Mixed Use and RE1 Pubic Recreation
Current Use	Interim Cruise Passenger Terminal and Water Treatment Plant at south-western portion
Geographical Co-ordinates, Elevation	Easting – 333620m E, Northing – 6251850m, 2-3m AHD
Site Area	Approximately 4.3 ha

The Barangaroo Central Site boundary will be defined as:

- North – The northern boundary of the Barangaroo Central Site is defined by the southern boundary of the Barangaroo Headland Park as defined in *Remedial Action Plan Barangaroo Delivery Authority Barangaroo Headland Park revision 3*, JBS Environmental, 8 November 2011;
- East – The eastern extent of Lot 5 DP876514, apart from the proximity of the Declaration Area. The Barangaroo Central Site eastern boundary in proximity of the Declaration Area is defined by the northern and western extent of the Significantly Contaminated Land as identified by the NSW DECCW under the *Contaminated Land Management Act 1997* (Declaration Number 21122, Area Number 3221, dated 6 May 2009);
- South – The northern boundary of the 'Stage 1' area as shown by the Stage 1 Site plan in the *Part 3A Preliminary Assessment Barangaroo Concept Plan Modification Request for DGRs and PEAR*, prepared by JBA Urban Planning Consultants in February 2010 (JBA 2010), apart from the proximity of the Declaration Area. The Barangaroo Central Site southern boundary in proximity of the Declaration Area is defined by the northern and western extent of the Significantly Contaminated Land as identified by the NSW DECCW under the *Contaminated Land Management Act 1997* (Declaration Number 21122, Area Number 3221, dated 6 May 2009); and
- West – The western extent of Lot 6 DP876514.

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The extent of the Barangaroo Central site boundaries are shown on **Figure 2**.

2.2 Current Site Condition

The Barangaroo Central Site is characterised as being level over the site area and paved. The northern and central portions of the Barangaroo Central Site are currently used as Interim Cruise Passenger Terminal, as per a lease agreement with Sydney Ports Corporation. A large temporary structure is located over the central west portion of the Barangaroo Central Site, comprising the Interim Terminal. The temporary structure is provided with a false floor within the southern and central portions, for use as Passenger waiting area and Customs. The northern portion of the temporary structure is used for luggage handling and does not have temporary flooring. The area to the east of the Interim Terminal is used for car parking and passenger drop off / pick up as associated with the Cruise Ships.

A Water Treatment Plant is located within the southern portion of the Barangaroo Central Site. This is characterised by a series of large above ground storage tanks, filters and associated smaller tanks and shipping containers. The Water Treatment Plant is understood to be used with the current site development works on the Stage 1 Development.

A small Gate House Structure is located adjoining the eastern boundary of the Barangaroo Central Site. Portions of the Foreshore Walk are also present within the Barangaroo Central Site, with a walkway moving in an east-west direction through the southern portion, and extending in a southerly direction along the eastern boundary. The Foreshore Walk areas are delineated on the Barangaroo Central Site by fencing and signage.

2.3 Proposed Site Condition

For the purposes of this HHRA, the Barangaroo Central Site is proposed to be initially developed as 'Barangaroo Stage 1 Public Domain' and later developed for a combined high density residential / recreational land use. The site suitability requires to be assessed for both land uses.

Potential uses / areas that have been identified with these land-uses as per BDA concept plans (**Figures 3** and **4**) include:

- Landscaped area as located within the central and northern parts of Barangaroo Central Site with the Barangaroo Stage 1 Public Domain. Landscaped areas confined to the western portion of the site with the subsequent high density residential / recreational development;
- A foreshore walk provided to the northern and western site boundaries as constructed consistent with the foreshore walk through the Barangaroo Headland Park;
- Access corridors throughout the Barangaroo Central Site; and
- Pavilions, presumed to be naturally ventilated and marked as being approximately 500 m^2 in area, present adjoining the northern and eastern boundaries.

The landscaping areas for the Barangaroo Stage 1 Public Domain will be formed by the importation and placement of 80 000 to 150 000 m^3 of soils over the site, gently grading towards Darling Harbour. The area will be landscaped with grassed areas, small and large plantings. It has been reported by BDA that site pavement will be removed from within

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the proposed landscaped areas. Part of this fill material will potentially be retained in the open spaces areas of the proposed high density residential / recreational land use.

2.4 Surrounding Landuse

The surrounding uses of land adjacent to the Barangaroo Central Site have been previously reported as follows (ERM 2008b[1]):

- North: Immediately to the north is the proposed Northern Cove, to be constructed with the development of the Headland Park Site.
- East: Immediately to the east is Hickson Road. Residential and commercial areas of the northern part of Sydney are located further east.
- South: Immediately to the south is the Barangaroo Stage 1 Development. This also comprises the Declaration Area.
- West: Immediately to the west is Darling Harbour.

A former gasworks is known to have operated until the 1920s over part of the Stage 1 Development, located adjoining the south of the Barangaroo Central Site. The former gasworks location is known to continue to the east beneath Hickson Road, and the contaminated gasworks waste material in this area has been identified to contaminate soils and groundwater on the south-eastern portion of the Barangaroo Project Site. This part of the Stage 1 Development, referred to as the Declaration Area in this SAQP, has been declared a Remediation Site by NSW DECCW (Declaration No. 21122, Area No. 3221) under the CLM Act 1997. The Declaration Area forms part of the eastern and southern boundary of the Barangaroo Central Site. It is understood that environmental assessment programs are being undertaken on the Stage 1 Development in preparation for remediation.

2.5 Topography

The topography of the Barangaroo Central Site is relatively flat, having been filled for its previous use as a stevedoring facility (ERM 2008b).

The topography is proposed to modified by the importation of fill material to create a sloped surface towards Darling Harbour. It is estimated that 80 000 to 150 000 m^3 of materials will be imported to the Barangaroo Central Site to create the raised site surface for the Barangaroo Stage 1 Public Domain, predominantly over the northern and central portions.

2.6 Hydrology

The closest surface water body to the Barangaroo Central Site is Darling Harbour, located immediately adjacent to the western boundary (ERM 2008b). Surface water from the Barangaroo Central Site is collected via a sub-surface drainage network, which generally flows toward the Harbour.

Hydrology on the proposed Headland Park will be potentially modified with the amended topography. However, it is proposed at this stage that any future drainage system provided to the Barangaroo Central Site will also discharge to Darling Harbour.

[1] *Stage 2 Remedial Action Plan for Barangaroo*, Hickson Road, Sydney, ERM, September 2008 (ERM 2008b)

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2.7 Geology

According to the 1:100 000 Geological Survey of NSW (Sydney) Sheet 9130 (Ed 1) 1983, the Barangaroo Central Site is generally underlain by man-made fill that has been placed over marine sands over Hawkesbury Sandstone, which is described as follows (ERM 2008b):

- Man-made fill may consist of "dredged estuarine sand and mud, demolition rubble, industrial and household waste"; and
- Hawkesbury Sandstone is characterised as "medium to coarse-grained quartz sandstone with very minor shale and laminite lenses".

The general geological profile observed at the Barangaroo Central Site, as reported by previous investigations, is summarised in **Table 2.2**.

Table 2.2 Summary of Observed Site Geology

Lithological Unit	Description	Depth (mbgl)
Hardstanding	Asphalt, bitumen or concrete, generally in good condition with no staining.	0 – 0.46
Road base fill	Very dark grey, dry, loose, medium grained sand to fine gravel, poorly sorted, sub angular, no odours or staining noted.	0 – 0.5
Fill	A range of materials have been reported as being present as fill, including silty clay, clayey sand, sand, sandy gravel, sandy gravelly clay, sandy clay and gravelly sand. Sandstone floaters have also been reported as occurring in fill materials. Anthropogenic materials have also been reported in fill material including building rubble, bricks and concrete.	Surface depth to 4 – 18.3
Marine Clay/Sand	Interbedded clayey sand and sandy clay, dark greyish brown, saturated, some shell fragments and organic matter. Sandy clay – soft, high plasticity. Clayey Sandy – loose to dense, fine to coarse sand, low to no plasticity.	Below 4 – 18.4
Bedrock	Weathered sandstone, white, light yellowish brown, olive brown and reddish brown, wet, fine to coarse grained, some fracturing noted.	Below 9.5 - 38

An estimate has been prepared of the quality of fill as present on the area of Barangaroo Central requiring to be assessed for this data gap investigation. This has been prepared using available borelogs in ERM (2007 and 2008b), surveyed levels of borehole elevations and reported depths to natural materials in borelogs. A three dimensional interpretation of the site surface, and underlying fill / natural soil interface, is provided as **Figure 5**. Volume calculations undertaken on the basis of a contouring package using the site surface and depth to fill plot has estimated that 560 000 m^3 of fill material is present within the Barangaroo Central Site.

2.8 Hydrogeology

As previously reported (ERM 2008b), information obtained from the Department of Natural Resources (DNR) indicated that 32 registered groundwater bores were situated within a 4 kilometre (km) radius of the Barangaroo Central Site. Review of the groundwater bore information indicated that the bores were used for the following purposes: recreation (8), irrigation (3), and monitoring (22). None of the listed bores were reported to be registered for drinking water purposes. No registered groundwater bores have been reported to be present on or adjacent to the Barangaroo Central Site, apart from monitoring bores.

The quality of groundwater on the Barangaroo Central Site has been reported to have been assessed via a network of monitoring wells installed across the Site (ERM 2008b). Locations of groundwater monitoring wells are shown on **Figure 4**. Hydrological data indicated that groundwater on the Headland Park Site was strongly influenced by tidal fluctuations, suggesting a hydraulic connection with the Harbour.

The hydrological data suggest that much of the Barangaroo Central Site is likely to be subject to significant seawater flushing, as consistent with the extent of filling undertaken

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on the site. Under typical conditions there is reported to be a likely net groundwater flux towards the Harbour, at a velocity of up to 7.6 m/day (ERM 2008b).

It is not anticipated that the current hydrogeological regime would change substantially with the proposed development. The removal of site pavement from the majority of the Barangaroo Central Site has the potential to cause greater levels of surface infiltration to occur.

2.9 Site History

The site history has been detailed in JBS (2012a and 2012b).

2.10 Previous Investigations

Previous investigations have been reported in JBS (2012a and 2012b). Finings of the most recent environmental assessment which have necessitated the completion of this risk assessment are summarised in **Section 3**.

2.11 Meteorology

The Sydney area has a humid to temperate climate with a seasonal rainfall maximum during the summer and autumn months. Annual mean rainfall recorded at Sydney (Observatory Hill) is 1212 mm (BOM 2010)[2].

The area has a history of droughts, which are broken by periods of heavy rainfall resulting in significant recharges to groundwater resources. The 1940s and 1980s and the current decade are observed to be dry periods, while the early 1970s and 1990s were wet periods.

Summer winds are predominantly northeasterly with southerly thunderstorms common. Winter winds are predominantly westerly.

[2] http://www.bom.gov.au/climate/averages/tables/cw_066062.shtml visited 7th May 2010 (BOM 2010)

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3 Contamination Status

The most recent assessment of the contamination status of the site, which has considered all available environmental data has been reported in JBS (2012a). With regard to the proposed site uses it was found:

- Near surface unsaturated zone soils are unsuitable to be used as growing medium based on potential phytotoxicity risk posed by elevated levels of copper, nickel and heavy polycyclic aromatic hydrocarbons (PAHs);
- Localised areas of near surface unsaturated zone soils are considered unsuitable for future use in areas of the site with unrestricted human exposure based on elevated levels of lead and PAHs;
- An area of tar contaminated materials is present at depth at the south-eastern portion of the site which is considered to be acting as a source of groundwater contamination;
- Potential seepage water as may migrate into future deep basements as constructed on the site have been found to exceed adopted human health investigation criteria and may pose a potential human health risk; and
- Based on an assessment of hydrogeologically upgradient and downgradient levels of impact in site groundwater, apart from the tar contaminated materials at the south-eastern portion of the site, the fill materials and naturally occurring soils as assessed are not considered to be acting as a source of groundwater contamination.

It was recommended that human health risk assessment is required for the following impacted media and potential exposure pathways:

- Assessment of impacted soils present in the unsaturated zone of the site for potential limited / restricted human exposures as may occur with future / recreational or residential developments of the site. These soils do not require assessment for unrestricted exposures, as they are considered non suitable for use in non paved areas of the site based on the potential for phytotoxicity effects; and
- Assessment of potential seepage water migration into basements as proposed with the residential development of the site.

It was also reported in JBS (2012a) that heavy metal, PAH and monocyclic aromatic hydrocarbons (MAH) impacted soils were located at depth in saturated fill and naturally occurring soils. However no complete human exposure pathways were identified for these materials that necessitated future human health risk assessment. Vapour migration from these soils was found to be restricted by their saturated condition.

JBS (2012a) has also reported that there was no requirement for ecological risk assessment. Near surface soils were found to be unsuitable for use as growing media based on phytotoxicity assessment to criteria provided in *Human Health and Ecological Risk Assessment Barangaroo Delivery Authority Barangaroo Headland Park Hickson Road, Sydney*, NSW, JBS Environmental, August 2011 (JBS 2011). Fill based and naturally occurring soils on the site have not been found to pose a potential ecological risk to groundwater apart from tar contaminated material at the south-east of the site which has been identified as requiring remediation / management.

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4 Conceptual Site Model

A conceptual site model (CSM) has been prepared to document the constituents of potential concern (COPCs), sources of COPCs, pathways, and potential receptors on the Barangaroo Central Site. The CSM is considered to be an essential pre-requisite prior to development of data quality objectives for the additional investigations.

4.1 Constituents of Potential Concern

COPCs identified as adversely impacting soils and/or groundwater within the Barangaroo Central Site of the overall Barangaroo Project site have been found to include:

- Heavy metals including arsenic, cadmium, copper, lead, nickel and zinc;
- Total petroleum hydrocarbons (TPH);
- Polycyclic aromatic hydrocarbons; and
- Ammonia (as N).

The principal COPCs are considered to be heavy metals and PAHs. Other hydrocarbon constituents, including TPH and MAHs, typically occur where higher levels of PAHs are present.

Investigations undertaken by JBS on the Headland Park Site have also identified asbestos containing materials as present throughout fill materials. Anecdotal reports have indicated that asbestos containing materials also occur on the Barangaroo South site. However asbestos has not been identified by the investigations completed to date, and has not been assessed in this HHRA.

4.2 Exposure Pathways

The human exposure pathways considered to be potentially complete for the Barangaroo Central Site, considering the interim and long term development scenarios for the site, include:

- Inhalation of COPC vapours migrating upwards from current in-situ impacted soils and/or groundwater; and/or
- Inhalation of COPC vapours migrating upwards and laterally from current in-situ impacted soils and/or groundwater and accumulating with basements or overlying residential buildings; and/or
- Potential dermal and oral contact to impacted soils as present at shallow depths and/or accessible by future service excavations with the proposed site design; and/or
- Potential oral and dermal contact to shallow groundwater as accessible by potential future service excavations; and/or
- Potential oral and dermal contact to groundwater and potential inhalation of volatilised constituents, of groundwater as may seep into basements; and/or

Oral and dermal contact of regular site users to current 'in-situ' soils on the Barangaroo Central Site is anticipated to be restricted over the majority of the area by the extent of site basements and associated pavement with the extent of the residential buildings. Areas of accessible soils will be formed by imported fill materials. Soils located on the Barangaroo Central site are considered unsuitable to be used as growing medium based on potential phytotoxicity impacts, necessitating the importation of growing soils.

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It is not anticipated that any groundwater extraction will occur over the area of the Barangaroo Central Site. Levels of total dissolved solids, consistent with marine water, cause the groundwater underlying the site to be unsuitable for beneficial use. There is also anticipated to be a surplus of grey water, as harvested from near surface seepage water flows, available from the Headland Park site. This has not been considered as a complete exposure pathway for potential surface users as per either of the development scenarios.

However basements are proposed to be constructed with the residential buildings that extent substantially below the current depth of groundwater. Users of the basement will be potentially exposed to infiltrating seepage water.

4.3 Receptors

Potential human receptors of COPCs include:

- Future recreational users of the Barangaroo Central Site; and/or
- Future residents of the residential buildings and associated basements (sub-surface car parks); and/or
- Excavation / construction / maintenance workers conducting activities at or in the vicinity of the Barangaroo Central Site, who may potentially be exposed to COPCs through inhalation of vapours or via direct dermal contact with impacted soils present within excavations.

4.4 Existing Environmental Data

Soil and groundwater data are available for the site are summarised in JBS (2012a). The requirement for human health risk assessment on the basis of this data has been discussed in **Section 3**.

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5 Issue Identification

Issue identification is the first step of the risk assessment process.

5.1 Issue Identification

Issue identification determines whether risk assessment is useful, and establishes a context for the risk assessment by a process of identifying the concerns the risk assessment needs to address. Issue identification draws on all relevant lines of information.

Issue identification comprises several phases:

1. Identification of environmental health issues (or an individual issue) and determining whether there are hazards amenable to risk assessment. This will involve demarcating 'hazards' from 'issues' and may require environmental sampling;
2. Putting the hazards into their environmental health context (clarification and prioritising of problems and hazards);
3. Identification of potential interactions between agents; and
4. Stating clearly why risk assessment is needed and the scope and objectives of the risk assessment. This will involve identifying problems for which information is, or can be, available to undertake adequate risk assessments and problems which risk assessment cannot assist.

5.2 Identification of Environmental Hazards

Environmental health hazards may be caused by physical, chemical, biological or social factors in the environment. Physical factors include heat, cold, noise, mechanical hazards etc. Chemical factors include synthetic and naturally occurring substances. Biological factors include viruses, prions, bacteria, parasites and vermin.

The proposed development(s) of the Barangaroo Central Site is the subject of this assessment. Environmental impact has been identified on the Barangaroo Central Site in soils and groundwater. Soils may potentially be accessible to some users of the Barangaroo site. Groundwater impact may potentially infiltrate into future site basements as seepage water.

5.3 Environmental Sampling and Analysis

Environmental sampling and analysis are a key factor in identifying the agents that may be present, their concentrations and distributions. Environmental sampling and analysis of materials are to be used as imported fill is required to be assessed to address the identified potential environmental hazards.

Environmental sampling and analysis has been detailed in previous investigations reported as JBS (20120a). Heavy metals, PAHs and MAHs have been identified as constituents that pose a potential human health risk on the site.

5.4 Putting Hazards into their Environmental Health Context

Putting the hazards into their environmental context entails consideration of:

- Whether the hazard has single or multiple sources;

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- Whether the type of environmental impact affects multiple environmental media;
- How stakeholders perceive the problem, including different groups of stakeholders; and
- How the hazards compare to other environmental hazards affecting the community.

The environmental hazards across the Barangaroo Project Site may have multiple sources arising from the former commercial / industrial processes undertaken (including operation of a gasworks) and the anticipated significant generation and potential on-site placement of waste materials / by-products. Human health risks associated with tar-based contaminants include potential dermal and oral contact with tar containing materials, and potential inhalation of volatile constituents of tars (i.e. benzene and naphthalene). These materials may also pose ecological impacts, particularly in locations where leaching of impact may enter waterways, or seep into sub-surface basements or soils used as a growing medium. The risk is greater where more sensitive site uses and longer exposure periods occur.

The risk assessment requires consideration of the redevelopment of Barangaroo Central into the Barangaroo Stage 1 Public Domain, and later development for high density residential and open space uses. The major human stakeholders identified for Barangaroo Central include recreational users of open space facilities and future residents of residential buildings and their basements.

As the environmental hazards present on the Barangaroo Project Site (which will potentially be present in imported soils to be used on Barangaroo Central) are related to commonly occurring commercial / industrial contaminants, including heavy metals, monocyclic and polycyclic aromatic hydrocarbons, which have previously been used widely throughout Australia, it can be demonstrated that the environmental hazard is not a unique hazard to the community. However, the presence of these contaminants in uncontrolled locations, potentially accessed by sensitive populations, may increase the exposure of the community and/or the environment to the environmental hazard.

5.5 Identification of Potential Interactions between Agents

There may be interactions between the physical, chemical, biological and social hazards that require identification and consideration as part of a risk assessment. There are several potential types of interactions between hazardous agents which include: additive effects; synergistic effects; potentiation effects and antagonistic effects.

It is widely acknowledged that activities such as smoking can increase the susceptibility of a person to the potential effects of some carcinogens. To this effect, it is required that conservatively derived data and reasonably maximum exposed receptors are used as the basis for any risk assessment.

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5.6 Why is Risk Assessment Needed?

The occurrence of environmental hazards in the sub-surface of a site is unique for every site and location. Further, the particular populations exposed to an environmental hazard will be unique for each occurrence of the environmental hazard. Regulatory authorities within NSW do not provide comprehensive guidance for environmental hazard assessment of the range of contaminants identified within the Barangaroo Central site for the particular exposure scenarios identified as being required to be assessed. The limited guidance available is considered unsuitable to be applied to the proposed Barangaroo Central development without additional justification.

The requirement, and/or the method, of remediation/management for an environmental hazard needs to be determined. The extent and need for this requirement must be determined by assessment of the presence of an environmental hazard; the degree of potential harm posed by the environmental hazard (in an isolated environment); and the likely exposure of the surrounding community and environment to the environmental hazard. Only through assessment of these factors can the true impact of the environmental hazard be determined.

The risk assessment process is designed to include all of these factors to determine a site specific estimate of the potential for an unacceptable level of risk requirement and associated requirement for a site acceptance criteria for a range of environmental constituents, which may be present in soils and/or seepage water and/or groundwater which will occur on the Site.

5.7 Limitations and Uncertainties

Potential limitations and uncertainties that may occur in the risk assessment process include:

- Information gaps, e.g. effects of mixtures, low level and variable exposures over time, relative contribution of 'lifestyle' factors;
- Poor exposure information, e.g. complex mixtures of hazards with complex behaviours in the environment, or limited knowledge about the actual or potential sub-population;
- Limitations of toxicological or epidemiological research, e.g. small populations and limited exposure information, multifactorial causes of many diseases on health impacts, 'background noise' affecting research into common diseases or symptoms, population heterogeneity;
- Complexity, e.g. large numbers of combinations of hazards, exposures and health states;
- Confidentiality of health and commercial information;
- Charged atmosphere of fear, antagonism and distrust; and
- Value conflicts.

The risk assessment requires a thorough sensitivity analysis subsequent to the provision of the risk outcomes. The sensitivity analysis will be required to take these matters into account, testing the outcome of the risk assessment of reasonable upper and lower bounds of each assumption. Sensitivity analysis of all assumptions has been undertaken throughout the risk assessment. Risk assessment outcomes may be required to be modified where sensitive parameters are observed to have large reasonable potential distributions.

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6 Selection of Constituents of Potential Concern

JBS (2012a) has identified constituents which have exceeded NSW EPA published or endorsed investigation levels. Constituents have been identified in soils and groundwater on the site as requiring risk assessment. Soil constituents identified as COPCs and maximum concentrations reported in unsaturated soils, are summarised in **Table 6.1**. Groundwater constituents identified as COPCs and maximum concentrations as reported on the site, considering shallow and deep groundwater, are summarised in **Table 6.2**. Shallow and deep groundwater has been considered as the proposed depth of the basements is not known to have been finalised.

Table 6.1: Summary of Soil COPCs and Maximum Concentrations

Constituent	Maximum Concentration (mg/kg)	Historical Sample ID
Lead	1000	BH518 0.9-1.0
Acenaphthene	1.9	BH538 1-1.1
Acenaphthylene	8.7	BH547 1.0
Anthracene	11	BH547 1.0
Benz(a)anthracene	24	BH547 1.0
Benzo(a)pyrene	30	BH547 1.0
Benzo(b&k)fluoranthene	37	BH547 1.0
Benzo(g,h,i)perylene	10	BH547 1.0
Chrysene	22	BH547 1.0
Dibenz(a,h)anthracene	2.8	BH547 1.0
Fluorene	64	BH547 1.0
Fluoranthene	5.9	BH547 1.0
Indeno(1,2,3-c,d)pyrene	12	BH547 1.0
Naphthalene	4.2	BH547 1.0
Phenanthrene	33	BH547 1.0
Pyrene	61	BH547 1.0

Table 6.2: Summary of Groundwater COPCs and Maximum Concentrations in Proximity of Proposed Basements

Constituent	Maximum Concentration (mg/L)	Historical Sample ID
Arsenic	0.14	MW542
Lead	0.014	MW08
Nickel	0.08	MW08
Ammonia (as N)	42	MW541D
Acenaphthene	0.034	MW541D
Acenaphthylene	0.097	MW541D
Anthracene	0.056	MW541D
Benz(a)anthracene	0.050	MW541D
Benzo(a)pyrene	0.050	MW541D
Benzo(b&k)fluoranthene	0.061	MW541D
Benzo(g,h,i)perylene	0.017	MW541D
Chrysene	0.04	MW541D
Dibenz(a,h)anthracene	0.0039	MW541D
Fluorene	0.12	MW541D
Fluoranthene	0.081	MW541D
Indeno(1,2,3-c,d)pyrene	0.018	MW541D
Naphthalene	1.9	MW541D
Phenanthrene	0.17	MW541D
Pyrene	0.12	MW541D
Benzene	4.3	MW541D
Toluene	1.9	MW541D
Ethylbenzene	0.078	MW541D
Xylenes	0.76	MW541D
Trimethylbenzenes	0.115	MW541D
Styrene	0.007	MW541D

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6.1 Assessment of Total Petroleum Hydrocarbons

It is noted that JBS (2011a) and JBS (2012b) have selected total petroleum hydrocarbons (TPH) as a COPC with the PAHs and MAHs. JBS (2011a and 2012b) have been prepared based on soils that may be received at the site. Detailed chemical information on the nature of mixtures of hydrocarbons that may occur in these samples has generally not been available. This has required inclusion of a substantial number of COPCs.

Guidance for the health based assessment of TPH is provided in *Health-based Soil Investigation Levels*, enHealth, 2001. Two approaches for the assessment of TPH are nominated including:

- Examining the presence of indicator chemicals which are carcinogenic substances. Substances such as benzo(a)pyrene and benzene are nominated; or
- In the absence of indicator chemicals, assessment of TPH by TPH fractions using toxicity criteria as assigned by the Total Petroleum Hydrocarbon Working Group.

Indicator chemicals including benzo(a)pyrene and/or benzene are present at significant concentrations in the COPCs. On this basis, it is considered that assessment of potential effects of TPH by assessment of speciated chemicals is appropriate for this HHRA.

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7 Toxicological Review

There are two elements to the toxicological review for the human health risk assessment: hazard identification (using toxicological studies); and dose-response assessment. The Australian approach to each is discussed in detail following.

7.1 Hazard Identification

Hazard identification examines the capacity of an agent to cause adverse health effects in humans and other animals.

Hazard identification uses:

- Animal data. These are usually assessed by toxicological methods;
- Human data. These are usually assessed by epidemiological methods when groups of people are involved, or by toxicological methods when using case studies and acute chamber studies; and
- Other data. These include structure data such as structure activity data or in vitro data assessed by toxicologists.

Hazard identification mostly relies on the results of in vitro toxicity studies conducted according to standard protocols (e.g. OECD Test Guidelines). The following types of studies are defined:

- Acute toxicity studies are studies which investigate the effects of single doses of a substance. The standard acute toxicity studies include tests for: acute, oral, dermal and inhalational toxicity; eye irritation; skin irritation; and skin sensitisation;
- Sub-chronic toxicity studies are short term repeat-dose studies. The main purpose of sub-chronic testing is to identify any target organs and to establish dose levels for chronic exposure studies;
- Chronic toxicity studies, or long-term studies, are defined as studies lasting for the greater part of the lifespan of the test animals. The protocol for these studies may cover the investigation of chronic toxicity or carcinogenicity, or both;
- Reproductive toxicity studies are studies designed to provide general information about the effects of a test substance on reproductive performance in both male and female animals;
- Developmental toxicity studies are studies which examine the spectrum of possible in-utero outcomes for the conceptus, including death, malformations, functional deficits and developmental delays; and
- Genotoxicity studies are designed to determine whether test chemicals can perturb genetic material to cause gene or chromosomal mutations.

The essential purpose of toxicity studies is the detection of valid biological evidence of the hazard potential of the substance being investigated. The evaluation of the weight of evidence from toxicity studies is by a process which considers the cumulative data pertinent to arriving at a level of concern about the potential adverse effects of a substance. In assessing toxicological studies and hazard analysis, judgement and supporting rationale are provided for:

- The acceptability of the study and its database;

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- The existence of biologically important adverse effects;
- The relevance of any factors noted during the evaluation which might have had some bearing on the outcomes of the study and modified the findings in some way; and
- The likelihood that any of the observed effects were induced by the administered substance.

Toxicology assessments are often complemented with epidemiological studies in hazard assessment. Epidemiology is the direct human evidence component of the assessment. Epidemiological studies are used to investigate the cause of adverse health effects; the natural history of health conditions; the description of the health status of populations; to evaluate the health status of populations; and to evaluate health related interventions.

7.2 Dose-Response Assessment

The dose-response assessment examines the quantitative relationships between exposure and the effects of concern. There are different ways of characterising dose-response relationships including:

- Effect levels (e.g. LD_{50}, LC_{50}, ED_{10}) and no observed adverse effect levels (NOAELs);
- Margins of safety;
- Therapeutic indices; and
- Models to interpolate high dose experimental data to the low doses likely to be experienced in the environment.

There are often limited human exposure data, and animal bio-assay data are most often used for dose-response assessment. The use of these data requires extrapolations from animals to humans and interpolations from high doses to low doses.

Dose-response assessments and calculations are generally undertaken by either of a threshold approach or a non-threshold approach. Each is described in further detail following.

7.3 Threshold Approaches

A threshold is considered to occur because of biological mechanisms such as the ability to metabolise or excrete a toxin to repair damage up to a certain dose.

The approach with these models is to derive exposure limits such as an allowable daily intake (ADI), Tolerable Daily Intake (TDI) or reference dose (R*f*D). This approach makes no attempt to calculate a level of risk at low exposures. Rather, it derives a dose which is apparently without effect in a human or suitable animal model population, and then applies a factor to derive an exposure which has a high likelihood that no effect will occur in the general human population.

These exposure limits are derived by first determining the No Observed Adverse Effect Level (NOAEL) or, if the NOAEL cannot be determined, the Lowest Observed Adverse Effect Level (LOAEL) and dividing the value by factors to account for:

- Interspecies differences (extrapolating from animals to humans);
- Intraspecies differences (differing sensitivities between individuals);
- The severity of the adverse effect; and

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- The quantity and quality of the scientific data.

Traditionally, safety factors for intraspecies and interspecies differences have each been assigned values of ten, and the other two have been assigned values between one and ten. An additional factor of ten is sometimes used if the NOAEL was not established in the study. The individual factors are then multiplied to determine an overall safety factor by which the NOAEL is divided to give the ADI, TDI or R*f*D.

Historically, the most common overall factor used by a number of regulatory bodies is 100, if a large toxicological database has been assessed, although the overall factor can range from 10 to 10,000. From the data available on humans and experimental animals, it appears that interspecies and intraspecies differences are in general less than 10; hence the often used safety factor of 100 for these two factors is highly conservative and adequately protective of public health.

7.4 Non-Threshold Approaches

These approaches do not recognise the possibility of a threshold effect and are appropriate for radiation and some genotoxic carcinogens. As a science policy decision, a threshold approach is applied to all carcinogens by the US EPA.

Non-threshold models assume linearity between the lowest experimentally derived dose and the zero dose (the origin). This implies that there is a calculable probability of an adverse effect (risk) no matter how small the dose. This does not mean that there is no dose that could be considered safe unless safety must be equated with zero risk.

Numerical estimates of risk probabilities are generated by fitting one or more mathematical models to the data in the experimental dose range and extrapolating to the low environmental exposure doses. For example, low-dose extrapolation using a linear model is a default approach for cancer risk assessment in the USA and has been used by the WHO for genotoxic carcinogens in deriving water quality guidelines.

The outcomes are estimates of either:

- The dose at a predetermined acceptable risk level (note that this requires some judgement on what constitutes an acceptable level of risk); or
- The estimated risk level at any particular dose.

It has been recognised by IARC and other European based agencies that not all carcinogens have genotoxicity as their prime mode of action. The dose-response curve is assumed to be non-threshold for genotoxic carcinogens and threshold for non-genotoxic carcinogens. Accordingly, the Australian approach is to apply non-threshold and threshold models to genotoxic and non-genotoxic carcinogens.

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7.5 Sources of Toxicological and Tolerable Intake Data

Enhealth (2002) provides advice as to the quality of toxicological data that is available to be used in risk assessments. Data is categorised as Level 1, 2 or 3 data. Level 1 sources are recommended as the preferred sources of chemical data. Level 1 sources, in the order of preference for which they are recommended to be used, include:

1. National Health and Medical Research Council documents and documents from other joint Commonwealth, State and Territory Health organisations. These may be a source of Australian guidance values. Publications prepared by the former Australian and New Zealand Environmental and Conservation Council are considered a suitable Commonwealth source to be included here;
2. ADI list from the Therapeutic Goods Administration;
3. World Health Organisation (WHO) documents. Australia is a party to the WHO process and has incorporated their material in a variety of environmental health criteria. A range of documents include those from the WHO/ILO/UNEP International Programme on Chemical Safety (IPCS) which produces Environmental Health Criteria monographs and Concise International Chemical Assessment documents (CICADs). Documents detailing international Acceptable Daily Intakes (ADI's), Tolerable Daily Intakes (TDI) or Tolerable Weekly Intakes (TWI) may be found in evaluations by the WHO/FAO Joint Meeting on Pesticide Residues (JMPR) and by the Joint FAO/WHO Expert Committee on Food Additives (JECFA);
4. enHealth Council documents;
5. National Environmental Health Forum documents distributed by the Commonwealth Department of Health and Ageing;
6. International Agency for Research on Cancer (IARC) Monographs;
7. WHO/FAO Joint Meeting on Pesticide Residues (JMPR) Monographs;
8. NICNAS Priority Existing Chemical (PEC) reports;
9. US Agency for Toxic Substances and Disease Registry (ATSDR) documents for general toxicological reviews and Reference Doses;
10. National Toxicology Program (NTP) carcinogenicity appraisals which report in detail the results of carcinogenicity tests on a wide range of chemicals;
11. OECD Standard Information Data Sets (SIDS) and SIDS Initial Assessment Reports (SIAR); and
12. US EPA Reference Doses.

Where a rare substance is being assessed, or insufficient data are available within Level 1 sources, then Level 2 sources may require research. Level 2 sources include:

1. European Centre of Ecotoxicology and Toxicology of Chemicals (ECETOC): Monographs, JACC reports and Technical Reports;
2. Chemical Institute of Toxicology (CIIT) reports; and
3. Unpublished industry reports submitted for regulatory purposes. These may have restricted availability but information may be available in evaluation reports from regulatory agencies that have reviewed individual reports.

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Level 2 sources may also include peer-reviewed journals.

7.6 Review of Published Hazard Data

Available toxicological, epidemiological studies and dose-response studies have been reviewed for each of the COPC's (identified in **Section 6**) by the protocols established in **Section 7.5**. Consequently, citing the authority of the Level 1 agencies, there has been no requirement in this risk assessment to further review and comment upon the hazard studies reviewed by each organisation, or those that may be available elsewhere that are not endorsed by these organisations.

Instead, the pertinent toxicological effects identified for each of the COPC's by the Level 1 agencies has been reviewed and summarised for each identified COPC. Risk / hazard factors and guideline values have also been identified from these sources. The most current guidance only has been referenced for each of the sources. It is noted that some agencies have removed historical assessments of some chemicals in most recent guidance.

A brief summary of the toxicological endpoints of each of the identified COPCs is provided in the following sections. The summaries have been generated by a review of the available data held by the Level 1 agencies. Level 2 sources have been reviewed in some cases where no Level 1 data are available, or where recommended in the case of the assessment of PAHs by DECCW officers.

7.6.1 Arsenic

Arsenic has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for arsenic has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.1**.

Table 7.1: Summary of Published Level 1 Hazard Data for Arsenic

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Arsenic in Drinking Water' WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 6.1)
enHealth	YES	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	No	enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	YES	IARC Monographs (1987)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (August 2007) 'Toxicological Profile for Arsenic'
NTP	YES	US Department of Health and Human Services (2009) '11th Report on Carcinogens'
OECD SIDS SIAR	No	
EPA	YES	IRIS database (1998)

NHMRC

NHMRC/NRMMC (2011) recommends the use of a maximum tolerable daily intake (TDI) for arsenic of 0.002mg/kg body weight per day as based on the WHO (1998) guideline value. It is reported that the WHO data were based on the estimated additional lifetime risk of six skin cancers per 10 000 people.

It is estimated in NHMRC/NRMMC (2011) that the average Australia adult dietary intake of arsenic is approximately 0.04mg/day.

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WHO

Arsenic in drinking water is noted to be classified by IARC as a carcinogen. The guideline value by WHO (2003), of 10µg/l is reported to be based on the maximum likelihood estimates, using linear extrapolation, for bladder and lung cancer for US populations exposed to 10µg of arsenic per litre in drinking water of 12 and 18 per 10 000 population for females and 23 and 14 per 10 000 population for males. It is also reported to be based on the practical quantification limit for arsenic and extent to which arsenic can be removed from drinking water.

Arsenic is classified as a human carcinogen in WHO (2000). Risk estimates have been derived from studies in exposed human populations in the United States and Sweden. At an air concentration of 1µg/m^3 an estimate of lifetime risk of $1.5*10^{-3}$ is reported.

enHealth

enHealth (2001) reports a WHO provisional tolerable weekly intake (PTWI) of 0.015mg/kg/week for arsenic. It is reported that there is a narrow margin between the WHO PTWI and intakes reported to have toxic effects in other studies. It is reported that dietary exposure of children could account for 50% of the PWTI.

IARC

Arsenic and arsenic compounds are classified by the IARC as a Group 1 carcinogen.

ATSDR

ATSDR reports that no minimal risk level (MRL) has been derived for exposure to inorganic arsenic by inhalation.

An oral MRL of 0.005 mg As/kg/day has been derived for acute-duration (14 days or less) oral exposure to inorganic arsenic. This is based on an assessment of poisoning cases associated with an episode of arsenic contamination of soy sauce in Japan. The MRL is reported to have been derived on the basis of an LOAEL of 0.05 mg As/kg/day with an uncertainty factor of 10.

An MRL of 0.0003 mg As/kg/day has been derived for chronic-duration (365 days or more) oral exposure to inorganic arsenic. This is reported to have been on the incidence of Blackfoot Disease and dermal lesions (hyperkeratosis and hyperpigmentation) in a large number of poor farmers (both male and female) exposed to high levels of arsenic in well water in Taiwan. The MRL is derived by applying an uncertainty factor of 3 (for human variability) to the NOAEL of 0.0008 mg/kg/day.

NTP

NTP reports that inorganic arsenic compounds are known to be human carcinogens based on sufficient evidence of carcinogenicity in humans. Epidemiological studies and case reports of humans exposed to arsenic compounds for medical treatment, in drinking water, or occupationally have demonstrated that exposure to inorganic arsenic compounds increases the risk of cancer. Cancer tissue sites include the skin, lung, digestive tract, liver, bladder, kidney, and lymphatic and hematopoietic systems (organs and tissues involved in production of blood).

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US EPA

Arsenic is classified as a human carcinogen (Classification A) by the US EPA based on increased lung cancer mortality observed in multiple human populations exposed primarily through inhalation. Increased mortality from multiple internal organ cancers (liver, kidney, lung, and bladder) and an increased incidence of skin cancer were observed in populations consuming drinking water high in inorganic arsenic.

An oral slope factor of 1.5 per (mg/kg)/day is provided by the US EPA on the basis of studies of persons exposed to arsenic in drinking water.

An oral RfD of $3*10^{-4}$ mg/kg/day is provided for arsenic on the basis of studies of effects and dose-response relationships of skin cancer and blackfoot disease with arsenic and the prevalence of skin cancer in an endemic area of chronic arsenicism in Taiwan. The RfD has been based on the lowest of the report NOAELs with an uncertainty factor of 3 to account for lack of data to preclude reproductive toxicity and sensitive individuals.

An inhalation unit risk of $4.3*10^{-3}$ $(\mu g/m^3)^{-1}$ is provided by US EPA on the basis of studies of lung cancers in male humans occupationally exposed by inhalation. The unit risk is the geometric mean of the unit risk derived in several studies.

Level 2 Sources

It is noted that the US EPA (November 2010) 'Regional Screening Levels' adopt a Californian EPA health based RfC of $1.5*10^{-5}mg/m^3$ for assessment of inhalation exposure to arsenic.

7.6.2 Lead

Lead has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for lead has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.2**.

Table 7.2: Summary of Published Level 1 Hazard Data for Lead

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Lead in Drinking Water' WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 6.7)
enHealth	YES	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	No	enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	YES	IARC Monographs (1987 and 2006)
WHO/FAO JMPR	No	
NICNAS PEC	YES	NICNAS (September 2007) 'Lead Compounds in Industrial Surface Coatings & Inks'
ATSDR	YES	ATSDR (August 2007) 'Toxicological Profile for Lead'
NTP	YES	US Department of Health and Human Services (2009) '11th Report on Carcinogens'
OECD SIDS SIAR	No	
EPA	YES	IRIS data base (2004)

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NHMRC

NHMRC/NRMMC (2011) has recommended a daily intake of 0.0035mg/kg body weight per day of lead as based on a level which has been demonstrated to not result in an increase in lead retention in metabolic studies with infants. The recommended daily intake is reported to have been based on a WHO value.

NHMRC/NRMMC (2011) estimates that average Australian adult dietary intake of lead to be approximately 0.1mg/day. It is estimated that approximately 80% of the daily intake of lead is from the ingestion of food, dirt and dust.

WHO

It is reported in WHO (2003) that the evidence for the carcinogenicity of lead in humans is inconclusive because of the limited number of studies, the small cohort sizes, and the failure to take adequate account of potential confounding variables. However, an association has been demonstrated experimentally between the ingestion of lead salts and renal tumours. However as there is evidence from human studies that adverse effects other than cancer may occur at very low lead levels, the WHO drinking water guideline has been derived using the TDI approach.

The WHO (2003) drinking water guideline is based on a provisional tolerable weekly intake (PTWI) of 25 µg of lead per kg of body weight (equivalent to 3.5 µg/kg of body weight per day) for infants and children which took account of the fact that lead is a cumulative poison so that any increase in the body burden of lead should be avoided.

WHO (2000) reports that the guideline for lead in air has been based on the concentration of lead in blood. Critical effects in adults include elevation of free erythrocyte protoporphyrin. For children, cognitive deficit, hearing impairment and disturbed vitamin D metabolism are taken as the decisive effects. The guideline is based on a critical level in blood of 100µg/l, based on a child exposure. It is recommended that an annual average lead level in air should not exceed 0.5µg/m^3.

enHealth

enHealth (2001) describes the adopted approaches for assessing lead being the assessment for potential impacts to children by the use of a WHO PTWI of 25µg/kg/week. It was also noted that background exposures may contribute approximately 50% of the PWTI.

IARC

IARC classifies lead compounds as Group 2A chemicals, probably carcinogenic to humans. IARC classified lead as a Group 2B chemical, possibly carcinogenic to humans.

IARC (2006) notes that lead potentially has reduced bioavailability subsequent to exposure. A range of bioavailabilities are presented based on the chemical form of lead (i.e. lead sulphide, lead oxide, lead acetate etc) and the exposure pathway. Based on the range of bioavailabilities presented, it is considered that a bioavailability of 50% (from soil, dust, food and water) is most likely suitably conservative.

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NICNAS

Lead and inorganic lead compounds are reported to have diverse effects on multiple body systems including neurological, gastrointestinal, reproductive and cardiovascular systems.

Few data were reported to be available from acute exposure in humans to lead. Most data was derived from cases of accidental or intentional ingestion of dirt containing lead or lead-based paint. High acute exposure had resulted in encephalopathy, gasterointestinal and renal effects.

It was reported that lead had been shown in animals to produce a variety of cardiovascular effects. The endpoint of greatest concern to humans was possible changes in blood pressure. Although there have been numerous epidemiological studies examining the effect of low concentrations of lead on blood pressure (amongst other endpoints) no causal relationship is reported to have been demonstrated between blood pressure and low blood lead concentration in humans.

The most important confirmed effects of long term exposure to lead were reported to be neurological, including encephalopathy and neurobehavioural changes. Neurological effects were reported to be particularly important in the foetus and in children. Lead was reported to be a known developmental toxicant in humans. Blood lead levels greater than 10 µg/dL can result in a decline in IQ and neurobehavioural deficits. Peripheral neuropathy has been observed in children at blood levels between 60 and 130µg/dL

The report recommended that lead not be used in industrial coatings.

ATSDR

ATSDR reports that MRLs were not derived for lead because a clear threshold for some of the more sensitive effects in humans has not been identified and data suggest that certain subtle neurobehavioral effects in children may occur at very low lead blood levels.

It is reported that blood levels as low as <10µg/dL can cause depressed aminolevulinic acid dehydratase (i.e. anemia). A range of other effects are reported at higher concentrations.

NTP

NTP reports that lead and lead compounds are reasonably anticipated to be human carcinogens based on limited evidence from studies in humans and sufficient evidence from studies in experimental animals. Lead exposure has been associated with increased risk of lung, stomach, and bladder cancer in diverse human populations. The strongest epidemiological evidence is reported to be for lung and stomach cancer, which are consistently but weakly associated with occupations and industries entailing lead exposure and with indices of individual lead exposure, including job history and biological monitoring of occupationally exposed and general populations.

US EPA

The US EPA has classified lead as a probable human carcinogen (Class B2) on the basis of ten rat bioassays and one mouse assay that have shown statistically significant increases in renal tumors with dietary and subcutaneous exposure to several soluble lead salts. Short term studies are also reported to show that lead affects gene expression. Human evidence is described as being inadequate.

US EPA further reports that health effects associated with exposure to inorganic lead and compounds include, but are not limited to, neurotoxicity, developmental delays, hypertension, impaired hearing acuity, impaired hemoglobin synthesis, and male

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reproductive impairment. Lead is reported to have particularly significant effects in children, well before the usual term of chronic exposure can take place.

US EPA does not provide an oral RfD for lead on the basis that some of the effects of lead exposure, particularly changes in the levels of certain blood enzymes and in aspects of children's neurobehavioral development, may occur at blood lead levels so low as to be essentially without a threshold.

An RfC is not provided for lead for the same reason.

7.6.3 Nickel

Nickel has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for nickel has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.3**.

Table 7.3: Summary of Published Level 1 Hazard Data for Nickel

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2004) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2005) 'Nickel in Drinking Water' WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 6.10)
enHealth	YES	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	No	enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	YES	IARC Monographs (1990)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (August 2005) 'Toxicological Profile for Nickel'
NTP	YES	US Department of Health and Human Services (2009) '11th Report on Carcinogens'
OECD SIDS SIAR	No	
EPA	YES	IRIS database (1996 & 2006)

NHMRC

NHMRC/NRMMC (2004) has recommended a daily intake of 5 mg/kg body weight per day based on a no effect level for altered organ to body weight ratios in a 2 year study with rats. The rats were orally exposed to high nickel doses. It is also recommended that a 1,000 safety factor be used with this daily intake (TDI of 0.005 mg/kg body weight per day) to account for interspecies variations, intraspecies variations and to compensate for a lack of adequate studies on chronic effects and for increases in intestinal absorption on an empty stomach.

NHMRC/NRMMC (2004) estimates that average Australian adult dietary intake of nickel to be between 0.1 and 0.3mg/day generally through food consumption.

WHO

WHO (2005) reports a two-generation study on rats where it was found that a NOAEL of 2.2 mg of nickel per kg of body weight per day was identified for all the end-points studied, including the variable of post-implantation/perinatal lethality. An uncertainty factor of 100 (10 to account for interspecies variation and 10 to account for intraspecies variation) gives a TDI of 22 µg/kg of body weight. This study is found to be more recent that the background to the NHMRC value.

However it was found this general toxicity value may not be sufficiently protective of individuals sensitised to nickel. The guideline value for nickel in drinking-water is

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reported to have been derived using the LOAEL of 12 µg/kg of body weight established after provocation of fasted patients with an empty stomach.

WHO (2000) reports that nickel compounds are human carcinogens by inhalation exposure on the basis of studies in occupationally exposed human populations. It is reported that an incremental risk of $3.8*10^{-4}$ can be given for a concentration of nickel in air of 1µg/m^3.

enHealth

enHealth (2001) reports a US EPA chronic oral RfD of 0.02mg/kg/day as based on a NOAEL derived from a chronic feeding study in rats. The potential for sensitisation to nickel was also reported in enHealth (2001). Risk based calculations were adjusted by a factor of approximately 2 to account for potential sensitisation of susceptible receptors by dermal exposure.

IARC

IARC classifies nickel compounds as a Group 1 carcinogen. Nickel is classified as a Group 2B chemical, possibly carcinogenic to humans.

ATSDR

ATSDR reports an intermediate duration inhalation exposure MRL of 0.0002mg Ni/m^3. The MRL has been derived by a human equivalent NOAEL derived from a study of alveolar macrophage hyperplasia as observed in rats. The NOAEL was divided by an uncertainty factor of 30 to account for species to species extrapolation and human variability.

A chronic duration inhalation exposure MRL of $9*10^{-5}$mg Ni/m^3 has been derived. This is reported to have been based on a human equivalent NOAEL as derived from inhalation studies of rats. Effects of the inhalation studies are reported to have included chronic lung inflammation and bronchialisation, alveolar epithelium hyperplasia, fibrosis and rapid and shallow breathing. The NOAEL was divided by an uncertainty factor of 30 to account for species to species extrapolation and human variability.

No oral exposure MRLs are provided for nickel. It is reported that data on the chronic toxicity of ingested nickel (oral exposure) are limited to one animal study that found significant decreases in body weight and liver weights in rats. This was considered inadequate for MRL derivation.

NTP

NTP reports that nickel compounds are known to be human carcinogens based on sufficient evidence of carcinogenicity from studies in humans, including epidemiological and mechanistic information, which indicates a causal relationship between exposure to nickel compounds and human cancer. The findings of increased risk of cancer in exposed workers are supported by evidence from experimental animals that shows that exposure to an assortment of nickel compounds by multiple routes causes malignant tumors to form at various sites in multiple species of experimental animals.

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US EPA

The US EPA classified nickel refinery dusts as a carcinogen (Classification A) on the basis of human data, in which exposure to nickel refinery dust caused lung and nasal tumors in sulfide nickel matte refinery workers in several epidemiologic studies in different countries. Animal data have also demonstrated carcinomas produced in rats exposed to nickel refinery dust by inhalation and injection.

An inhalation unit risk of $2.4*10^{-4}$ $(\mu g/m^3)^{-1}$ is provided for nickel on the basis on estimates of lung cancer in occupationally exposed workers.

Nickel and soluble salts have been reported by US EPA to cause body weight decreases in rates exposed by oral pathways. An oral RfD of $2*10^{-2}$ mg/kg/day was derived for nickel on the basis of a NOAEL derived from a study of decreased body and organ weights in rats, adjusted by an uncertainty factor of 300 to account for interspecies extrapolation, to protect sensitive populations and account for inadequacies in the reproductive studies.

7.6.4 Ammonia (as N)

Ammonia (as N) has been selected as a COPC for the assessment of potential aesthetic and human health impacts. A brief summary of the toxicological data available for ammonia has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.4**.

Table 7.4: Summary of Published Level 1 Hazard Data for Ammonia

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Ammonia in Drinking Water'
enHealth	No	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	No	enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	No	
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (September 2004) 'Toxicological Profile for Ammonia'
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	IRIS database (1991)

NHMRC

NHMRC / NRMMC (2004) provide a guideline value for ammonia based on aesthetic considerations only. The aesthetic guideline of 0.5mg/l is based on likelihood of corrosion to copper pipes and fittings. No health based guideline is provided as it is concluded that ammonia is unlikely to occur in drinking water supplies at levels that may cause health effects.

Ammonia is reported to have a toxic effect where the detoxification capacity of the body is exceeded. This is reported to occur at a dose above 32mg ammonium per kg body weight.

WHO

WHO (2003) states that ammonia is not of direct importance for health in the concentrations expected in drinking water. It is reported that the ammonium can have a toxic effect where the intake becomes higher than the capacity to detoxify, which is reported to occur at a dose above 33.7mg ammonium per kg body weight.

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ATSDR

ATSDR provides an MRL of 1.7ppm for the acute duration inhalation exposure to ammonia. The MRL is reported to be based on the LOAEL of 50ppm base don mild irritation in exposed humans.

An MRL of 0.1ppm is provided for chronic duration inhalation exposure to ammonia. The MRL is reported to be based on an a NOAEL of 9.2ppm for the sense of smell and prevalence of respiratory symptoms in occupationally exposed humans. The NOAEL is reported to have been calculated by adjusting the mean TWA (time weighted average) exposure, dividing by an uncertainty factor of 10 and a modifying factor of 3.

No oral MRLs are provided for ammonia by ATSDR based on the lack of suitable toxicological studies and the high doses of ammonium that are anticipated to be required in drinking water / food to allow acceptable levels to be exceeded. It was further noted that oral exposure to ammonia generally consists of ammonium chloride. The anion chloride is reported to assist in the metabolism of the co-occurring ammonium.

US EPA

The US EPA provides a reference concentration (RfC) for ammonia of 0.1mg/m^3. The RfC is reported to be based on studies of occupationally exposed workers and a study of rats which identified significantly increased severity of rhinitis, otitis media, tracheitis and pneumonia, a significant concentration response between observed respiratory lesions and increasing environmental ammonia concentration, gross bronchiectasis and/or pulmonary abscesses and the extent of gross atelectasis. The RfC has been principally derived from a NOAEL derived from the occupational study.

No data was available on the potential toxicity of ammonia by oral exposure or potential carcinogenicity.

7.6.5 Benzene

Benzene has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for benzene has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.5**.

Table 7.5: Summary of Published Level 1 Hazard Data for Benzene

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Benzene in Drinking Water' WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 5.2)
enHealth	No	
NEHF	YES	NEHF (1997) 'Benzene National Environmental Health Monographs' NEHF (May 2003) 'Benzene Health Review' NEHF (2004) 'National Environment Protection (Air Toxics) Measure'
IARC	YES	IARC Monographs (1987)
WHO/FAO JMPR	No	
NICNAS PEC	YES	NICNAS (September 2001) 'Benzene Priority Existing Chemical Assessment Report No. 21'
ATSDR	YES	ATSDR (August 2007) 'Toxicological Profile for Benzene'
NTP	YES	US Department of Health and Human Services (2009) '11th Report on Carcinogens'
OECD SIDS SIAR	No	
EPA	YES	IRIS Database (2003)

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NHMRC

NHMRC/NRMMC (2011) reports that the IARC has concluded that benzene is carcinogenic to humans. The guideline value presented is reported to have been based on a WHO extrapolation model as based on the incidence of leukaemia in humans. The NHMRC/NRMMC (2011) guideline value is further noted to be based on an incremental risk of cancer of 1 in 100 000.

A background exposure to benzene was not reported in NHMRC/NRMMC (2011). It was reported that benzene has not been found in Australian drinking waters.

WHO

WHO (2003) reports that benzene is carcinogenic in mice and rats after both inhalation and oral exposure, producing malignant tumours at many sites. It is considered to be a human carcinogen and is classified by IARC in Group 1. The drinking water guideline has been derived based on a risk estimate using data on leukaemia from epidemiological studies involving inhalation exposure. The epidemiological data was reported to be supported by leukaemia and lymphomas in female mice and oral cavity squamous cell carcinomas in male rats. A slope factor for oral exposure of 0.035 $(mg/kg/day)^{-1}$ is reported to have been used.

WHO (2000) reports that benzene is carcinogenic to humans. The geometric mean of the range of estimates of the excess lifetime risk of leukaemia at an air concentration of $1\mu g/m^3$ is reported to be $6*10^{-6}$.

NEHF

NEHF (1997) reports a number of effects of benzene exposure including narcotic or anaesthetic effects, deaths of workers, development of severe and sometimes fatal damage to the blood-forming elements of the bone marrow preventing the manufacture of essential blood cells, central nervous system depression, cardiac arrhythmia, respiratory failure, headaches, lassitude and general weakness, increases in the number of chromosomal aberrations, increasing susceptibility to allergens, increased incidence of leukemias (especially non-lymphocytic leukemia) and some evidence of decreased immune function. NEHF (1997) reports that the most commonly found associations have been with increases in non-lymphocytic leukemia.

NEHF (1997) reports that WHO concluded that a time-weighted average of 1 ppm or less over a 40-year working life is not statistically associated with any increase in deaths from leukemia. It is further reported that in the United Kingdom, the Expert Panel on Air Quality Standards determined that a level of 0.5 ppm over a working lifetime would not produce any detectable adverse health effect.

NEHF (2003) contains a review of international sources of benzene toxicological data. This is undertaken to premise the benzene criteria as provided to the NEHF (2004) 'National Environment Protection (Air Toxics) Measure' (Air Toxics NEPM). An annual average of 0.003ppm as an eight year goal is recommended for benzene.

IARC

IARC classifies benzene as a Group 1 carcinogen.

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NICNAS

NICNAS reports anecdotal evidence of acute exposure to benzene vapours causes dizziness and other CNS effects at concentrations above 25 ppm and eye, mucous membrane and skin irritation at levels above 30-60 ppm. Aspiration of liquid benzene is reported to have been observed to cause lung oedema and bleeding. Deaths from cardio-respiratory arrest are reported to have occurred following short-term inhalation of 20 000 ppm benzene, or from ingestion of a single dose of 125 mg benzene per kg.

Several studies are reported to demonstrate that repeated exposure to benzene may induce bone marrow depression, cause damage to genetic material and induce leukaemia. Some studies also reported to point to an association between benzene exposure and the risk for lymphoma. For bone marrow depression, the best estimate for a LOAEL is reported to be 7.6 ppm (TWA). An appropriate NOAEL is reported to have not been determined, although studies with various limitations indicate that would be likely to be >0.5 ppm (TWA).

The risk of developing leukaemia is reported to increase with exposure and has been shown to be significantly elevated above, but not below, a cumulative exposure of 50 ppm-years, corresponding to an average occupational exposure of 1.25 ppm (TWA) over 40 years. A potential lack of conservatism is noted in this study.

A national occupational exposure standard of 0.5ppm (TWA) was recommended in the study.

ATSDR

ATSDR provides an acute duration inhalation exposure MRL of 0.009ppm. The MRL is reported to have been derived from a LOAEL value of 10.2 ppm for reduced lymphocyte proliferation following mitogen stimulation in mice.

An intermediate duration inhalation exposure MRL of 0.006ppm has been reported. This is reported to have been derived from a LOAEL of 10ppm for significantly delayed splenic lymphocyte reaction to foreign antigens evaluated in *in vitro* mixed lymphocyte reaction following the exposure of male mice to benzene vapours.

A chronic duration inhalation exposure MRL of 0.003ppm has been reported by ATSDR. The MRL is reported to be based on statistically significantly decreased counts of B-lymphocytes in workers of shoe manufacturing industries in Tianjin, China. A benchmark dose was derived from this study and adjusted by an uncertainty factor of 10 to account for human variability.

No acute or intermediate duration MRLs have been derived for benzene based on insufficient studies being available.

A chronic duration oral exposure MRL of 0.0005 mg/kg/day has been reported by ATSDR. This is reported to have been based on inhalation studies in workers, as described for the inhalation MRL. A benchmark dose has been derived from this study and adjusted for an oral route of exposure. A further uncertainty factor of 30 has been incorporated to account for human variability and uncertainty in route to route extrapolation.

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NTP

Benzene is reported to be a human carcinogen based on sufficient evidence in humans. Case reports and case series have reported leukemia (mostly acute myelogenous leukemia, also known as acute myeloid or myelocytic leukemia) in individuals exposed to benzene. It was also reported that occupational exposure to benzene increased the risk of mortality from leukemia (mainly acute myelogenous leukemia).

US EPA

The US EPA classifies benzene as a known human carcinogen (classification A) for all routes of exposure. Epidemiologic studies and case studies are reported to provide clear evidence of a causal association between exposure to benzene and acute nonlymphocytic leukemia and also suggest evidence for chronic nonlymphocytic leukemia and chronic lymphocytic leukemia. Other neoplastic conditions that are associated with an increased risk in humans are hematologic neoplasms, blood disorders such as preleukemia and aplastic anemia, Hodgkin's lymphoma, and myelodysplastic syndrome. These human data are reported to be supported by animal studies.

US EPA provides an oral slope factor of $1.5*10^{-2}$ to $5.5*10^{-2}$ per (mg/kg)/day based on occurrences of leukaemia in occupational workers exposed by inhalation. An air unit risk of $2.2*10^{-6}$ to $7.8*10^{-6}$ is provided for benzene on the basis of the occurrence of leukaemia in humans.

An oral RfD of $4.0*10^{-3}$ mg/kg/day is also provided by the US EPA. This is reported to have been derived based on a benchmark dose calculated by the modelling of the absolute lymphocyte count (ALC) data from an occupational epidemiologic study in which workers were exposed to benzene by inhalation. Absolute lymphocyte count, white blood cell count, red blood cell count, hematocrit, and platelets were all significantly decreased, and mean corpuscular volume was significantly increased in the exposed workers. The benchmark dose was adjusted by an uncertainty factor of 300.

The same study has been used by the US EPA to derive an inhalation RfC of $3*10^{-2}$ mg/m^3. The benchmark concentration has been likewise adjusted by an uncertainty factor of 300.

7.6.6 Toluene

Toluene has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for toluene has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.6**.

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Table 7.6: Summary of Published Level 1 Hazard Data for Toluene

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2004) 'Toluene in Drinking Water' WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 5.14)
enHealth	No	
NEHF	YES	NEHF (May 2003) 'Toluene Health Review' NEPC (2004) 'National Environment Protection (Air Toxics) Measure'
IARC	YES	IARC Monographs (1999)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (2000) 'Toxicological Profile for Toluene'
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	IRIS database (2005)

NHMRC

NHMRC/NRMMC (2011) has recommended a daily intake of 312mg/kg body weight per day as based on a no effect levels derived from a 13 week oral study using rats. Rats and mice exposed via a 13 year gavage study reported increased liver weights at doses from 625 mg/kg body weight per day.

It was also recommended that a safety factor of 1 000 is used with the recommended tolerable daily intake based on interspecies variations, intraspecies variations and to account for the use of a less than lifetime study. A correction factor of 5/7 is also recommended to convert a 5 day per week gavage study to a 7 day week equivalent (TDI of 0.223 mg/kg body weight per day).

A background exposure to toluene was not reported in NHMRC/NRMMC (2011). It was reported that toluene has not been found in Australian drinking waters.

WHO

WHO (2004) reports that the guideline value for toluene has been derived by a TDI approach. A TDI of 223 µg/kg of body weight is reported to have been derived using the LOAEL for marginal hepatotoxicity in mice of 312mg/kg of body weight per day (equivalent to 223 mg/kg of body weight per day for 7 days per week dosing) and applying an uncertainty factor of 1000 (100 for inter- and intraspecies variation and 10 for the short duration of the study and use of a LOAEL instead of a NOAEL).

WHO (2000) reports that the LOAEL for effects on the CNS from occupational studies, is approximately 332mg/m^3. A guideline value of 0.26mg/m^3 is reported to be established from these data adjusting for continuous exposure (dividing by a factor of 4.2) and dividing by an uncertainty factor of 300 (10 for interindividual variation, 10 for use of a lowest-observed-adverse-effect level rather than a no-observed-adverse-effect level, and an additional factor of 3, given the potential effects on the developing CNS). It is recommended that this guideline value be applied as a weekly average.

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NEHF

NEHF (2003) contains a review of international sources of toluene toxicological data. This is undertaken to premise the toluene criteria as provided to the Air Toxics NEPM. An annual average of 0.1ppm as an eight year goal is recommended for toluene. A 24 hour average of 1ppm is also recommended for toluene as an eight year goal.

IARC

IARC classifies toluene as a Group 3 chemical, not classifiable as to its carcinogenicity to humans.

ATSDR

ATSDR provide an acute duration inhalation exposure MRL of 1mg/kg/day. This is reported to be based on changes in neurological effects of human subjects to short terms exposures. A NOAEL was derived from this study and adjusted for an uncertainty factor of 10 to account for human variability.

A chronic duration inhalation exposure MRL of 0.08mg/kg/day is reported. This is based on studies of Canadian workers occupationally exposed to toluene. A LOAEL was derived from this study on the basis of colour vision impairment. The LOAEL was adjusted to account for affects of age and alcohol exposure. An uncertainty factor of 100 was also used to account for use of an LOAEL and human variability.

An acute duration oral exposure MRL of 0.8mg/kg/day is reported. This is based on the observation of neurological effects in rats. The LOAEL derived from the study was divided by an uncertainty factor of 300 to account for use of an LOAEL, extrapolation from humans to animals and human variability.

An intermediate duration oral exposure MRL of 0.02mg/kg.day has been reported by ATSDR. This is based on significant increases in norepinephrin present in the hypothalamus and in the midbrain in dosed mice. A LOAEL was derived from this study and divided by an uncertainty factor of 300 to account for used of an LOAEL, extrapolation from humans to animals and human variability.

A chronic duration oral MRL is not available.

US EPA

US EPA reports that there is inadequate information to assess the carcinogenic potential of toluene because studies of humans chronically exposed to toluene are inconclusive. Toluene is reported to have not been found to be carcinogenic in adequate inhalation cancer bioassays of rats and mice exposed for life.

An oral RfD of 0.08mg/kg-day is reported by the US EPA as based on a benchmark dose derived from a subchronic study that examined oral exposure to toluene in rodents (rats and mice). The rodents developed increased kidney and liver weights. Histopathologic lesions in the liver consisted of hepatocellular hypertrophy. Nephrosis was observed in rats that died, and damage to the tubular epithelia of the kidney occurred in terminally sacrificed rats. The benchmark dose was derived on the basis of increased kidney weights. This is reported by US EPA to have been supported by several acute oral and inhalation human toxicity studies. The RfD incorporated an uncertainty factor of 3 000 to account for extrapolation for interspecies differences, consideration of intraspecies variation, use of a subchronic study to estimate chronic effects and database insufficiencies and contradictions in the immunotoxicity data.

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An inhalation RfC of 5mg/m^3 is reported by US EPA as based on an average NOAEL as derived from studies of neurological effects of occupational workers exposed by inhalation. Neurological effects are reported to include impaired colour vision, impaired hearing, decreased performance in neurobehavioral analysis, changes in motor and sensory nerve conduction velocity, headache and dizziness. The RfC incorporated an uncertainty factor of 10 for intraspecies differences.

7.6.7 Ethylbenzene

Ethylbenzene has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for ethylbenzene has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.7**.

Table 7.7: Summary of Published Level 1 Hazard Data for Ethylbenzene

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Ethylbenzene in Drinking Water'
enHealth	No	
NEHF	No	
IARC	YES	IARC Monographs (2000)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (November 2010) 'Toxicological Profile for Ethylbenzene'
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	IRIS Database (1991)

NHMRC

NHMRC/NRMMC (2011) has recommended a daily intake of 136 mg/kg body weight per day as based on a no effect level from a 6 month gavage study using rats. The gavage study found that rats reported enlargement of the liver and kidney at high doses (400 mg/kg body weight per day).

It was also recommended that a safety factor of 1 000 is used with the recommended tolerable daily intake based on interspecies variations, intraspecies variations and to account for the use of a less than lifetime study. A correction factor of 5/7 is also recommended to convert a 5 day per week gavage study to a 7 day week equivalent (TDI of 0.097 mg/kg body weight per day).

A background exposure to ethylbenzene was not reported in NHMRC/NRMMC (2011). It was reported that ethylbenzene has not been found in Australian drinking waters.

WHO

WHO (2003) reports that the guideline value for ethylbenzene has been derived by a TDI approach. The TDI is reported to have been derived using a NOAEL of 136 mg/kg of body weight per day based on hepatotoxicity and nephrotoxicity observed in a limited 6-month study in rats (administration 5 days per week). After application of an uncertainty factor of 1 000 (100 for intra- and interspecies variation and 10 for the limited database and short duration of the study), a TDI of 97.1 µg/kg of body weight is reported to have been used.

Most recent editions of WHO air quality guidelines do not include an assessment of ethylbenzene in air.

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IARC

IARC classified ethylbenzene as a Group 2B chemical, possibly carcinogenic to humans.

ATSDR

ATSDR provide an acute duration inhalation exposure MRL of 5ppm. This is reported to be based on auditory losses of rats. Increased kidney and liver weights have also been reported in exposed rats.

An intermediate duration inhalation exposure MRL of 2ppm. This is reported to be based on a loss of cochlear outer hair cells in exposed rats. Human equivalent concentrations were calculated from the data and divided by an uncertainty factor of 30 to account for extrapolation from animals to humans and human variability.

A chronic duration inhalation exposure MRL of 0.06ppm was reported as based on the human equivalent concentrations of observed nephropathy in rats. The MRL has incorporated an uncertainty factor of 300 to account for use of an LOAEL, extrapolation from animals to humans and human variability.

An intermediate duration oral exposure MRL of 0.4 mg/kg/day has been reported by ASTDR as based on a human equivalent toxicity dose derived for liver effects in exposed male rats. The human equivalent toxicity was divided by an uncertainty factor of 30 to account for extrapolation from animals to humans and human variability to derive the MRL.

No acute or chronic duration oral exposure MDLs were provided by ASTDR.

US EPA

US EPA reports that ethylbenzene is not classifiable as to human carcinogenicity due to a lack of animal bioassays and human studies.

An oral RfD of 0.1mg/kg/day is reported by US EPA based on a NOAEL derived for a oral bioassay study of rats given ethylbenzene doses in olive oil gavage. Toxic effects on the animals included growth, mortality, appearance and behaviour, hematologic findings, terminal concentration of urea nitrogen in the blood, final average organ and body weights, histopathologic findings and bone marrow counts. The RfD incorporated an uncertainty factor of 1 000 for intraspecies and interspecies variability and extrapolation of a subchronic effect level to its chronic equivalent.

An inhalation RfC of 1mg/m^3 is reported based on a NOAEL as derived from inhalation experiments conducted with Wistar rats and New Zealand white rabbits. The principal observation of the exposed animals was a reduced number of live rabbit kittens per litter, an increased incidence of supernumerary and rudimentary ribs and extra ribs in exposed rats and increased liver, kidney, and spleen weights in pregnant rats. The RfC incorporated an uncertainty factor of 300 for unusually sensitive individuals, interspecies conversion and to adjust for the absence of multigenerational reproductive and chronic studies.

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7.6.8 Xylene

Xylene has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for xylene has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.8**.

Table 7.8: Summary of Published Level 1 Hazard Data for Xylene

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Xylenes in Drinking Water'
enHealth	No	
NEHF	YES	NEHF (May 2003) 'Xylenes Health Review' NEPC (2004) 'National Environment Protection (Air Toxics) Measure'
IARC	YES	IARC Monographs (1999)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (August 2007) 'Toxicological Profile for Xylene'
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	IRIS Database (2003)

NHMRC

NHMRC/NRMMC (2011) has recommended a daily intake of 250 mg/kg body weight per day as based on a no effect level from a 2 year gavage study using rats and mice. The gavage study found that rats and mice reported decreased growth at high doses (500 mg/kg body weight per day).

It was also recommended that a safety factor of 1 000 is used with the recommended tolerable daily intake based on interspecies variations, intraspecies variations and to account for the use of a less than lifetime study. A correction factor of 5/7 is also recommended to convert a 5 day per week gavage study to a 7 day week equivalent (TDI of 0.179 mg/kg body weight per day).

Background exposure to xylenes was not reported in NHMRC/NRMMC (2011). It was reported that xylenes have not been found in Australian drinking waters.

WHO

WHO (2003) reports that the guideline value for xylene has been derived by a TDI approach. A TDI of 179 µg/kg of body weight is reported to have been derived using a NOAEL of 250 mg/kg of body weight per day based on decreased body weight in a 103-week gavage study in rats with administration 5 days per week (equivalent to 179 mg/kg of body weight per day 7 days per week) and an uncertainty factor of 1000 (100 for intra- and interspecies variation and 10 for the limited toxicological endpoint).

Most recent editions of WHO air quality guidelines do not include an assessment of xylenes in air.

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NEHF

NEHF (2003) contains a review of international sources of xylene toxicological data. This is undertaken to premise the xylene criteria as provided to the Air Toxics NEPM. An annual average of 0.2ppm as an eight year goal is recommended for xylene. A 24 hour average of 0.25ppm is also recommended for toluene as an eight year goal.

IARC

IARC classify xylenes as a Group 3 chemical, not classifiable as to its carcinogenicity to humans.

ATSDR

ATSDR report an acute duration inhalation exposure MRL of 2ppm for mixed xylenes. This is based on neurological and respiratory effects of humans. A LOAEL was derived from the study and divided by an uncertainty factor of 30 to account for use of an LOAEL and human variability to derive the MRL.

An intermediate duration inhalation exposure MRL of 0.6ppm is reported for mixed xylenes. This was based on neurotoxicity effects in rats. A human equivalent LOAEL was derived from the study and divided by an uncertainty factor of 90 to account for use of a LOAEL, extrapolation from humans to animals and human variability.

A chronic duration inhalation exposure MRL of 0.5ppm has been reported for mixed xylenes. The MRL was based on the observation of respiratory and neurological effects in exposed workers. The study derived an LOAEL as the geometric mean of the critical neurological and respiratory effects. The LOAEL was divided by an uncertainty factor of 100 to account for use of an LOAEL and human variability and a modifying factor of three to account for lack of supporting studies evaluating the chronic neurotoxicity of xylene.

An acute duration oral exposure MRL of 1mg/kg/day was reported for mixed xylenes. This was derived from neurotoxicity effects observed in exposed rats. An NOAEL was derived from this study. The NOAEL was divided by an uncertainty factor of 100 to account for extrapolation from animals to humans and human variability to derive the MRL.

An intermediate duration oral exposure MRL of 0.4mg/kg/day was reported for mixed xylenes. This was based on an NOAEL derived from observations of hyperactivity in exposed mice. An uncertainty factor of 100 to account for extrapolation from animals to humans and human variability and a modifying factor of 10 to account for the lack of testing for sensitive neurological end points and lack of developmental and multigenerational data were applied to a duration adjusted NOAEL to derive the MRL.

A chronic duration oral exposure MRL of 0.2 mg/kg/day has been reported for mixed xylenes. This was based on an NOAEL derived from observations of hyperactivity in exposed mice. An uncertainty factor of 100 to account for extrapolation from animals to humans and human variability and a modifying factor of 10 to account for the lack of testing for sensitive neurological end points and lack of developmental and multigenerational data were applied to a duration adjusted NOAEL to derive the MRL.

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US EPA

It is reported that data are inadequate for an assessment of the carcinogenic potential of xylenes. Available animal data are reported to be inconclusive.

An oral RfD of 0.2mg/kg/day is reported for xylene on the basis of a NOAEL as based on increased mortality and decreased body weight of rats. It is reported that a study of rats administered mixed xylenes by gavage identified effects of exposure including decreased body weight and decreased survival. Studies of mice have also reported hyperactivity. The RfD incorporated an uncertainty factor of 1 000 for interspecies and intraspecies differences and database uncertainty.

An inhalation RfC of 0.1mg/m^3 is reported for xylenes based on a NOAEL derived from a study of rats exposed to toluene and xylene via inhalation. Exposed rats exhibited statistically significantly decreased rotarod performance and decreased spontaneous activity. Another study of rats reported statistically significant decreases in erythrocyte number and decreased levels of hemoglobin. Rats also reported increased sensitivity to pain. The RfC incorporated an uncertainty factor of 300 for laboratory animal-to-human interspecies differences, intraspecies uncertainty, extrapolation from subchronic to chronic duration and uncertainties in the database.

7.6.9 Trimethylbenzenes

1,2,4- and 1,3,5-trimethylbenzene have been selected as a COPC for the assessment of potential human health impacts. 1,2,4-trimethylbenzene is reported to be the more toxic of the trimethylbenzene isomers, and the assessment of trimethylbenzene has been based A brief summary of the toxicological data available for 1,2,4-trimethylbenzene has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.9**.

Table 7.9: Summary of Published Level 1 Hazard Data for 1,2,4-trimethylbenzene

Organisation	Availability	Reference
NHMRC	No	
Therapeutic Goods Administration	No	
WHO	No	
enHealth	No	
NEHF	No	
IARC	No	
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	No	
NTP	No	
OECD SIDS SIAR	No	
EPA	YES	US EPA (August 1994) 'Chemical Summary for 1,2,4-trimethylbenzene

Significant information on the toxicity of 1,2,4-trimethylbenzene has only been identified with the US EPA preparation of a chemical summary of 1,2,4-trimethylbenzene of the Level 1 sources. It is reported that direct contact with liquid 1,2,4-trimethylbenzene is irritating to the skin. Inhalation of vapour has been found to cause chemical pneumonitis, headache, fatigue and drowsiness. Long term exposure of humans to trimethylbenzenes has been found to cause nervousness, tension and anxiety, asthmatic bronchitis, anemia, and alterations in blood clotting, based on a study of painters exposed to a solvent containing 50% 1,2,4-trimethylbenzene.

A review of Level 2 sources has been additionally undertaken. The US EPA (November 2010) regional screening level table cites a provisional peer reviewed toxicity value as an RfC equal to $7*10^{-3}$mg/m^3. Background studies on the derivation of PPRTV's are not available.

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Level 2 Sources

Air quality standards for trimethylbenzenes have been provided to Ontario Ministry of the Environment (June 2007) 'Ontario Air Standards for Trimethylbenzenes: 1,2,3-Trimethylbenzene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene'. A 24 hour average Ambient Air Quality Criterion of 220µg/m^3 has been provided for any isomer of 1,2,3-trimtehylbenzene or 1,2,4-trimethylbenzene or any mixture of those isomers based on the central nervous system effects of those compounds. This guideline has been based on a NOAEL of 123mg/m^3 of trimethylbenzenes as adjusted for time and uncertainty factors.

7.6.10 Styrene

Styrene has been selected as a COPC for the assessment of potential human health impacts. A brief summary of the toxicological data available for styrene has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.10**.

Table 7.10: Summary of Published Level 1 Hazard Data for Styrene

Organisation	Availability	Reference
NHMRC	No	NHMRC (2004), 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Styrene in Drinking Water'
enHealth	No	
NEHF	No	
IARC	YES	IARC Monographs (1991)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (August 2010) 'Toxicological Profile for Styrene'
NTP	YES	US Department of Health and Human Services (2003) 'Expert Panel Review of Styrene'
OECD SIDS SIAR	No	
EPA	YES	US EPA IRIS (2011) 'Styrene CASRN 100-42-5'

NHMRC

A guideline value of 0.03 mg/L has been set for health. It is noted that this value is above the odour threshold of 0.004mg/L. the guideline value has been provided based on a no effect level of 7.7 mg/kg body weight per day with a recommended safety factor of 1000 to account for interspecies, intraspecies and carcinogenic and genotoxic effects. The no effect level is reported to have been based on a study of rats who exhibited depressed body weights when exposed to high doses.

WHO

WHO reports that studies in humans demonstrate that exposure by inhalation of styrene results in irritation of the mucous membranes of the eyes, nose, and respiratory tract, and depression of the central nervous system. In long term occupational exposure studies, irritation of the conjunctival and respiratory mucosa and prenarcotic symptoms were reported.

WHO reports a TDI of 7.7 µg/kg of body weight based on a NOAEL of 7.7 mg/kg of body weight per day for reduced body weight in a 2-year drinking water study in rats. This includes an uncertainty factor of 1000. This results in a guideline value of 20 µg/litre for drinking water. It is noted that the lowest observed odour threshold for styrene in water is also 20 µg/litre.

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IARC

Styrene is classified by the IARC as Group 2A: probably carcinogenic to humans, based on sufficient evidence in experimental animals and supporting mechanistic evidence.

ATSDR

ATSDR has developed an MRL of 5 ppm for acute-duration inhalation exposure (14 days or less) to styrene. This is based on several studies examining neurotoxicity in humans, systemic toxicity studies in mice, neurotoxicity studies in rats, mice, and rabbits, a reproductive toxicity study in mice, and developmental toxicity studies in rats, mice, hamsters, and rabbits. The MRL was derived based on a NOAEL of 49 ppm and an uncertainty factor of 10.

ATSDR has developed an MRL of 0.2 ppm for chronic-duration inhalation exposure (greater than 365 days) to styrene, based on occupational exposure studies. This MRL was derived from a LOAEL of 20 ppm, adjusted for intermittent exposure, and divided by an uncertainty factor of thirty.

ATSDR has developed an MRL of 0.1 mg/kg/day acute-duration oral exposure (14 days or less) to styrene. This MRL is based on studies on neurotoxicity and developmental toxicity. The MRL was derived from a LOAEL of 100 mg/kg/day and an uncertainty factor of 1000. Intermediate and chronic duration MRLs were not derived.

NTP

NTP reported that styrene is considered to be of negligible concern for developmental or reproductive toxicity in humans.

US EPA

The US EPA reports a RfD of 0.2 mg/kg/day based on a NOAEL of 200 mg/kg/day for blood cell and liver effects in dogs, and an uncertainty factor of 1000. Medium confidence is expressed in this recommendation.

US EPA further reports a RfC of 1 mg/m^3 based on a NOAEL of 34 mg/m^3 for central nervous system effects in humans, and an uncertainty factor of 30.

7.6.11 Polycyclic Aromatic Hydrocarbons

A range of polycyclic aromatic hydrocarbons (PAHs) have been selected as COPCs for the assessment of potential human health impacts. A brief summary of the toxicological data available for PAHs has been provided following. The summary has been generated by a review of the available data held by the Level 1 agencies, as summarised in **Table 7.11**.

Table 7.11: Summary of Published Level 1 Hazard Data for Polycyclic Aromatic Hydrocarbons

Organisation	Availability	Reference
NHMRC	YES	NHMRC/NRMMC (2011) 'Australian Drinking Water Guidelines'
Therapeutic Goods Administration	No	Full review of safety alerts and advisory statements, no information
WHO	YES	WHO (2003) 'Polynuclear aromatic hydrocarbons in Drinking-water' WHO (2000) 'Air Quality Guidelines for Europe, 2nd Edition' (chapter 5.9)
enHealth	YES	enHealth (2001) 'Health-based Soil Investigation Levels'
NEHF	YES	NEHF (May 2003) 'Polycyclic Aromatic Hydrocarbons (PAHs) Health Review' NEHF (2004) 'National Environment Protection (Air Toxics) Measure' enHealth reported by the Australian Government Department of Health and Ageing to have replaced NEHF. Refer to enHealth (2001)
IARC	YES	Anthracene, IARC Monograph in preparation (2010) Benz(a)anthracene, IARC Monograph in preparation (2010) Benzo(a)pyrene, IARC Monograph in preparation (2010)

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Organisation	Availability	Reference
		Benzo(b)fluoranthene, IARC Monograph in preparation (2010) Benzo(k)fluoranthene, IARC Monograph in preparation (2010) Chrysene, IARC Monograph in preparation (2010) Dibenz(a,h)anthracene, IARC Monograph in preparation (2010) Fluorene, IARC Monograph in preparation (2010) Indeno(1,2,3-c,d)pyrene, IARC Monograph in preparation (2010) Naphthalene, IARC Monographs (2002) Phenanthrene, IARC Monograph in preparation (2010) Pyrene, IARC Monograph in preparation (2010)
WHO/FAO JMPR	No	
NICNAS PEC	No	
ATSDR	YES	ATSDR (August 1995) 'Toxicological Profile for Polycyclic Aromatic Hydrocarbons' ATSDR (August 2005) 'Toxicological Profile for Naphthalene, 1-Methylnaphthalene and 2-Methylnaphthalene'
NTP	YES	US Department of Health and Human Services (2009) '11th Report on Carcinogens'
EPA	YES	IRIS Database (1991), acenaphthylene IRIS Database (1994), benz(a)anthracene IRIS Database (1994), benzo(a)pyrene IRIS Database (1994), benzo(b)fluoranthene IRIS Database (1990), benzo(g,h,i)perylene IRIS Database (1994), benzo(k)fluoranthene IRIS Database (1994), chrysene IRIS Database (1994), dibenz(a,h)anthracene IRIS Database (1990), fluorene IRIS Database (1994) ,indeno(1,2,3-c,d)pyrene IRIS Database (1998), naphthalene IRIS Database (1994), phenanthrene IRIS Database (1994), pyrene

NHMRC

It is reported in NHMRC (2011) that most of the toxicological literature is specific to benzo(a)pyrene with few studies available for other PAHs. It is reported that the IARC defines benzo(a)pyrene as probably carcinogenic to humans (though recently updated to a confirmed carcinogen as discussed in IARC review).

A guideline value has been presented for benzo(a)pyrene. This is reported to have been based on a WHO linear multistage model as based on the incidence of leukaemia in humans. The NHMRC/NRMMC (2004) guideline value is further noted to be based on an incremental risk of cancer of 1 in 1 000 000.

Background exposure to PAHs were not reported in NHMRC/NRMMC (2011) for Australia. It was reported that benzo(a)pyrene occurs in US drinking waters at a typical concentration of 55ng/l. The intake of PAHs from foods was reported as being at least an order of magnitude higher than from drinking water.

WHO

WHO (2003) reports that benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, Dibenzo(a,h)anthracene, fluoranthene and indeno(1,2,3-c,d)pyrene are classifiable as carcinogens. Relative potencies of PAHs are summarised following:

- Benz(a)anthracene – 0.1;
- Benzo(a)pyrene – 1.0
- Benzo(b)fluoranthene – 0.1;
- Benzo(k)fluoranthene – 0.1;
- Dibenz(a,h)anthracene – 1.0; and
- Indeno(1,2,3-c,d)pyrene – 0.1.

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An earlier WHO publication, WHO / IPCS (1998) 'Environmental Health Criteria Selected Non-Hetrocyclic Polycyclic Aromatic Hydrocarbons' also provides potency factors for an increased list of PAHs that includes chrysene. These are reproduced following.

- Benzo(a)pyrene – 1.0
- Benzo(a)anthracene – 0.1-0.145;
- Benzo(b)fluoranthene – 0.1-0.167;
- Benzo(k)fluoranthene – 0.01-0.02;
- Chrysene – 0.001-0.004;
- Diebnz(a,h)anthracene – 1-1.11; and
- Indeno(1,2,3-c,d)pyrene – 0.055-0.1.

It is noted that a range of potential toxicity equivalences are also provided for benzo(g,h,i)perylene of 0.01-0.022, fluoranthene of 0.001-0.1 and pyrene of 0.001-0.81. No final relative potency is recommended for these constituents as there is considered to be insufficient evidence of carcinogenicity.

It is reported that evidence that mixtures of PAHs are carcinogenic in humans comes primarily from occupational studies of workers. Cancer associated with exposure to PAH-containing mixtures in humans occurs predominantly in the lung and skin following inhalation and dermal exposure, respectively.

A guideline value has been derived by WHO (2003) for benzo(a)pyrene, described as the most carcinogenic of PAHs. It is reported that an excess lifetime cancer risk of $1*10^{-5}$ was estimated for 0.7µg/l, based on an oral carcinogenicity study and a two-stage birth–death mutation model, which incorporated variable dosing patterns and time of sacrifice. It is further reported that a study on forestomach tumour incidence in mice gave nearly identical results.

A guideline value has also been derived for fluoranthene. This is reported to have been estimated from a 13-week oral gavage study in mice with a NOAEL of 125 mg/kg of body weight per day, based on increased serum glutamate-pyruvate transaminase levels, kidney and liver pathology, and clinical and haematological changes. An uncertainty factor of 10 000 (100 for inter- and intraspecies variation, 10 for the use of a subchronic study and inadequate database, and 10 because of clear evidence of co-carcinogenicity with BaP in mouse skin painting studies) is reported to result in a TDI of 0.0125 mg/kg of body weight per day.

WHO (2000) nominated benzo(a)pyrene as an indicator chemical to represent the carcinogenic potential of PAHs in air. It is noted that that evaluation of benzo(a)pyrene solely probably underestimates the carcinogenic potential of airborne PAH mixtures. Based upon epidemiological data from studies in coke-oven workers, a unit risk for benzo(a)pyrene as an indicator in air of PAH constituents, is estimated to be $8.7*10^{-5}$ $(ng/m^3)^{-1}$. This was reported to be supported by animal data.

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enHealth

enHealth (2001) reports that some PAHs are classified as IARC Group 2A and 2B carcinogens and the procedure for these compounds, in the absence of an ADI/PTWI, was to establish their carcinogenic potency, and then estimate a dose associated with a particular increased lifetime cancer risk.

A guideline value based on an exposure to benzo(a)pyrene of 0.8ng/kg/day was reported to have been used to derive soils criteria.

NEHF

NEHF (2003) contains a review of international sources of PAHs toxicological data. Most of the available toxicological data is found in this document to be available for benzo(a)pyrene. This review has been undertaken to premise the PAHs criteria as provided to the Air Toxics NEPM. An annual average of 0.3ng/m^3 as an eight year goal is recommended for benzo(a)pyrene as a marker for PAHs.

IARC

IARC classifies anthracene as a Group 3 chemical, not classifiable as to its human carcinogenicity.

IARC classifies benz(a)anthracene as a Group 2B chemical, possibly carcinogenic to humans.

IARC classifies benzo(a)pyrene as a Group 1 carcinogen.

IARC classifies benzo(b)fluoranthene and benzo(k)fluoranthene as Group 2B chemicals, possibly carcinogenic to humans.

IARC classifies chrysene as a Group 2B chemical, possibly carcinogenic to humans.

IARC classifies dibenz(a,h)anthracene as a Group 2A chemical, possibly carcinogenic to humans.

IARC classifies fluorene as a Group 3 chemical, not classifiable as to its human carcinogenicity.

IARC classifies indeno(1,2,3-c,d)pyrene as a Group 2B chemical, possibly carcinogenic to humans.

IARC classifies naphthalene as a Group 2B chemical, possibly carcinogenic to humans.

IARC classifies phenanthrene as a Group 3 chemical, not classifiable as to its human carcinogenicity.

IARC classifies pyrene as a Group 3 chemical, not classifiable as to its human carcinogenicity.

ATSDR

ATSDR report that no inhalation exposure MRLs have been derived for PAHs (apart from naphthalene and isomers) consequent of lack of dose-response data that identify noncancer health effects for humans or animals.

No acute or chronic duration oral exposure MRLs are reported to be provided for PAHS, also consequent of a lack of data.

A chronic duration inhalation exposure MRL of 0.0007ppm has been reported for naphthalene. The MRL has been based on an LOAEL derived for nonneoplastic lesions in nasal olfactory epithelium (metaplasia in mice, and hyperplasia, atrophy, and chronic

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inflammation in rats) and respiratory epithelium (hyperplasia in mice, and hyperplasia, metaplasia, hyaline degeneration, or gland hyperplasia in rats). Exposed rats were also reported to show increased incidences of nasal tumours. A human equivalent LOAEL was derived and divided by an uncertainty factor of 300 to account for use of an LOAEL, extrapolation from animals to humans and human variability.

An intermediate duration oral exposure MRL of 0.6mg/kg.day has been reported for acenaphthene. This is reported to be based on an LOAEL for liver weight changes in exposed mice. The MRL has been obtained by dividing the LOAEL by an uncertainty factor of 300 to account for use of an LOAEL, extrapolation of animals to humans and human variability.

An intermediate duration oral exposure MRL of 0.4mg/kg/day has been reported for fluoranthene. This is reported to be based on an LOAEL for liver weight changes in exposed mice. The MRL has been obtained by dividing the LOAEL by an uncertainty factor of 300 to account for use of an LOAEL, extrapolation of animals to humans and human variability.

An intermediate duration oral exposure MRL of 0.4mg/kg/day has been reported for fluorene. This is reported to be based on an LOAEL for liver weight changes in exposed mice. The MRL has been obtained by dividing the LOAEL by an uncertainty factor of 300 to account for use of an LOAEL, extrapolation of animals to humans and human variability.

An intermediate duration oral exposure MRL of 10mg/kg/day has been reported for anthracene. This is reported to be based on an NOAEL for potential liver effects in exposed mice. The MRL has been obtained by dividing the LOAEL by an uncertainty factor of 100 to account for extrapolation of animals to humans and human variability.

An acute and intermediate duration oral exposure MRL of 0.6mg/kg/day was reported for naphthalene. This is reported to be based on decreased body weights in exposed rats, to derive an NOAEL. The NOAEL has been divided by an uncertainty factor of 100 to account for extrapolation from animals to humans and human variability to derive the MRL.

A chronic duration oral exposure MRL of 0.6mg/kg/day has been reported for naphthalene. This was based on a rat developmental study. Effects observed included slow respiration, lethargy, or prone body posture in most rats following dose administration on the first and second day of dosing. The MRL was calculated from the LOAEL derived for these effects and an uncertainty factor of 90 to account for use of an LOAEL, extrapolation from animals to humans and human variability.

NTP

NTP reported polycyclic aromatic hydrocarbons including benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene and indeno(1,2,3-c,d)pyrene to be reasonably anticipated to be human carcinogens based on sufficient evidence of carcinogenicity in experimental animals.

Benz(a)anthracene is reported to have induced papillomas of the forestomach in mice, lung adenomas and hepatomas in mice, skin papillomas in mice sarcomas in adult mice and pulmonary adenomas and adenocarcinomas in newborn mice and local carcinomas in mice (by bladder implantation).

Benzo(a)pyrene is reported to induce malignant and benign forestomach tumors in mice and hamsters, and mammary tumors in female rats, increase the incidence of forestomach tumors and induced lung adenomas in mice, induced skin carcinomas and

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papillomas in mice, rats, guinea pigs, and rabbits, tracheal papillomas and carcinomas in hamsters and squamous cell carcinomas of the lung in rats, lung tumors in rats, tracheobronchial tumors in hamsters, and squamous carcinomas of the lung in two of six subhuman primates, local sarcomas in rats, hamsters, guinea pigs, newts, subhuman primates, and adult mice, abdominal fibrosarcomas in mice of both sexes, and mammary and uterine carcinomas in rats, mammary carcinomas in female rats, local tumors in rats, increased incidence of lung adenomas and initiated skin carcinogenesis in the offspring.

Benzo(b)fluoranthene is reported to have induced skin tumours in mice and local sarcomas in mice.

Dibenz(a,h)anthracene is reported to have induced local sarcomas in mice, squamous cell carcinomas and papillomas of the forestomach in mice, alveologenic carcinomas of the lung and hemangioendotheliomas in mice of both sexes and mammary carcinomas in female mice, lung squamous cell carcinomas in rats, local sarcomas in rats, guinea pigs, pigeons, fowl, adult mice, and newborn mice, lung adenomas and renal adenocarcinomas

NTP reports that that exposure to coke oven emissions, which contain a variety of PAHs, has been demonstrated to cause increased incidences of lung and genitourinary cancer mortality in coke oven workers. Workers exposed to creosote containing numerous PAHs developed skin tumors. Exposures to other chemical mixtures that contain PAHs, such as cigarette smoke, coal tar, coal tar pitch, and bitumens, have been associated with increased incidences of lung cancer in humans. Dermal exposure to coal tar and shale oils containing PAHs have been associated with increased incidences of skin tumors in humans.

US EPA

Acenaphthene

US EPA describes acenapthene as a white crystal-like solid most commonly produced from extraction, transport, and refining of petroleum products and combustion products resulting from their use.

US EPA reports an oral RfD of $6x10^{-2}$ mg/kg-day based on a NOAEL of 175 mg/kg-day from a hepatoxicity study in mice. This includes an uncertainty factor of 3000, from 10 each for intra- and inter-species variability, 10 for the use of a subchronic study for chonic RfD derivation, and 3 for the lack of data in a second species and reproductive / development data. Low confidence is reported in this RfD.

No data is available for inhalation RfC calculation or carcinogenicity assessment.

Acenaphthylene

Acenaphthylene has been reported as being non classifiable as to human carcinogenicity, based on no human data and inadequate data from animal bioassays.

Anthracene

US EPA describes anthracene as varying in appearance from a colorless to pale yellow crystal-like solid most commonly produced from extraction, transport, and refining of petroleum products and combustion products resulting from their use.

US EPA reports an oral RfD of $3x10^{-1}$ mg/kg-day based on a NOEL of 1000 mg/kg-day from a subchronic toxicity study in mice. This includes an uncertainty factor of 3000, with 10 to account for interspecies extrapolation, 10 for intraspecies variability, and 30 for the use of a subchronic study for chronic RfD derivation, and the lack of data in a second species and reproductive / development data. Low confidence is reported in this RfD.

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An inhalation RfC calculation is not provided.

Anthracene is considered to be non-classifiable as to its human carcinogenicity.

Benz(a)anthracene

Benz(a)anthracene has been reported by US EPA to be a probable human carcinogen (classification B2) based on data from animal bioasays. Benz[a]anthracene administration has been reported to cause an increase in the incidence of tumors in animals by gavage, dermal application and both subcutaneous injection and intraperitoneal injection.

Benzo(a)pyrene

Benz(a)anthracene has been reported by US EPA to be a probable human carcinogen (classification B2) based on human data from multiple animal studies in many species demonstrating benzo(a)pyrene to be carcinogenic following administration by numerous routes. Benzo(a)pyrene is also reported to have produced positive results in numerous genotoxicity assays.

Benzo(a)pyrene administered in the diet or by gavage to mice, rats and hamsters has produced increased incidences of stomach tumours. Intratracheal instillation and inhalation studies in guinea pigs, hamsters and rats have resulted in elevated incidences of respiratory tract and upper digestive tract tumours. Intraperitoneal BAP injections have caused increases in the number of injection site tumours in mice and rats.

US EPA provides an oral slope factor for benzo(a)pyrene of 7.3 per (mg/kg)/day. This data has been derived on the extrapolation of animal studies that resulted in forestomach, larynx and esophagus, papillomas and carcinoma type tumours. The slope factor has been set by the calculation of a geometric mean of a range of slope factors.

Benzo(b)fluoranthene

Benzo(b)fluoranthene has been reported by US EPA to be a probable human carcinogen (classification B2) based on data from animal bioasays. Benzo[b]fluoranthene is reported to have produced tumors in mice after lung implantation, intraperitoneal or subcutaneous injection, and skin painting.

Benzo(g,h,i)perylene

Benzo(g,h,i)perylene has been reported as being non classifiable as to human carcinogenicity, based on no human data and inadequate data from animal bioassays.

Benzo(k)fluoranthene

Benzo(k)fluoranthene has been reported by US EPA to be a probable human carcinogen (classification B2) based on data from animal bioasays. Benzo(k)fluoranthene is reported to have produced tumours after lung implantation in mice and when administered with a promoting agent in skin-painting studies. Equivocal results have reported to have been found in a lung adenoma assay in mice. Benzo[k]fluoranthene is also reported to have been shown to be mutagenic in bacteria.

Chrysene

Chrysene has been reported by US EPA to be a probable human carcinogen (classification B2) based on data from animal bioasays. Chrysene is reported to have produced carcinomas and malignant lymphoma in mice after intraperitoneal injection and skin carcinomas in mice following dermal exposure. Chrysene is reported to have produced chromosomal abnormalities in hamsters and mouse germ cells after gavage exposure,

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positive responses in bacterial gene mutation assays and transformed mammalian cells exposed in culture.

Dibenz(a,h)anthracene

Dibenz(a,h)anthracene has been reported by the US EPA to be a probable human carcinogen (classification B2) based on data from animal bioassays.
Dibenz(a,h)anthracene is reported to have produced carcinomas in mice following oral or dermal exposure and injection site tumors in several species following subcutaneous or intramuscular administration and induced DNA damage and gene mutations in bacteria as well as gene mutations and transformation in several types of mammalian cell cultures.

Fluorene

Fluorene has been reported as being non classifiable as to human carcinogenicity, based on no human data and inadequate data from animal bioassays.

An oral RfD of $4*10^{-2}$mf/kg/day is reported by the US EPA on the basis of a NOAEL and LOAEL from a gavage study of mice. A significant decrease in red blood cell count and packed cell volume were observed in the mice. Decreases in erythrocyte count, packed cell volume, and haemoglobin concentration were all observed in the mice. A significant decreasing trend in blood urea nitrogen and a significant increasing trend in total serum bilirubin were observed in both high-dose subjects. Dose-related increases in liver, spleen and kidney weights were also observed. The LOAEL and NOAEL were derived on the basis of the observed haematological effects.

The RfD has also incorporated an uncertainty factor of 3,000 to account for intra- and interspecies variability, the use of a subchronic study for chronic RfD derivation and to account for the lack of adequate toxicity data in a second species and reproductive / developmental data.

Indeno(1,2,3-c,d)pyrene

Indeno(1,2,3-c,d)pyrene has been reported by US EPA to be a probable human carcinogen (classification B2) based on data from animal bioassays. Indeno(1,2,3-c,d)pyrene is reported to produce tumours in mice following lung implants, subcutaneous injection and dermal exposure. Indeno(1,2,3-c,d)pyrene is reported to have tested positive in bacterial gene mutation assays.

Naphthalene

Naphthalene is classified by the US EPA as a possible human carcinogen (classification C). This is based on limited evidence of carcinogenicity in animals via the inhalation route. Mice exposed to naphthalene vapours were found to have increased rates of mortality. Increases in incidences of nonneoplastic lesions were found in the lung and nose and alveolar/bronchiolar adenomas were also observed.

An oral RfD of $2*10^{-2}$mg/kg/day is reported to have been derived on the basis of the NOAEL as derived from a gavage study of rats. Rats of both sexes were reported to have displayed diarrhoea, lethargy, hunched posture, and rough coats at intermittent intervals throughout the study. Decreases in mean body weight and depression were also reported. A LOAEL and NOAEL were derived on the basis of the decrease in body weight.

The oral RfD has incorporated an uncertainty factor of 3 000 to account for extrapolation from rats to humans, sensitive humans, extrapolation from subchronic to chronic exposure and the lack of chronic oral exposure studies and 2-generation reproductive toxicity studies.

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An inhalation RfC of $3*10^{-3}mg/m^3$ is reported to have been derived on the basis of LOAEL human equivalent concentration as derived from an inhalation study of mice. Inflammation, metaplasia of the olfactory epithelium, and hyperplasia of the respiratory epithelium were reported to have occurred in the noses of virtually all exposed mice. The LOAEL was derived on the basis of naphthalene-related effects on the nasal epithelium.

The inhalation RfC has incorporated an uncertainty factor of 3 000 to account for extrapolation from mice to humans, sensitive humans, extrapolation from a LOAEL to a NOAEL and database deficiencies including the lack of a 2-generation reproductive toxicity study and chronic inhalation data for other animal species.

Phenanthrene

Phenanthrene has been reported as being non classifiable as to human carcinogenicity, based on no human data and inadequate data from animal bioassays.

Pyrene

Pyrene has been reported as being non classifiable as to human carcinogenicity, based on no human data and inadequate data from animal bioassays. An oral RfD of $3*10^{-2}$ mg/kg/day is provided for pyrene on the basis of the average of the NOAEL and the LOAEL as determined by a gavage study of mice. Nephropathy, characterised by the presence of multiple foci of renal tubular regeneration, often accompanied by interstitial lymphocytic infiltrates and/or foci of interstitial fibrosis, was reported to be present in the mice. Kidney lesions were also reported. An NOAEL and LOAEL were derived from the study on the basis of nephropathy and decreased kidney weights. The RfD has also incorporated an uncertainty factor of 3 000 to account for intra- and interspecies variability, the use of a subchronic study for chronic RfD derivation and to account for the lack of both toxicity studies in a second species and developmental / reproductive studies.

Order of Potency of PAHs

US EPA (1993) 'U.S. Environmental Protection Agency. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons' provides an order of potency for PAHs on the basis of equivalent toxicity to benzo(a)pyrene. This is summarised following:

- Benzo(a)pyrene – 1.0
- Benzo(a)anthracene – 0.1
- Benzo(b)fluoranthene – 0.1
- Benzo(k)fluoranthene – 0.01;
- Chrysene – 0.001;
- Dibenz(a,h)anthracene – 1.0; and
- Indeno(1,2,3-c,d)pyrene – 0.1.

Level 2 Sources

Knafla A, Phillipps KA, Brecher RW, Petrovic S and Richardson M (2006) 'Development of a dermal cancer slope factor for benzo(a)pyrene' in Regulatory Toxicological and Pharmacology recommend that a dermal slope factor of 25 $(mg/kg/day)^{-1}$ be adopted for human health risk assessment of benzo(a)pyrene.

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7.7 Summary and Evaluation of Toxicological Data

The toxicological sources have been reviewed to determine the most appropriate toxicological values to characterise each of the potential exposure pathways for the COPCs. This has been generally undertaken by adopting the order of preference of toxicological data instructed by NEPC (1999) and enHealth (2002). It is also noted that assessment of PAHs has considered constituents in addition to benzo(a)pyrene (in contrast to the enHealth / NEPC approach). This is consequent of WHO (2000) reporting that assessment of benzo(a)pyrene solely probably underestimates the carcinogenic potential of PAHs.

US EPA (1989) reports that where dermal toxicity reference values are being derived from oral values it is necessary to adjust the oral toxicity value from an administered to an absorbed dose. Where the oral toxicity is expressed as an absorbed dose, it is not necessary to adjust the toxicity value. Further detail is provided in US EPA (2004) which provides conditions when an adjustment is required for the oral toxicity factor (to account for 'absorbed dose' in the dermal exposure pathway). These include:

- The toxicity value derived from the critical study is based on an administered dose (e.g. delivery in diet or by gavage) in its study design; and
- A scientifically defensible database demonstrates that the gastrointestinal absorption of the chemical in question, from a medium (e.g. water, feed) similar to the one employed in the critical study, is significantly less than 100%.

Where these conditions are not met, a default of complete oral absorption may be assumed. A review of gastrointestinal tract absorption values (ABS_{GI}), as provided in US EPA (2004), has been undertaken with the finalisation of toxicity values. Dermal toxicity values have been adjusted using an ABS_{GI} as recommended by US EPA (2004), where required.

Toxicological data for non-threshold effects are summarised in **Table 7.12** and threshold effects in **Table 7.13**.

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Table 7.12: Toxicity Criteria for Carcinogenic / Non-Threshold Endpoints

Constituent	Inhalation Unit Risk $(\mu g/m^3)^{-1}$	Oral Slope Factor $(mg/kg/day)^{-1}$	Dermal Slope Factor $(mg/kg/day)^{-1}$	Discussion / Comments
Benzene	$6.0*10^{-6}$	$3.5*10^{-2}$	$3.5*10^{-2}$	Inhalation slope factor based on WHO unit risk of $6.0*10^{-6}$ $(\mu g/m^3)^{-1}$. Oral slope factor based on NHRMC and WHO. No adjustment for dermal slope factor. Benzene reported to be rapidly and efficiently absorbed.
Benzo(a)pyrene	$8.7*10^{-2}$	0.5	25 (soil)	Inhalation slope factor based on WHO unit risk of $8.7*10^{-2}$ $(\mu g/m^3)^{-1}$. Oral slope factor based on WHO, as adopted in NHRMC/NRMMC (2004). No adjustment for dermal slope factor. PAHs reported to be rapidly and efficiently absorbed. Dermal slope factor for exposure to water borne PAHs based on oral slope factor. Dermal slope factor for exposure to benzo(a)pyrene based on Knafla et al (2006). Adopted for dermal exposure to soil containing benzo(a)pyrene. WHO oral slope factor adopted for dermal exposure to water borne benzo(a)pyrene. Other potentially carcinogenic PAH constituents assessed as benzo(a)pyrene toxicity equivalence factors (TEF) as per the following factors: benz(a)anthracene – 0.1; benzo(b)fluoranthene – 0.1; benzo(g,h,i)perylene – 0.01; benzo(k)fluoranthene – 0.1; dibenz(a,h)anthracene – 1.0; chrysene – 0.01; and indeno(1,2,3-c,d)pyrene – 0.1.
Nickel	$4.0*10^{-4}$	-	-	Inhalation slope factor based on WHO unit risk of 4.0*10-4 (µg/m3)-1. No oral or dermal slope factor as assessed using threshold endpoints.

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Table 7.13: Toxicity Criteria for Threshold Endpoints

Constituent	Inhalation RfC[1], mg/m³	Oral RfD, mg/kg/day	Dermal RfD, mg/kg/day	Discussion / Comments
Ammonia	$7.0*10^{-2}$	-	-	Assessment based on ATSDR chronic MRL of 0.1ppm. No toxicity values adopted for oral and dermal exposure pathways based on guidance in all Level 1 sources of non likelihood of toxicity.
Arsenic	$1.5 * 10^{-5}$	$2 * 10^{-3}$	$2 * 10^{-3}$	Inhalation ADI based on Californian EPA values. Alternate non-threshold guidelines for arsenic available typically based on industrial; exposure scenarios. Not considered appropriate for recreational / parkland setting Barangaroo and allows consistent assessment of arsenic by threshold approach. Oral RfD based on NHMRC TDI approach. Very similar to level used by enHealth. No adjustment for dermal RfD as US EPA (2004) reports high levels of absorption.
Lead	$5.0*10^{-4}$	$3.5*10^{-3}$	$3.5*10^{-3}$	Inhalation ADI based on WHO. Oral RfD based on NHMRC. No correction for dermal factor for lead. Toxicity data based on lead exposure to children. Lead absorption in children reported in WHO (2004) to be as high as 50%. Toxicity values and lead exposure assessment are also required to consider bioavailability of lead, conservatively estimated as 50% based on IARC (2006).
Nickel	-	$5 * 10^{-3}$	$2*10^{-4}$	No inhalation ADI as assessment by non-threshold endpoint using WHO unit risk. Oral RfD based on NHMRC TDI. More conservative than more recent WHO study. More conservative than US EPA value. Adjustment for dermal RfD required as NHMRC TDI based on feeding study with rats. US EPA (2004) recommends adjustment by 0.04.
Benzene	$1.0*10^{-2}$	$5*10^{-4}$	$5*10^{-4}$	Inhalation ADI based on ATSDR chronic duration inhalation exposure MRL of 10µg/m3. More conservative than US EPA value. Oral RfD based n ATSDR chronic duration oral exposure MRL. More conservative than US EPA value. No adjustment for dermal RfD. Benzene reported by WHO (2004) to be rapidly and efficiently absorbed.
Toluene	5.0	0.223	0.223	Inhalation ADI based on US EPA RfC of 5mg/m3. WHO value not used as exposure duration of 1 week less than required averaging times proposed for risk assessment. US EPA value used instead of ATSDR value as more recent, despite ATSDR preferred in hierarchy of sources of toxicological data. Oral RfD based on NHMRC TDI. Same as WHO value. Value is similar, though less conservative than ATSDR intermediate exposure MRL and US EPA RfD. No adjustment for dermal RfD. Toluene reported by WHO (2004) to probably be absorbed completely from the gastrointestinal tract.
Ethylbenzene	0.27	$9.7*10^{-2}$	$9.7*10^{-2}$	Inhalation ADI based on ASTDR chronic duration inhalation exposure MRL of 0.06 ppm. This is more conservative then the US EPA value.

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Constituent	Inhalation RfC[1], mg/m³	Oral RfD, mg/kg/day	Dermal RfD, mg/kg/day	Discussion / Comments
				Oral RfD based on NHMRC TDI. More conservative than the ATSDR intermediate duration oral toxicity MRL. Value very similar to US EPA value. No adjustment for dermal RfD. Ethylbenzene reported by WHO (2004) to be absorbed easily.
Xylene	0.87	0.179	0.179	Inhalation ADI based on ATSDR chronic MRL of 0.05ppm. Used in preference to NEHF air quality goal as based on more recent data and derived by approach consistent with human health risk assessment. Oral RfD based on NHMRC TDI. More conservative than ASTDR chronic duration oral exposure MRL and US EPA RfD. No adjustment for dermal RfD. Xylene reported by WHO (2004) to well absorbed after inhalation. No data on absorption via ingestion, though anticipated to be sufficiently high base don halation data.
Trimethylbenzenes	0.22	$6.3*10^{-2}$	$6.3*10^{-2}$	As per Ontario Air Standards for trimethylbenzenes in absence of Level 1 data able to be reviewed. RfC used as basis of RfD for oral and dermal effects.
Styrene	0.85	$7.7*10^{-3}$	$7.7*10^{-3}$	Inhalation ADI based on ATSDR chronic duration MRL of 0.2ppm ($0.85mg/m^3$). Oral RfD based on adopted value for derivation of NHMRC and WHO drinking water criteria. No adjustment for dermal RfD.
Acenaphthene	0.21	$6.0 * 10^{-2}$	$6.0 * 10^{-2}$	Inhalation ADI set equal to oral RfD in lieu of other data. RfC equal to 0.21mg/m3. Oral RfD based on US EPA RfD. No adjustment for dermal RfD.
Acenaphthylene	0.21	$6.0 * 10^{-2}$	$6.0 * 10^{-2}$	No values available for Acenaphthylene. Values for Acenaphthene used as surrogate. RfC equal to 0.21mg/m3.
Anthracene	1.1	0.3	0.3	Inhalation ADI set equal to oral RfD in lieu of other data. RfC equal to 1.1mg/m3. Oral RfD based on US EPA RfD. No adjustment for dermal RfD.
Fluoranthene	0.14	$4.0*10^{-2}$	$4.0*10^{-2}$	Inhalation ADI set equal to Oral RfD in lieu of other data. Oral RfD based on US EPA RfD. No adjustment for dermal RfD. Typically high levels of absorption of PAHs reported by US EPA (2004).
Fluorene	0.14	$4.0*10^{-2}$	$4.0*10^{-2}$	Inhalation ADI set equal to Oral RfD in lieu of other data. Oral RfD based on US EPA RfD. No adjustment for dermal RfD. Typically high levels of absorption of PAHs reported by US EPA (2004).
Naphthalene	$3.5*10^{-3}$	$2.0*10^{-2}$	$2.0*10^{-2}$	Inhalation ADI based on ATSDR chronic duration inhalation exposure MRL of 3.5µg/m3. Similar to US EPA value. Oral RfD based on US EPA RfD value. ATSDR noted to not provide chronic duration values (acute / intermediate exposure values only). No adjustment for dermal RfD. Typically high levels of absorption of PAHs reported by US EPA (2004).
Phenanthrene	1.1	0.3	0.3	No values available for Phenanthrene. Values for Anthracene used as surrogate. RfC equal to 1.1mg/m3.
Pyrene	0.1	$3*10^{-2}$	$3*10^{-2}$	Inhalation ADI set equal to Oral RfD in lieu of other data.

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Constituent	Inhalation RfC[1], mg/m³	Oral RfD, mg/kg/day	Dermal RfD, mg/kg/day	Discussion / Comments
				Oral RfD based on US EPA RfD. No adjustment for dermal RfD. Typically high levels of absorption of PAHs reported by US EPA (2004).

7.8 Odour Thresholds

Potential aesthetic impacts of environmental impact also require consideration. The most likely aesthetic impact will be odours from soils impacted with potentially volatile substances. Assessment is required to ensure that no odours related to environmental impact can be recognised at the redeveloped Barangaroo Central site surface, or at adjoining off-site locations. This assessment will be undertaken by the comparison of maximum concentrations of each constituent to odour thresholds. Odour thresholds of all potentially malodorous constituents have been summarised in **Table 7.14**. This has been undertaken as per a literature review of several available sources for each constituent.

Table 7.14: Summary of Odour Thresholds

Constituent	Odour Threshold	Source / Comments
Naphthalene	0.05 – 5.34 mg/m³ 0.0095 – 1.02 ppm Mean: 0.038 ppm	US EPA (1990) 'Reference Guide to Odour Thresholds for Hazardous Air Pollutants Listed in the Clean Air Act Amendments of 1990.' A series of values are given reflecting various studies. The mean value is given as the geometric mean or recommended best estimate.
	0.44 mg/m³	US EPA Air Toxics Web Site (2000) 'Naphthalene 91-20-3'. Thresholds derived from ATSDR Toxicological Profile and Journal of Applied Toxicology article (1983).
	0.44 mg/m³ 0.021 mg/L (water)	ATSDR (2005) 'Naphthalene, 1-methylnaphthalene and 2-methylnaphthalene'.
	0.0075 - 0.42 mg/m3	WHO (2010) 'WHO Guidelines for Indoor Air Pollutants – Selected Pollutants'. Values taken from review of external studies.
	<0.3 ppm	CDC NIOSH (1978) 'Occupational Health Guideline for Naphthalene'.
	<0.3 ppm	NTP (1992) 'NTP Technical Report on the Toxicology and Carcinogenesis Studies of Naphthalene in BC63F Mice'.
	0.038 ppm	ScienceLab (2010) 'Material Safety Data Sheet: Naphthalene MSDS'.
	2.5 ug/l	Young et al (1996) 'Taste and Odour Thresholds Concentrations of Potential Potable Water Contaminants', Water Research Vol 30.2. Study indicated the odour threshold for contaminants present in water
	0.35 mg/m³	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*0.35mg/m³*	
Ammonia	0.5 – 42 mg/m³	Gemert & Nettenbreijer, (2003) 'Odour Thresholds – Compilation of Odour Threshold Values in Air, Water, and Other Media'.
	150 µg/l	US EPA (2002) 'Guide To Field Storage of Biosolids and Other Organic By-Products Used in Agriculture and for Soil Resource Management'.
	25 ppm (18 mg/m³), 48 ppm (34 mg/m³), 53 ppm (38 mg/m³), 1.5ppm (water)	ATSDR (2002) 'Toxicological Profile for Ammonia'. Three sources cited for varying values.
	5.2 µg/l (air), 46.8ppm, 0.0266 -39.6mg/m³	ToxNet (2005) 'Ammonia CASRN 7664-41-7'
	1 mg/m³	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*1mg/m³*	
Benzene	1.5 ppm (5 mg/m³)	US EPA Air Toxics Web Site (2000) 'Benzene 71-43-2'.
	1.5 ppm (5 mg/m³)	US EPA 'National Air Toxics Program: The Integrated Urban Strategy Report to Congress'.
	34-119 ppm	ATSDR (2007) 'Toxicological Profile for Benzene'. From AIHA 1989 source.
	4.68ppm (4.9mg/m³), 2.0mg/L (water)	ToxNet (2005) 'Benzene CASRN 71-43-2' HSCB (2010) 'Benzene 71-43-2'

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Constituent	Odour Threshold	Source / Comments
	8.6 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*5mg/m^3*	
Toluene	1 mg/m^3	WHO (2000) 'Air Quality Guidelines for Europe'.
	40 – 120 µg/l	WHO (1993) 'Guidelines for Drinking Water quality'.
	2.9ppm	US EPA Air Toxics Web Site (2000) 'Toluene 108-88-3'.
	2.9ppm	Von Burg, (1993) 'Toxicology Update: Toluene', Journal of Applied Toxicology.
	8 ppm, 0.04-1ppm (water)	ATSDR (2000) 'Toxicological Profile for toluene'.
	2.14ppm (8mg/m^3)	ToxNet (2006) 'Toluene CASRN 108-88-3'
	1.2 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*1mg/m^3*	
Ethylbenzene	2 - 130 µg/l	WHO (1993) 'Guidelines for Drinking Water quality'
	2.3ppm	US EPA Air Toxics Web Site (2000) 'Ethylbenzene 100-41-4'
	20-100ppb	Von Burg, (1992) 'Toxicology Update: Toluene', Journal of Applied Toxicology Vol 12.1
	2.3ppm ,2-2.6ppm, 0.029mg/L (water), 0.14mg/L (water)	ATSDR (200) 'Toxicological Profile for Ethylbenzene'. Four sources cited for varying values
	140ppm, 0.4mg/m^3, 8.7mg/m^3	ToxNet (2005) 'Ethylbenzene 100-41-4'.
	0.8 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*0.8mg/m^3*	
Xylenes	20-1800 µg/L	WHO (1993) 'Guidelines for Drinking Water quality'.
	100 mg/m^3	AIHA (1997) 'Odor Thresholds for Chemicals with Established Occupational Health Standards'
	1.1 ppm	US EPA Air Toxics Web Site (2000) 'Xylenes (Mixed Isomers)'. M-xylene only
	1 ppm (mixed xylenes), 0.05 ppm (m-, p- or o-xylene)	ATSDR (2007) 'Toxicological Profile for Xylene'.
	6mg/m^3	ToxNet (2001) 'Xylenes CASRN 1330-20-7'.
	0.2-1.7 mg/m^3	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Adopted	*0.2mg/m^3*	
1,2,4-trimethylbenzene	0.6 mg/m^3 (adopted)	Nagata, 1990 'Measurement of Odor Threshold by Triangle Odor Bag Method'
Styrene	0.26 mg/m^3	WHO (2000) 'Air Quality Guidelines for Europe'.
	0.02 - 4.3 mg/m^3 0.0047 – 61 ppm 0.15 ppm (weighted mean)	US EPA (1990) 'Reference Guide to Odour Thresholds for Hazardous Air Pollutants Listed in the Clean Air Act Amendments of 1990.' A series of values are given reflecting various studies. The mean value is given as the geometric mean or recommended best estimate.
	1.36 mg/m^3 0.73mg/L (water), 0.011mg/L (water)	ATSDR (2010) 'Toxicological Profile for Styrene'
	65 ug/L (water)	Young et al (1996) 'Taste and Odour Thresholds Concentrations of Potential Potable Water Contaminants', Water Research Vol 30.2.
	0.73 ppm (water), 37ppm (water), 0.047 ppm. 0.15-25 ppm, 0.05ppm, 0.43mg/m^3	ToxNet (2005) 'Styrene CASRN 100-42-5' Numerous studies cited.
	0.036 mg/m^3	US EPA (1994) 'Styrene Fact Sheet: Support Document'
Adopted	*0.4mg/m^3*	
Acenaphthene	0.08 mg/l	Gemert & Nettenbreijer, (2003) 'Odour Thresholds – Compilation of Odour Threshold Values in Air, Water, and Other Media'.
	0.08ppm, 0.02-0.22ppm, 0.51ppm	ToxNet (2001) 'Acenaphthene CASRN 83-32-9'.
	0.08ppm	Speclab (2001) 'Chemical Fact Sheet – Acenaphthene'.
Adopted	*0.5mg/m^3*	

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7.9 Background Concentrations

Background / environmental contributions of each of the COPCs via oral and dermal pathways has generally been characterised by the review of NHMRC/NRMMC (2010) 'Australian Drinking Water Guidelines', Food Standards Australia and New Zealand (2003) 'The 20th Australian Total Diet Survey' and documents for each of the relevant COPCs. Background levels of the COPCs via an inhalation pathway in an Australian setting, were generally not identified in the toxicological review. Estimates of inhalation exposures to COPCs from background sources have been determined by review of:

- NSW DEC (December 2004) 'Ambient Air Quality Research Project (1996-2001) Internal working paper no. 2 Ambient concentrations of toxic organic compounds in NSW';
- NSW DEC (December 2004) 'Ambient Air Quality Research Project (1996-2001) Internal; working paper no. 3 Ambient Concentrations of Polycyclic Aromatic Hydrocarbon Species in NSW'; and
- NSW DEC (December 2004) 'Ambient Air Quality Research Project (1996-2001) Internal working paper no. 4 Ambient concentrations of heavy metals in NSW'.

To remain conservative, airborne levels of COPCs recorded in the Sydney CBD, or the wider Sydney area, have been used for each of the COPCs. These are generally the highest levels for each COPC. A range of measured airborne values is provided for each constituent. In general, the mid-point of the range of values reported in the relevant DEC document has been adopted as the background concentration. However, for the case of benzene and trimethylbenzene, it is noted that the majority of benzene and trimethylbenzene emissions are attributable to the use of petroleum products (i.e. motor vehicle exhaust emissions). It is further noted that with the prevalence of modern fuels, the extent of aromatic constituents, particularly benzene and trimethylbenzenes, has been reduced. On this basis, the lower of the reported values for benzene and trimethylbenzene has been adopted as the background concentration

Background levels of COPCs are summarised in **Table 7.15**.

Table 7.15: Summary of Background Exposures to COPCs

COPC	Background Exposure	
	Oral / Dermal	Inhalation
Arsenic	0.04 mg/day[3] 0.03-0.06mg/day[7]	0.51 ng/m^3 (1)
Lead	0.1 mg/day[3, 8] 0.001-0.03mg/day[7, 8]	48 ng/m^3[3, 8]
Nickel	0.2 mg/day[3,5]	No data
Benzene	Negligible[3]	0.4 ppb[9] (1.3µg/m^3)
Toluene	Negligible[3]	4.2 ppb[1] (15.4µg/m^3)
Ethylbenzene	Negligible[3]	0.5 ppb[1] (2.2µg/m^3)
Xylene	Negligible[3]	3.0 ppb[1] (13.1µg/m^3)
Trimethylbenzenes	No data	0.1 ppb[9, 10] (0.5µg/m^3)
PAHs (total)	1 µg/day[3,4,6]	3.90 ng/m^3 (2)
Benzo(a)pyrene	As per PAHs[3]	0.40 ng/m^3 (2)

Note: 1. DEC (December 2004) overall average for Sydney CBD
2. DEC average of mean summer (Sydney) and winter (Sydney CBD) concentrations
3. NHMRC/NRMMC (2010)
4. as derived from reported concentration in drinking water of 0.005mg/l and assumption of adults drinking 2L/day.
5. Average of reported range of values
6. Incorporating estimate of food exposure being an order of magnitude higher then water exposure.
7. Food Standards Australia and New Zealand (2003), range of intake from food consumption for adult males and females
8. Exposure assessment also requires consideration of bioavailability of lead
9. DEC (December 2004) lower range of reported values for Sydney CBD
10. Sum of 1,2,4- and 1,3,5-trimethylbenzene

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For constituents where no data are available, it has been assumed that background / environmental exposures are negligible. Background exposures have been added to site specific doses for each of the constituents in undertaking risk assessment calculations.

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8 Human Exposure Assessment

8.1 Exposure Scenario(s) Requiring Risk Assessment

A number of potential human exposure scenarios are required to be assessed for the proposed Barangaroo Central developments for the range of identified land-uses, as identified in JBS (2012a). These exposure scenarios are summarised in **Table 8.1** following.

Table 8.1: Summary of Required Exposure Scenarios

Source	Exposure Pathway	Location	Receptor
Soil	Inhalation	Recreational / open space areas	Adult Recreational Receptor Child Recreational Receptor
	Inhalation	Recreational / open space areas	Commercial / industrial (Greenkeeper / Gardener)
	Inhalation (dust and vapour) Dermal contact Ingestion	Services Trench (within Recreational / open space areas)	Sub-surface Maintenance Worker
	Inhalation of Indoor air	Basement Car Park	Resident (Adult / Child)
	Inhalation of Indoor air	Residential apartments (overlying basement car park)	Resident (Adult / Child)
Groundwater	Inhalation (pooled seepage water) Dermal contact (pooled seepage water)	Car Park / Basements Overlying residential Apartments	Commercial / industrial (car park attendant) – inhalation only Resident (Adult / Child)
	Inhalation	Recreational / open space areas	Adult Recreational Receptor Child Recreational Receptor
	Inhalation	Recreational / open space areas	Commercial / industrial (Greenkeeper / Gardener)
	Inhalation	Recreational / open space areas	Sub-surface Maintenance Worker

Each of these exposure scenarios are required to be assessed by risk modelling. The characterisation and approximation by modelling of the physical parameters for each potential exposure scenario is summarised following.

8.2 Discussion of Exposure Scenarios

8.2.1 Open Space / Recreational Areas

The western portion of the Barangaroo Central site will predominantly consist of an open vegetated area of recreational space. The majority of the site, as per the interim Barangaroo Stage 1 Public Domain development plan, will consist of open space area. With the proposed importation of specialised soils to be used as growing media and paving of others areas of the site, direct access to soils is not anticipated to occur for normal site users. Recreational receptors, potentially consisting of adults and children, would potentially be exposed to soil impact by inhalation of vapours only.

Commercial / industrial workers provided to the Park, typically consisting of gardeners, will similarly be potentially exposed to impact present within soils underlying growing media by inhalation pathways only.

Sub-surface excavation / maintenance workers may be potentially engaged on the site in the future, for either the installation or repair of sub-surface services. These workers have been assumed to be engaged within trenches with limited ventilation. JBS has been advised by BDA that sub-surface services should not extend below 0.5 m below ground surface in the open space areas of Barangaroo Central. Groundwater is not anticipated to occur in these shallow excavations. Oral / dermal exposure to seepage water / perched water flowing into excavations will therefore not occur.

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Sub-surface maintenance workers would be potentially exposed to impact present in soils in excavations (underlying growing soils or site pavement) by oral and dermal pathways and inhalation of dusts and vapours.

Residential occupants of the proposed future residential buildings would also be anticipated to use the recreational / open space areas. However, risk assessment of recreational receptor exposure to open space areas will be protective of potential residential occupant exposures.

8.2.2 Basement Car Park

Potential receptors within the Car Park have been identified as commercial / industrial workers (employed as 'car park attendants') and occasional users including residential adults and children.

Existing unsaturated zone soils will be located adjoining the car park / basement structures. Vapours from these soils may migrate laterally to the extent of the Car Park. There is also potential that surface water infiltrating through imported fill placed in proximity of the basement will discharge into the basement as seepage water. Where imported fill materials leach impact, they may cause seepage water to be impacted.

Residential users of the car park would also be potentially exposed to infiltrating seepage water via dermal exposure (i.e. splashing in puddles). There is little potential for sufficient infiltrating seepage water to be present to substantiate oral ingestion of seepage. Volatile constituents will also potentially volatilise from pooled seepage water and impact basement users. Residential and commercial users of the basement would be potentially exposed via inhalation to vapours from volatilising seepage water and vapours as migrating laterally into the basement.

Noting the anticipated substantial depth of the basements below the depth of groundwater, it is considered highly unlikely that sub-surface services would be constructed below the basements. There has been no consideration of the potential exposure of sub-surface maintenance workers completing work underlying basements.

8.2.3 Residential Apartments

The proposed residential buildings will comprise the construction of multi-storey above-ground residential units above multiple basement car parking levels. Vapours within the basements, as discussed in the preceding section, will potentially migrate into the overlying residential building. Vapours would be diluted in the basement car parks prior to migration into overlying residential buildings.

On this basis, residential occupants of the buildings will be potentially exposed by inhalation to laterally migrating vapours from unsaturated soils (subsequent to passing through the basement structure) and volatilised constituents from impacted seepage water accumulated within basements.

8.2.4 Other Commercial Structures

It is considered that the assessment of residential occupied basements and apartments will be protective of other less sensitive commercial buildings as may be constructed on the site.

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8.3 Exposure Parameters

Exposure parameters are required for each of the potentially exposed populations listed in **Table 8.1**. The exposure parameters selected for risk modelling are summarised in **Tables 8.2** to **8.8**. In developing exposure parameters, it is noted that no specific sub-surface works exposure parameters have been provided for commercial workers (i.e. landscapers / gardeners) within the Park. It is considered that the conservatism of the sub-surface maintenance worker assessment will be protective of the potential incidental sub-surface exposures of the regular site workforce.

Table 8.2: Global Parameters –Residential Receptor (Adult & Child) – New Residential Buildings / Basement

Exposure Parameter	Units	Factor	Reference
Exposure Frequency	days/year	365	enHealth (2001)
Exposure Frequency (exposure to pooled seepage water in car park)	days/year	24	Assumption of twice per month
Exposure Duration	years	70	enHealth (2001)
Exposure Time (Residential Building)	hours	20	enHealth (2004)
Exposure Time (Car Park)	hours	1 0.5	Conservative assumption for likely maximum time spent in basement for adult. Conservative assumption for likely maximum time spent in basement for child.
Body Weight	kg kg kg	13.2 34.5 70	Child 0-5 years, enHealth (2004) Child 6-15 years, Langley & Sobardo (1996) as per NEPC (1999) mean body weight for 10 year old child Adult 16+ years, NEPC (1999)
Averaging Time - non Threshold	years	70	enHealth (2004)
Averaging Time - Threshold	years	70	enHealth (2004)

Table 8.3: Global Parameters –Recreational Receptor (Adult & Child) – Recreational / Open Space Areas and 'Cultural Space' User

Exposure Parameter	Units	Factor	Reference
Exposure Frequency	days/year	265	enHealth (2004) – based on 365 days/year as subtracted of a typical number of 100 raindays per year for Park users
	days/year	365	enHealth (2004) used for indoor areas of the Cultural Space – no consideration of rainfall for Cultural Space receptors as building enclosed
Exposure Duration	years	6 10 54	Child 0-5 years, enHealth (2004) Child 6-15 years, enHealth (2004) Adult 16+ years, enHealth (2004)
Exposure Time	hours	2	NEPC (1999)
Body Weight	kg kg kg	13.2 34.5 70	Child 0-5 years, enHealth (2004) Child 6-15 years, Langley & Sobardo (1996) as per NEPC (1999) mean body weight for 10 year old child Adult 16+ years, NEPC (1999)
Averaging Time – non Threshold	years	70	NEPC (1999)
Averaging Time – Threshold	years	70	NEPC (1999)

Table 8.4: Global Parameters – Adult Commercial / Industrial Workers – Car Park Attendants, 'Cultural Space' Staff, and Greenkeepers / Landscapers

Exposure Parameter	Units	Factor	Reference
Exposure Frequency	days/year	240	enHealth (2004)
Exposure Duration	years	30	enHealth (2004)
Exposure Time	hours	8	enHealth (2004)
Body Weight	kg	70	NEPC (1999)
Averaging Time – non Threshold	years	70	NEPC (1999)
Averaging Time – Threshold	years	30	NEPC (1999)

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Table 8.5: Global Parameters – Adult Excavation / Maintenance Worker

Exposure Parameter	Units	Factor	Reference
Exposure Frequency	days/year	15	Assumption of maximum time spent undertaking maintenance works, three working weeks
Exposure Duration	years	1	Based on single event only
Exposure Time	hours	8	NEPC (1999) as per commercial / industrial worker
Body Weight	kg	70	NEPC (1999)
Averaging Time – non Threshold	years	70	NEPC (1999)
Averaging Time – Threshold	years	1	Based on single event only

Table 8.6: Ingestion Parameters (Soil)

Exposure Parameter	Units	Factor	Reference
Sub-Surface Maintenance Worker	mg/day	330	US EPA (1991)

Table 8.7: Dermal Contact Parameters – Skin Area

Exposure Parameter	Units	Factor	Reference
Exposed skin surface Sub-Surface Maintenance Worker	cm^2	3 870	US EPA (1997). 50th percentile male surface areas assuming to be wearing short sleeved shirt and long pants.
Exposed skin surface Adult Residential Car Park User – infiltrating seepage water	cm^2	904	Hands only. 50th percentile values, US EPA (2004)
Exposed skin surface Child Residential Car Park User (6-15 years) – infiltrating seepage water	cm^2	633	Hands only. US EPA (2004) 10-11 year old.
Exposed skin surface Child Residential Car Park User (0-5 years) – infiltrating seepage water	cm^2	313	Hands only. US EPA (2004) 2-3 year old.

Table 8.8: Dermal Contact Parameters – Soil Adherence Rates

Exposure Parameter	Units	Factor	Reference
Soil adherence – Sub-Surface Maintenance Worker	$mg/cm^2/day$	1.5	US EPA (1989)

8.4 Estimation of Inhalation Exposure

Inhalation exposures have been estimated by the approach in US EPA (January 2009) '*Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)*'. Equations are provided here for estimating exposure concentrations for assessing cancer risks and for calculating hazard quotients from chronic exposures as per the following:

EC = (CA * ET * EF * ED)/AT (cancer risks)

EC = (CA * ET * EF * ED)/AT (hazard quotients)

Where: EC – exposure concentration ($\mu g/m^3$);

CA – contaminant concentration in air ($\mu g/m^3$);

ET – exposure time (hours/day)

EF – exposure frequency (days/year)

ED – exposure duration (years)

AT – averaging time, cancer risks (lifetime in years * 365 days/year * 24 hours/day)

AT – averaging time, hazard quotient (ED in years * 365 days/year * 24 hours/day)

Table 8.9, following, summarises each of the adjustment factors to be used for each of the receptors assessed by the risk assessment.

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Table 8.9: Summary of Factors to Adjust Airborne Concentrations for Inhalation Exposure

Receptor	Media	Cancer Risks (EC)	Hazard Quotients (EC)
Residential (Adult and Child) Residential Building	Soil, volatilisation from infiltrating seepage water	0.833 * CA	0.833 * CA
Residential (Adult), Car Park	Soil, volatilisation from infiltrating seepage water	$3.21*10^{-2}$ * CA	$4.17 * 10^{-2}$ * CA
Residential (Child), Car Park	Soil, volatilisation from infiltrating seepage water	$4.76*10^{-3}$ * CA	$2.08*10^{-2}$ * CA
Recreational (Adult and Child) – Open Space	Soil	$6.05*10^{-2}$ * CA	$6.05*10^{-2}$ * CA
Sub-Surface Maintenance Worker	Soil	$1.96*10^{-3}$ * CA	$1.37*10^{-2}$ * CA
Commercial / industrial User (Outdoor / Basement Car Park Attendant)	Soil, volatilisation from infiltrating seepage water (basement car park only)	$9.34*10^{-2}$ * CA	0.219 * CA

Assessment of acute risks is advised to be undertaken by direct comparison to the contaminant concentration in air. It is noted that inhalation toxicity data, summarised in **Section 7**, has been converted to slope factors on the basis of a rate of inhalation of $20m^3$/day and an adult body weight of 70 kg.

8.5 Estimation of Oral and Dermal Exposure

Oral and dermal exposures have been adjusted using the exposure parameters in **Section 8.3** as per the relationships provided to the relevant US EPA Risk Assessment Guidance for Superfund guidelines. These calculations have been undertaken using the RISC v4.03 package. Equations used in the RISC v4.03 modelling package are provided as **Appendix A**.

Maximum levels of soil constituents as summarised in **Table 6.1** has been used for oral and dermal exposures to soils. Levels of constituents in seepage water in basements as caused by leaching from unsaturated soils have been estimated using the maximum soil concentration in **Table 6.1** with the estimated leaching relationship from JBS (2012b). These concentrations are summarised in **Table 8.10** following.

Table 8.10: Estimation of Constituent Levels in Seepage Water from Unsaturated Soils

COPC	Maximum Concentration in Unsaturated Soils (mg/kg)	Estimated Leachability (mg/l / mg/kg)	Estimated Maximum Level in Seepage Water from Unsaturated Soils (mg/L)
Ammonia	-	13	-
Arsenic	49	$5.0*10^{-4}$	$2.5*10^{-2}$
Lead	1000	$9.5*10^{-5}$	$9.5*10^{-2}$
Nickel	99	$3.3*10^{-4}$	$3.3*10^{-2}$
Acenaphthene	1.9	$3.0*10^{-3}$	$5.7*10^{-3}$
Acenaphthylene	8.7	$1.7*10^{-3}$	$1.5*10^{-2}$
Anthracene	11	$5.9*10^{-4}$	$6.5*10^{-3}$
Benzo(a)pyrene (TEF)	40.4	$5.7*10^{-4}$	$2.3*10^{-2}$
Fluoranthene	5.9	$1.7*10^{-4}$	$1.0*10^{-3}$
Fluorene	64	$2.6*10^{-3}$	0.17
Naphthalene	4.2	$8.7*10^{-3}$	$3.7*10^{-2}$
Phenanthrene	33	$1.0*10^{-3}$	$3.3*10^{-2}$
Pyrene	61	$1.5*10^{-4}$	$9.2*10^{-3}$

Maximum concentrations of constituents in seepage water from infiltration of groundwater have been undertaken on the basis of maximum concentrations summarised in **Table 6.2**.

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8.6 Estimation of Airborne Concentration

Airborne concentrations have been estimated for constituents as: vapour concentrations (by movement of vapours through soils to the area of exposure); as levels contained within particulates for exposure scenarios where dust generation may occur; and by volatilisation of pooled seepage in basements. These calculations have been undertaken as described in the following sections.

8.6.1 Vapour from Soil

Vapour concentrations have only been estimated for constituents that are considered to be volatile. This has been undertaken by a review of Henry's Law constants for each constituent as summarised in **Table 8.11** following. Constituents which are found to have a Henry's Law constant below $1*10^{-5}$ atm-m^3/mol are considered to be non-volatile and unlikely to pose a significant health risk via the vapour intrusion pathway as per US EPA (2004) '*User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings*'.

Table 8.11: Summary of Henry's Law Constants for COPCs

COPC	Henry's Law Constant (atm-m^3/mol)	Reference / Source / Comments
Ammonia	$1.6*10^{-5}$	Risk Assessment Information System, conversion by US EPA On-line Tools for Site Assessment Calculation at 25°C
Arsenic	-	Non volatile
Lead	-	Non volatile
Nickel	-	Non volatile
Benzene	$5.55*10^{-3}$	US EPA (November 2010)
Toluene	$6.64*10^{-3}$	US EPA (November 2010)
Ethylbenzene	$7.88*10^{-3}$	US EPA (November 2010)
Xylenes	$5.18*10^{-3}$	US EPA (November 2010) as based on xylenes mixture
1,2,4-trimethylbenzene	$6.16*10^{-3}$	US EPA (November 2010)
Styrene	$2.75*10^{-3}$	US EPA (November 2010)
Acenaphthene	$1.84*10^{-4}$	US EPA (November 2010)
Acenaphthylene	$1.14*10^{-4}$	Risk Assessment Information System, conversion by US EPA On-line Tools for Site Assessment Calculation at 25°C
Anthracene	$5.56*10^{-5}$	US EPA (November 2010)
Benzo(a)pyrene	$4.57*10^{-7}$	US EPA (November 2010)
Fluoranthene	$8.86*10^{-6}$	US EPA (November 2010)
Fluorene	$9.62*10^{-5}$	US EPA (November 2010)
Naphthalene	$4.40*10^{-4}$	US EPA (November 2010)
Phenanthrene	$4.25*10^{-5}$	Risk Assessment Information System, conversion by US EPA On-line Tools for Site Assessment Calculation at 25°C
Pyrene	$1.19*10^{-5}$	US EPA (November 2010)

On the basis of **Table 8.11**, inhalation of vapours assessment is not required for the heavy metals and heavier PAHs which are being assessed as benzo(a)pyrene and TEFs, and fluoranthene.

8.6.2 Particulates

Ambient Air Quality Goals Recommended by National Health and Medical Research Council, NHMRC, 1996 recommends an annual level of 90 µg/m^3 of total suspended particulates. This has been adopted in *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, NSW DEC, 2005 as an air quality impact assessment criteria. On this basis it has been assumed that dust levels within an excavation for the maintenance of sub-surface services will be at a consistent maximum concentration of 90 µg/m^3. Constituent concentrations have been assumed to be present within particulates as occur in the soils (i.e. a soil constituent present in soils at a concentration of 1 mg/kg will occur in the excavation atmosphere at $9*10^{-8}$ mg/m^3).

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8.6.3 Volatilised Constituents from Seepage Water in Basement

Seepage water may potentially accumulate in localised areas of the Basement Car Park due to infiltration through cracks and joints in the basement walls. Contaminants which are present in seepage water will potentially volatilise into the Car Park atmosphere. Exposure to seepage water may occur by direct contact of Car Park occupants, or volatilisation of constituents out of the pooled water into human breathing zones.

Volatilisation of constituents out of pooled seepage water in the car park has been undertaken using the method in *Air Emissions Models for Waste and Wastewater*, US EPA, November 1994 (US EPA 1994). US EPA (1994) provides equations for estimation of organic constituent emissions from pooled water. The equations provided to the emissions model for impoundments and open tanks which are flowing have been adopted for the calculations here. Details of equations and associated calculations are provided in **Appendix B**.

Estimated airborne concentrations of each of the potentially volatile constituents are provided in **Table 8.12**. The maximum concentration of each constituent as measured in groundwater has been used as the basis of the calculations for saturated soils. Estimated leaching of constituents from unsaturated soils, using maximum concentrations of each constituent as reported in unsaturated soils, has been used as the basis of calculations for unsaturated soils.

Table 8.12: Summary of Estimated Airborne Concentrations from Volatilisation from Pooled Seepage Water in Basements

Potentially Volatile Constituent	Airborne Concentration as Predicted Based on Leaching of Unsaturated Soils into Basement (mg/m^3)	Airborne Concentration as Predicted Based on Groundwater seepage into Basement (mg/m^3)
Ammonia	No data	$2.5*10^{-2}$
Benzene	Soil data <LOR	0.25
Toluene	Soil data <LOR	0.11
Ethylbenzene	Soil data <LOR	$4.3*10^{-3}$
Xylenes	Soil data <LOR	$4.2*10^{-2}$
1,2,4-trimethylbenzene	Soil data <LOR	$5.6*10^{-3}$
Styrene	Soil data <LOR	$2.5*10^{-4}$
Acenaphthene	$2.4*10^{-5}$	$1.4*10^{-4}$
Acenaphthylene	$3.6*10^{-5}$	$2.4*10^{-4}$
Anthracene	$7.1*10^{-6}$	$6.1*10^{-5}$
Fluorene	$3.5*10^{-4}$	$2.4*10^{-4}$
Naphthalene	$3.8*10^{-4}$	$1.9*10^{-2}$
Phenanthrene	$2.6*10^{-5}$	$1.3*10^{-4}$
Pyrene	$1.8*10^{-6}$	$2.3*10^{-5}$

8.7 Use of RISC Modelling Package

The RISC v4.03 modelling package has been used for modelling to estimate airborne concentrations of constituent vapours.

RISC uses risk equations based on those provided in US EPA Risk Assessment guidance (RAGS Guidelines). These are noted in NEPC (1999) as being appropriate for use in human health risk assessment. Chemical parameters provided to the RISC model have been updated to comply with NEPC (1999) and NSW EPA guidance where specific guidance is provided (i.e. source of toxicity data). Exposure parameters have likewise also been based on NEPC and enHealth guidance where available. Updated parameters are detailed throughout this risk assessment document. Other parameters, as provided within the RISC package (i.e. physical properties of modelled constituents), have not been altered in use of the RISC package.

In undertaking modelling of vapour migration into buildings a default value of 5 L/min as advised in *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings*, US EPA,

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November 1994 for all indoor modelling scenarios (i.e. Car Park) has been used to estimate the rate of soil gas flow into a building.

The RISC model uses Johnson & Ettinger relationships in estimating transport of volatile constituents into human breathing zones. US EPA (2003) reports that the use of Johnson & Ettinger relationships is appropriate in undertaking human health risk assessments. The amendments to the RISC model described above ensure that RISC is behaving as closely as possible to the most recent guidance for the use of the Johnson & Ettinger relationships.

8.8 Characterisation of Open Space / Recreational Outdoor Areas

Outdoor areas in RISC are characterised by a box model. The default parameters provided to RISC for outdoor air exposures will be used in the modelling here. It is noted that an outdoor wind speed of 2 m/s has been used in the modelling. Unsaturated soils have been assumed to be present at 0.5m below the site surface for unpaved areas, or 0.1m below pavements for paved areas. Pavement has been assumed to be 50mm thick consistent with anticipated pathway thicknesses, with default parameters for pavement adopted as per **Section 8.10.1**. Groundwater has been assumed to be present at a depth of 2m below the site surface.

8.9 Characterisation of Sub-Surface Maintenance Trench/ Excavation

Sub-surface maintenance trenches have been assumed to be placed to a maximum depth of 0.5 m in accordance with the advice from BDA. A trench of this depth that is excavated in a fashion that is safe for a sub-surface maintenance worker to enter will most likely be subject to normal rates of ambient ventilation. The trench has been modelled as being subject to rates of ventilation consistent with normal outdoor wind speeds.

8.10 Characterisation of Indoor Spaces

8.10.1 Car Park

The Car Park has been assumed to be constructed with a pavement thickness of 150 mm. Default crack width and porosity parameters provided to the RISC model have been used to characterise the pavement.

Residential and commercial / industrial receptors will potentially be exposed within the Car Park. The majority of commercial / industrial exposures are anticipated to be restricted to the Car Park Attendants Office. Residential users of the Car Park would have exposures across the area of the Car Park and within the Car Park Attendants Office. On this basis, in undertaking volatilisation modelling, it has been assumed for both receptors that the exposures occur within the Car Park Attendant's Office.

Noting that finalised designs are not available for the proposed construction of a Car Park Attendant's Office, the standard building dimensions as provided to RISC have been used to characterise this space / building. This is a small office within the larger Car Park structure. These are summarised following:

- Building volume – 400 m^3;
- Building cross-sectional area – 150 m^2;
- Fraction of foundation present as cracks – 0.001;
- Porosity in foundation cracks – 0.25; and

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- Water content in foundation cracks – 0.

It is noted that these dimensions are not representative of the volume of the Car Park structure as a whole, but an office / room that may be constructed within the Car Park.

The proposed ventilation of the Car Park has been determined in accordance with AS1668.2-2002 '*The use of ventilation and air conditioning in buildings Part 2: Ventilation design for indoor air contaminant control (excluding requirements for the health aspects of tobacco smoke exposure)*'. The ventilation calculations for the Car Park have been based on a consideration of the whole volume of the Car Park, which is distinct from the Car Park Attendant's Office described above.

It has been assumed that the Car Park will be provided with sufficient ventilation to achieve a fresh / outdoor air flow rate of 3 L/s per m^2. BDA have advised that the car park will be constructed with a typical roof height of 3m. On this basis, an air exchange rate of 3.5 volume changes per hour is estimated for the car park.

Car Park users have also been modelled as being potentially exposed to:

- Impacted seepage water, which may migrate through the walls of the Car Park, as discussed in **Section 8.6.3**; and
- Lateral migration of vapours from unsaturated soils potentially adjoining the car park / basement walls.

Maximum levels of soil impact in unsaturated soils have been considered. A vapour migration distance of 0.1m has been used to characterise unsaturated soils directly against basement / car park walls.

8.10.2 Residential Building

Little information is available on the proposed design of residential buildings. It is anticipated that dwelling dimensions within the residential building will be similar to the default building dimensions provided in the RISC model, as summarised in **Section 8.10.1**. The default values have, therefore, been adopted to characterise the buildings pavements along with default porosity parameters and fraction of pavement cracks to characterise vapour movement through pavements. In adopting these values it is assumed that the Residential Building will be constructed with suspended concrete slabs, which is considered appropriate in the absence of detailed design plans.

A ventilation rate of 0.5 volume changes per hour, as recommended by ASTM (2002) for a residential building (based on an air exchange rate of 0.00014/s) has been used for the residential building occupancies.

It is noted that sub-surface vapours which enter the residential building will firstly migrate into the underlying basement car park. Hence, assessment of potential vapour levels in the residential apartments will be required to recognise vapour dilution that occurs in the underlying car parks by the ventilation rate of 3.5 volume changes per hour.

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8.10.3 Vapour Flow into Buildings

At the current stage of building design, it is understood that there is no provision for vapour controls on the proposed buildings.

Vapours are anticipated to migrate laterally into Buildings from underlying unsaturated soils. A review has been undertaken of the potential for lateral migration of vapours to occur to buildings. Recent three dimensional sub-surface soil vapour migration studies reported in Bozkurt O, Pennell K and Suubery E (2009) '*Simulation of the Vapor Intrusion Process for Nonhomogeneous Soils Using a Three Dimensional Numerical Model*' in Ground Water Monitoring & Remediation (Boskurt et al 2009) and Pennell K, Bozkurt and Suuberg E (2009) '*Development and Application of a Three Dimensional Finite Element Vapor Intrusion Model*' in Journal of the Waste Management Association (Pennell et al 2009) indicate that significant lateral migration of soil vapours may occur in the proximity of buildings.

Vapour migration into buildings is reported to occur by advection where there is a pressure differential between the building interior and the sub-surface. Large residential buildings are reported to commonly be at negative pressures relative to the surrounding environment. This relative negative pressure draws sub-surface soil vapours into the structures through cracks and joins that occur in the building pavement / slab. Pennell et al (2009) describe this as a 'chimney effect' that results in a flow of soil gas into the building through breaches in the foundation. This causes a concentration gradient-driven upward diffusion of a sub-surface contaminant toward the ground surface in the proximity of the building. A portion of the upward diffusing contaminant is captured by and carried with the advective flow entering the structure. Diffusion of the contaminant through building foundation cracks also occurs.

Soil vapour flow modelling is reported by Bozkurt et al (2009) using a small building at a negative pressure within a large area of contamination (100 m * 100 m). Soil gas outside the area of the structure was reported to be drawn toward a structure. Where the airflow of soil gas crossed an area of nonzero contaminant vapour concentration, it was reported that the contaminant vapour was carried with the soil gas into the structure.

Lowell P S and Eklund B (April 2004) '*VOC Emission Fluxes as a Function of Lateral Distance from the Source*' in Environmental Progress provide an assessment of the extent of potential lateral movement of soil vapours into buildings. Lowell and Eklund state that emission flux and the soil-gas concentration are insignificant within a relatively short distance from the source. A conservative upper estimate of the potential lateral migration of vapours is nominated as 100 feet within the paper (approximately 30 m). This is consistent with guidance provided in several US documents.

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8.10.4 Impacts of Soil Types on Vapour Movement into Buildings

Soils and fill materials within the open space areas of the Barangaroo Central site can be vertically differentiated into the following soils:

- Upper depth Root Zone Soils, present at a depth of 0.5 to 1.8m, which are characterised as being loose and sandy and generally optimised for the support of vegetation. These soils will consist of imported fill materials, likely to be specifically manufactured to support plant life on the site; and
- Underlying in-situ and imported soils.

The 'root zone soils', present at the site surface, will be relatively well oxygenised. This would indicate that vapours that may be present in these surface soils (used as growing medium) would preferentially migrate to outdoor air by a 'convective sweep' effect that occurs through the relatively well aerated soils. The convective sweep is caused by wind movement over the near surface penetrating into the permeable soil horizons. These 'root zone soils', where occurring within 30 m of buildings, can be excluded from consideration of potential lateral vapour migration into the buildings. It is also noted that phytotoxicity requirements of these soils would preclude significant levels of volatile constituents form being present.

Soils underlying the root zone soils, or underlying pavements are anticipated to be well compacted, to achieve geotechnical specifications and prevent root penetration to underlying saline groundwater or support overlying pavements. The extent of compaction is anticipated to exclude atmospheric effects. On this basis, it is assumed that the in-situ unsaturated will potentially be a source of vapour inflow into the Basement Car Park structures to a distance of 30 m as measured laterally from the enclosed part of these buildings.

8.11 Characterisation of Site Geology

Limited analysis of geological parameters of existing soils on the Barangaroo Site has been undertaken as reported in JBS (2012b). Levels of organic carbon in site soils have been found to range from 0.15% to 2.8%.

To remain conservative, unsaturated zone soils have been characterised as dry sand. Organic carbon has been assumed to be present at a typical concentration of 0.3%, biased towards the lower end of the scale of site measurements.

Geological properties adopted for modelling are summarised in **Table 8.13**.

Table 8.13: Summary of Soil Properties

Soil Property	Sand – Unsaturated
Total Porosity	0.375
Water Porosity	0.053
Height of Capillary Zone (cm)	-
Bulk Density	1.66
Organic Carbon Content (%)	0.3
Vapour Permeability (cm^2)	$1*10^{-7}$ (1)

Note: 1. Based on upper range value for medium sand and low range value for fine sand

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8.12 Characterisation of Physical and Chemical Properties of COPCs

A range of physical and chemical properties are required to be identified for each of the COPCs to allow the risk modelling to occur. This have been summarised in **Table 8.14** for physical properties and **Table 8.15** for properties affecting the dermal availability of the COPC. All values have been sourced from the most recent values available to the on-line Risk Assessment Information System (RAIS). Where values for a particular property are not available within RAIS, the default values provided to the RISC model have been adopted.

Table 8.14: Summary of Physical Properties of COPCs

COPC	Diffusivity in air	Diffusivity in water	Henry's Law constant	Soil-water partition coefficient	Organic carbon partition coefficient	Log of octonal water partition coefficient
	D_a (cm^2/s)	D_w (cm^2/s)	H	K_D (cm^3/g)	K_{OC} (L/kg)	Log K_{OW}
Ammonia	0.1	$1*10^{-5}$	$6.58*10^{-4}$	0.4	-	-
Arsenic	-	-	-	29	-	-
Lead	-	-	-	900	-	-
Nickel	-	-	-	65	-	-
Benzene	$8.95*10^{-2}$	$1.03*10^{-5}$	0.227	-	146	2.13
Toluene	$7.78*10^{-2}$	$9.2*10^{-6}$	0.271	-	234	2.73
Ethylbenzene	$6.85*10^{-2}$	$8.46*10^{-6}$	0.322		446	3.15
Xylenes	$8.74*10^{-2}$	$9.90*10^{-6}$	0.212	-	383	3.12
1,2,4-trimethylbenzene	$6.07*10^{-2}$	$7.92*10^{-6}$	0.252	-	614	3.63
Styrene	$7.11*10^{-2}$	$8.78*10^{-6}$	0.112	-	446	2.95
Acenaphthene	$5.06*10^{-2}$	$8.33*10^{-6}$	$7.52*10^{-3}$	-	$5.03*10^{3}$	3.92
Acenaphthylene	$4.50*10^{-2}$	$6.98*10^{-6}$	$4.66*10^{-3}$	-	$5.03*10^{3}$	3.94
Anthracene	$3.90*10^{-2}$	$7.85*10^{-6}$	$2.27*10^{-3}$	-	$1.64*10^{4}$	4.45
Benzo(a)pyrene	$4.3*10^{-2}$	$9.0*10^{-6}$	$1.87*10^{-5}$	-	$5.87*10^{5}$	6.13
Fluoranthene	$3.0*10^{-2}$	$6.4*10^{-6}$	$3.62*10^{-4}$	-	$5.55*10^{4}$	5.16
Fluorene	$4.40*10^{-2}$	$7.89*10^{-6}$	$3.93*10^{-3}$	-	$5.55*10^{4}$	5.16
Naphthalene	$6.05*10^{-2}$	$8.38*10^{-6}$	$1.80*10^{-2}$	-	$1.54*10^{3}$	3.30
Phenanthrene	$3.45*10^{-2}$	$6.69*10^{-6}$	$1.73*10^{-3}$	-	$1.67*10^{4}$	4.46
Pyrene	$2.87*10^{-2}$	$7.25*10^{-6}$	$4.87*10^{-4}$	-	$5.43*10^{4}$	4.88

Skin permeability coefficients and dermal absorption factors for each of the COPCs as used in the modelling are summarised in **Table 8.15** following.

Table 8.15: Summary of Skin Adsorption Properties of COPCs

COPC	Skin permeability coefficient	Dermal absorption factor	Source
	K_p (cm/h)	Dermal ABS (-)	
Ammonia	$1 * 10^{-3}$	-	Risk Assessment Information System No RAGS Part E ABS factor.
Arsenic	$1 * 10^{-3}$	0.03	Risk Assessment Information System
Lead	$1 * 10^{-4}$	0.1	Risk Assessment Information System. ABS based on RAGS Part E value for 'lead alkyls'.
Nickel	$2 * 10^{-4}$	-	Risk Assessment Information System. No RAGS Part E value available
Benzene	$1.49 * 10^{-2}$	-	Risk Assessment Information System. No RAGS Part E value available
Toluene	$4.53 * 10^{-2}$	-	Risk Assessment Information System. No RAGS Part E value available
Ethylbenzene	$7.39 * 10^{-2}$	-	Risk Assessment Information System. No RAGS Part E value available
Xylenes	$7.04 * 10^{-2}$	-	Risk Assessment Information System as based on value for 'xylene, mixture'. No RAGS Part E ABS factor.
1,2,4-trimethylbenzene	$8.57*10^{-2}$	-	Risk Assessment Information System. No RAGS Part E value available
Styrene	$3.72*10^{-2}$	-	Risk Assessment Information System. No RAGS Part E value available
Acenaphthene	$8.60*10^{-2}$	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Acenaphthylene	$9.11*10^{-2}$	0.13	Risk Assessment Information System. RAGS Part

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COPC	Skin permeability coefficient K_p (cm/h)	Dermal absorption factor Dermal ABS (-)	Source
			E ABS factor
Anthracene	0.142	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Benzo(a)pyrene	0.713	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Fluoranthene	0.308	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Fluorene	0.11	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Naphthalene	$4.66*10^{-2}$	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Phenanthrene	0.144	0.13	Risk Assessment Information System. RAGS Part E ABS factor
Pyrene	0.201	0.13	Risk Assessment Information System. RAGS Part E ABS factor

8.13 Models

Each of the potential exposure scenarios has been assessed by modelling. Modelling outputs are provided as **Appendix C**. **Table 8.16** summarises each of the populations, media and exposure pathways assessed by the risk modelling.

Table 8.16: Summary of Risk Modelling

Population	Exposure Location	Media	Exposure Pathways			
			Inhalation - Particulates	Inhalation – Vapour	Oral	Dermal
Recreational users (adult & child)	Outdoors - unpaved	Soil		•		
	Outdoors - paved	Soil		•		
	Outdoors - unpaved	Groundwater		•		
	Outdoors - paved	Groundwater		•		
Commercial / Industrial (Gardener)	Outdoors - unpaved	Soil		•		
	Outdoors - paved	Soil		•		
	Outdoors - unpaved	Groundwater		•		
	Outdoors - paved	Groundwater		•		
Sub-surface maintenance / excavation worker	Outdoors (excavation)	Soil	•	•	•	•
		Groundwater		•		
Resident (adult and child)	Basement	Soil		•		
	Overlying Apartment	Soil		•		
	Basement	Groundwater (as seepage water)		•		•
	Overlying Apartment	Groundwater (as seepage water)		•		
Commercial / Industrial (Car Park Attendant)	Basement	Groundwater (as seepage water)		•		

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9 Assessment of Human Health Risk

9.1 Risk Measurement

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen. The slope factor (SF) converts estimated daily intakes averaged over a lifetime of exposure directly to incremental risk of an individual of developing cancer. Because relatively low intakes (compared to those experienced by test animals) occur with exposures on most contaminated sites, it can generally be assumed that the dose response relationship is linear in the low-dose portion of the multistage model dose-response curve. Under this assumption the slope factor is constant and risk is directly related to intake. Thus the following linear based carcinogenic risk equation is used:

Risk = CDI * SF

where: Risk – unitless probability of an individual developing cancer;

CDI – chronic daily intake averaged over 70 years (mg/kg-day); and

SF – slope factor expressed in $(mg/kg\text{-}day)^{-1}$.

The slope factor is often an upper 95% percentile confidence limit of the probability of response based on experimental animal data used in the multistage model. Consequently, the carcinogenic risk estimate will often be an upper bound estimate (US EPA, 1989).

The measure used to describe the potential for non carcinogenic toxicity to occur in an individual is not expressed as the probability of an individual suffering an adverse effect. Instead, the potential for non carcinogenic effects is evaluated by comparing an exposure level over a specific time period with a reference dose derived for a similar exposure period. The ratio of exposure to toxicity is called a hazard quotient and is calculated as:

Noncancer hazard quotient = E / RfD

where: E – exposure level (or intake); and

RfD – reference dose (E and RfD are expressed in the same units (US EPA, 1989).

At most sites the potential health effects of more than one chemical are required to be assessed. Potential additive effects of exposure to multiple chemicals are required to be considered in risk assessment. US EPA (1989) recommends that carcinogenic risks are added.

To assess the overall potential for non-carcinogenic effects posed by more than one chemical a hazard index approach is used. This is undertaken by summing of all hazard quotients to determine a hazard index.

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9.2 Adopted Risk Criteria

Acceptable risk guidelines are available from a range of national and international environmental agencies. These include:

- US EPA (1991) states that "*Where the cumulative site risk to an individual based on an reasonable maximum exposure for both current and future land use is less than 10^{-4},… action is generally not warranted unless there are adverse environmental impacts*". Where the level of risk exceeds 10^{-4} it is recommended that remediation goals are developed based on a 10^{-6} cancer risk;
- WHO (1996) '*Guidelines for Drinking Water Quality*' are based on a risk of 1 in 100 000 (1×10^{-5}); and
- NHMRC/ARMCANZ (1996) '*Australian Drinking Water Guidelines*' nominate a negligible level of risk of 1 in 1 000 000 (1×10^{-6}).

No formal policy exists for the acceptable level of cancer risk, however it has been the experience of JBS that NSW, ACT and Victorian Environmental Auditors generally consider risks in the range of 1 in 100 000 (1×10^{-5}) to be acceptable. This level of acceptable risk will be adopted for this site.

For the purposes of this risk assessment an acceptable level of risk is defined as risk less than 1×10^{-5} incremental lifetime risk of cancer.

9.3 Assessment of Background Contributions

Background levels of a range of constituents were nominated in **Table 7.21** and are shown in **Table 9.1** following. These have been included in total exposures of each of the assessed populations. **Table 9.1** summarises the comparison of the background dose of each constituent to the relevant RfD or RfC available for the constituent.

Table 9.1: Estimation of Potential Background Levels of Hazard and Risk

COPC	Background Levels		% of RfD[1]	% of RfC
	Oral / Dermal	Inhalation		
Arsenic	0.04 mg/day	0.51 ng/m^3	30%	3.4%
Lead	0.1 mg/day	48 ng/m^3	41%[2]	9.6%[2]
Nickel	0.2 mg/day	No data	60%	-
Benzene	Negligible	0.4 ppb (1.3µg/m^3)	-	13%
Toluene	Negligible	4.2 ppb (15.4µg/m^3)	-	<1%
Ethylbenzene	Negligible	0.5 ppb (2.2µg/m^3)	-	<1%
Xylene	Negligible	3.0 ppb (13.1µg/m^3)	-	6.0%
Trimethylbenzenes	No data / negligible	0.1 ppb (0.5µg/m^3)		7%
Styrene	No data / negligible	0.1 ppb (0.4µg/m^3)		<1%
Benzo(a)pyrene	As per PAHs (1µg/day)	0.40 ng/m^3	Non threshold criteria only	Non threshold criteria only
Other PAHs	1µg/day	No data	Generally <1%, apart from naphthalene at 1.4%	-

Note: 1. Based on 70 kg receptor
2. Requires to be reduced by bioavailability of lead of 50%
3. Based on 2 year old, assumed to be 13.2 kg as per **Table 8.2**.

Based on review of **Table 9.1**, significant background exposures have been identified for arsenic, lead, nickel and benzene. Other constituents are generally found to be below 10%. Background exposures have been accounted for in the risk assessment by:

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- Addition of background levels of airborne COPCs to airborne concentrations predicted by fate and transport modelling undertaken with risk assessment calculations;
- Addition of hazard index of 0.3 to all arsenic assessments; and
- Addition of hazard index of 0.2 for lead assessment, taking into account the 50% bioavailability of the background sources of lead.

It is noted that background levels are not available for all the COPCs assessed. The COPCs with background data available are found to be the most prevalent in the environment. Other COPCs would be anticipated to be present at substantially reduced levels and more than likely not have significant levels of background exposure.

9.4 Estimation of Risk

The findings of the each of the modelling scenarios using the adopted maximum concentrations of each of the COPCs for each exposure scenario, potentially exposed population and exposure pathway are provided as **Appendix C**. A summary of all modelling results is provided in **Appendix C**. Results are summarised for each exposure scenario in **Table 9.2**.

Table 9.2: Summary of Risk and Hazard Estimates

Population	Exposure Location	Risk / Hazard	
Recreational users (adult & child)	Outdoors - unpaved	Risk	$6.5*10^{-7}$
		Hazard	$1.0*10^{-2}$
Commercial / Industrial (Gardener)	Outdoors - unpaved	Risk	$1.0*10^{-6}$
		Hazard	$1.2*10^{-1}$
Sub-surface maintenance / excavation worker	Outdoors (excavation)	Risk	$8.1*10^{-6}$
		Hazard	$5.6*10^{-1}$
Resident (adult and child)	Basement & Residential Apartment	Risk	$2.1*10^{-3}$
		Hazard	25
Commercial / Industrial (Car Park Attendant)	Basement	Risk	$1.4*10^{-4}$
		Hazard	6.9

Each of the estimated levels of risk and hazard are found to be acceptable apart from potential exposures in basements. By review of risk calculations in Appendix C, an unacceptable level of risk / hazard has been calculated based on potential exposure to:

- Benzene vapour from infiltrating seepage water in basements (HI = 19 and Risk = $1.1 * 10^{-3}$ for residential occupants);
- Dermal exposure to benzo(a)pyrene (assessed as TEF) in infiltrating seepage water (Risk = $9.6 * 10^{-4}$ for residential occupants); and
- Naphthalene vapour from infiltrating seepage water (HI = 4.2 for residential occupants).

9.5 Assessment of Aesthetics

Maximum airborne concentrations of each of the constituents, as summarised in the calculations in **Appendix C**, have been compared to the odour thresholds adopted in **Table 7.14**. None of the odour thresholds, or acute exposure levels (if available), have been exceeded by the predicted airborne concentrations.

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9.6 Risk Assessment

On the basis of the human health risk results, and review of levels of environmental constituents present in seepage water as reported in JBS (2012a) and potential levels of impact, and consideration of recommendations made in JBS (2012a) the site is not considered suitable form a human health perspective for the proposed residential development comprising basements consequent of:

- Potential levels of benzo(a)pyrene infiltrating into basements by leaching of unsaturated soils; and/or
- Potential levels of benzene, benzo(a)pyrene and naphthalene present in groundwater as may occur in basements as seepage water.

The site is considered suitable from a human health perspective for the proposed recreational / open space development subject to the preclusion of direct access of ordinary site users to current in-situ soils. It was recommended in JBS (2012a) that this will be addressed by the importation of growing media / soils and pavement of other site areas.

9.7 Derivation of Risk Based Criteria

Risk based criteria have been derived to determine:

- Levels of benzo(a)pyrene (assessed as TEF) in unsaturated soils that will be protective of potential leaching of unacceptable levels of seepage water impact into the proposed basements; and
- Levels of benzene, naphthalene and benzo(a)pyrene (assessed as TEF) in groundwater that will be protective of potential seepage into the proposed basements.

9.7.1 Unsaturated soils

A concentration of 0.7µg/L of benzo(a)pyrene (assessed as TEF) is allowable in seepage water in the basement to determine an acceptable level of risk. On this basis, the maximum level of benzo(a)pyrene (assessed as TEF) in unsaturated soils located in close proximity of the basement should not exceed 1.2 mg/kg.

9.7.2 Groundwater

A concentration of 0.7µg/L of benzo(a)pyrene (assessed as TEF) is allowable in seepage water in the basement to determine an acceptable level of risk. A concentration of 0.04 mg/L of benzene is allowable in seepage water in the basement to determine an acceptable level of risk and hazard. A concentration of 0.45 mg/L of naphthalene is allowable in seepage water in the basement to determine an acceptable level of hazard.

By review of groundwater data presented in **Table 6.2** and JBS (2012a) these constituents are observed to occur together. Consequently, risk based criteria are required to make provision for potential mixtures and associated additive effects. On this basis, it is recommended that groundwater which can potentially enter the basement as seepage water have levels of constituents not exceeding the following criteria:

- Benzo(a)pyrene at a maximum level of 0.35 µg/L over the extent at which groundwater may seep into the basement;
- Benzene at an average level of 0.02 mg/L over the extent at which groundwater may seep into the basement; and

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- Naphthalene at an average level of 0.23 mg/L over the extent at which groundwater may seep into the basement.

Criteria have been provided as a maximum allowable concentration for constituents which will potentially pose a risk via dermal exposure. This is consequent of their potential to accumulate in localised areas of the site, and the potential limited lateral extent of human exposures within a basement used as a car park.

Criteria have been provided as average concentrations for each constituent which pose a potential risk by inhalation. The basement is ventilated and mixing of potential vapours from seepage water would be anticipated over the chronic duration exposure periods being assessed.

The sum of risk and hazards from the risk based criteria meet the adopted acceptable levels of risk and hazard for the site.

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10 Sensitivity Analysis

An assessment has been required to be undertaken of the sensitivity of the risk assessment outcomes. Risk assessment calculations have been based on:

- Levels of COPCs as estimated by soil and groundwater sampling programs completed across the Barangaroo Project Site;
- Toxicological parameters used to characterise COPCs;
- Anticipated and assessed current and future land-uses;
- Exposure parameters used to characterise future population behaviours on the site;
- Physical parameters used to characterise site areas and buildings where exposures may occur; and
- Equations and related relationships used to estimate levels of COPCs from reported levels in soils and groundwater to points of exposure.

Each of these is discussed further following.

10.1 Sampling Programs

Soil, groundwater and soil leachate data used for the risk assessment have been obtained from sampling programs previously completed by ERM, AECOM, Douglas Partners and a recent comprehensive assessment completed by JBS. The soil data has been used for the selection of constituents of potential concern. Soil data is required to be appropriately representative of site conditions. The soil data are considered to more than likely overstate the extent of impact on the site because assessment locations have been targeted only to areas of the site where site impact is most likely. This has caused the extent of the data to positively bias the actual extent of impact that may be present on the site. This is typified by the concentration of samples locations completed in JBS (2012a) to the shared boundary with the Declaration Area, and the completion of risk assessment calculations on the basis of maximum levels of impact recorded in proximity of the Declaration Area.

A potentially limited analytical suite has been undertaken by the previous consultants and in JBS (2012a). This has included analysis for a limited range of monocyclic aromatic hydrocarbons (MAHs). It is noted that other monocyclic aromatic hydrocarbons will most likely also be present with site contamination, potentially including trimethylbenzenes, propyl benzenes, etc. Limited analysis has been undertaken for detailed volatile and semivolatile organic compound lists. Limiuted analysis has been undertaken for cyanides, However, the extent of data collected across the Barangaroo Project Site demonstrates that the most contaminated soil and groundwater samples are impacted with heavy metals and/or PAHs. It is considered that where the levels of these constituents are addressed by risk assessment, acceptable levels of risk will be determined for the relatively lower levels of any co-occurring contaminants.

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10.2 Toxicological Parameters

Toxicological data are generally derived by the conversion of dose factors as developed based on animal studies to appropriate levels for human exposure. The conservatism of these values is achieved through the use of uncertainty factors. An uncertainty factor of 100 is commonly applied in converting measured animal toxicity data for use for humans, comprising:

- A factor of 10 to allow for differences that affect the way a chemical behaves in humans rather than the animal species tested; and
- Another factor of 10 adequate to allow for differences in the way the chemical might affect different people, to allow for the most sensitive individuals.

Though the two processes most likely act in two separate ways, indicating a summed factor of 20 should be used, the factors are multiplied to generate an uncertainty factor of 100. It is also noted that most agencies will incorporate an additional factor of 10 where long term toxicity data are not available for a particular constituent, resulting in a total factor of 1000.

Actual conversion factors used in the derivation of toxicological values has been extensively detailed in **Section 7**. Toxicological data used in the risk assessment has incorporated these uncertainty factors. This is considered an appropriately conservative process for the site.

A highly conservative Level 2 source has been adopted as the source of the toxicological data to characterise dermal risks of benzo(a)pyrene in soils. The use of this Level 2 source has resulted in derivation of a soil and irrigation water criteria that are approximately an order of magnitude lower than criterion that would have been derived by applying the oral slope factor (to assess dermal exposure) as recommended by the Level 1 sources.

10.3 Land-Use

The risk assessment outcomes are only valid for the assumed future land-use of the site. Potentially sensitive land-uses such as the use of Barangaroo Central for agricultural purposes, or the beneficial use of seepage water / groundwater have not been considered. The risk assessment would be required to be revised where the site was used for a future use other than the proposed open space / recreational or high density residential / recreational uses described.

10.4 Exposure Parameters

Exposure parameters have been derived for the range of receptors as based on published guidance provided in Australian guidelines. Exposure parameters are based on reasonably maximum exposed persons and are considered to be conservative. For example, for the recreational and residential scenarios, a constant exposure to site impact over a 70 year period has been used for the modelling.

Risk results are generally found to adjust linearly with adjustments in exposure parameters.

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10.5 Building Parameters

The most potentially sensitive parameters for characterisation of the Car Park, Residential Building and 'Cultural Space' buildings for the risk assessment is the rate of ventilation of the buildings and the rate of vapour inflow through the pavement / walls.

The minimum required rate of ventilation for a Car Park, as recommended by the appropriate Australian Standard, has been adopted in the modelling. The ventilation of the Car Park is likely to exceed the Australian Standard.

The rate of ventilation adopted for the residential apartments was set as equal to 0.5 volumes changes per hour. In contrast, NZ Ministry for the Environment (1999) recommends that 2 volume changers per hour be adopted for a residential building. This is similarly considered to be low for a high density residential building provided with a forced ventilation system. This value is more commonly applied to low density residential buildings where no forced ventilation occurs.

The default US EPA (2003) value for vapour inflow has been adopted in the modelling. This is based on coarse grained soils being present below a building foundation. The use of this default value is found to substantially increase estimates of vapour inflow, and result in substantially more conservative risk based criteria. It is noted that the RISC modelling package contains algorithms to estimate rates of soil vapour inflow based on specific soil and building properties. Site specific estimates of vapour inflow would be anticipated to be substantially lower than the adopted default value, causing associated risk base criteria for volatile constituents to be higher.

10.6 Modelling Equations

Modelling for the risk assessment has been undertaken using the RISC modelling package. The modified Johnson and Ettinger model is used by the RISC package. Johnson and Ettinger (1991) developed a model for estimating indoor air concentrations resulting from contaminated soil. The non-depleting (infinite) source model developed by Johnson and Ettinger was used in the RBCA protocol. The Johnson and Ettinger model incorporates a simplification of the conceptual model that allows solution of a depleting source model. This model was historically modified to consider slab on ground construction and allow use of the same model to assess transport to outdoor air. The risk results as derived by the modified Johnson and Ettinger model are found to be more conservative than comparative models. For example, NZ Ministry for the Environment (1999) notes that results generated by the Johnson and Ettinger model are generally a factor of 2 more conservative than similar results as derived by the Jury (1983) modified behaviour assessment model.

Modifications have been made to the RISC modelling where necessary to ensure that the model undertakes calculations in accordance with the most recent published guidance for the use of Johnson and Ettinger relationships.

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10.6.1 Application of Johnson & Ettinger Relationships

The appropriateness of the application of the Johnson & Ettinger relationships for undertaking vapour intrusion modelling, and the associated adopted parameter physical properties, has been assessed by repetition of modelling scenarios using modelling spreadsheets as issued by the US EPA. This has been undertaken for vapour intrusion of naphthalene to the Car park from a soil source.

A default vapour inflow of 83.3 cm^2/s has been used in each of the models. The results of the comparative modelling are summarised in **Table 10.1** following.

Table 10.1: Summary of Comparison of Johnson & Ettinger Based Model Results using Default Rate of Vapour Inflow in Each Model (mg/m^3)

Model Scenario	Result using RISC	Result using US EPA Spreadsheets
	Naphthalene	Naphthalene
Unsaturated Soil to Car Park	$3.29 * 10^{-3}$	$4.89*10^{-4}$

The RISC predicted concentrations of naphthalene can be observed to be greater than those provided by the US EPA issued spreadsheets, confirming that the RISC model is appropriately conservative to be used for the risk calculations.

10.6.2 Biodegradation

Importantly, the Johnson and Ettinger model, and the risk assessment calculations, do not take into account potential degradation of hydrocarbon vapours as would occur by oxidation in the sub-surface. Potential vapour generation by contaminated soils and groundwater has been reported in several sources to be controlled by sub-surface oxygen levels, as discussed following.

An assessment of attenuation of hydrocarbon vapours by sub-surface oxygen has been undertaken in Abreu L and Johnson P (2006) '*Simulating the effect of aerobic biodegradation on soil vapor intrusion into buildings: Influence on degradation rate, source concentration and depth*' in Environmental Science and Technology. It was concluded that significant attenuation of petroleum hydrocarbons with depth can occur beneath and adjacent to foundations provided there is sufficient atmospheric O_2 replenishment to the sub-surface.

An assessment of the occurrence and levels of oxygen below buildings in hydrocarbon impacted sands has been undertaken in Lundegard P, Johnson P and Dahlen P (2008) '*Oxygen Transport From the Atmosphere to Soil Gas Beneath a Slab-on-Grade Foundation Overlying Petroleum Impacted Soil*' in Environmental Science & Technology. The study site consisted of a slab on grade house constructed over a fine to medium sand with tar like petroleum hydrocarbon impact present at a depth of 1.5 to 1.8m below the slab. It was found that soils between the depths of 0 and 1 m below the building had near atmospheric levels of O_2. Below this was an aerobic / anaerobic transition zone that occurred somewhere between 1.0 and 1.8 m, considered to be through the upper region of the hydrocarbon impacted soil zone. It was further demonstrated in the study that oxygen in shallow soils underlying this structure were rapidly replenished on purging of soils. Oxygen was further considered to rapidly move downwards by diffusion.

An assessment of soil-gas distribution beneath and around a slab-on-grade building overlying shallow petroleum hydrocarbon impacted coarse alluvial soils, consisting of fine and medium sands, has been reported in Luo H, Dahlen P, Johnson P, Peargin T and Creamer T (2009) '*Spatial Variability of Soil-Gas Concentrations near and beneath a Building Overlying Shallow Petroleum Hydrocarbon-Impacted Soils*' in Ground Water Monitoring & Remediation. The study site consisted of a slab on grade warehouse constructed on silty medium to fine sands with petroleum hydrocarbon impact recorded

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as shallow as 0.15 m below the base of the building. It was found in this study that levels of sub-surface petroleum hydrocarbon soil vapour were inversely related to levels of subsurface O_2, with levels of TPH in soil gas generally being at or near the study detection limits where levels of O_2 were above 5%.

Were models to incorporate sub-surface oxygen levels and associated degradation of hydrocarbon vapours, much lower estimates of vapour migrating to the surface would be anticipated to be predicted. However, in lieu of certainty as to the potential level of oxygenation of compacted fill based soils on the site, biodegradation has been omitted.

10.7 Geological Parameters

Geological parameters can substantially influence vapour migration estimates using Johnson & Ettinger based models. This is most prevalent for volatile constituents. A sensitivity analysis on the model results has been undertaken using alternate geological parameters. A dry sand soil has been assumed for the majority of the modelling undertaken. The sensitivity of the modelling to the assumed geology can be assessed by undertaking additional modelling for the naphthalene migration from unsaturated soils adjoining the basement. **Table 10.2** following summarises the modelling result for the dry sand as used in the modelling. Additional modelling has been undertaken using alternate geological parameters for:

- Gravels;
- Silty sand; and
- Silty clay.

Default geological parameters for each of the geologies of gravels, silty and silty clay, as provided to RISC, were used in the additional modelling.

Table 10.2: Additional Modelling of Naphthalene Levels for Unsaturated Soils Adjoining Cultural Space (mg/m^3)

Geology	Predicted Airborne Concentration
Sand (as modeled)	$3.29 * 10^{-3}$
Gravels	$4.38 * 10^{-3}$
Silty Sand	$9.45 * 10^{-4}$
Silty Clay	$1.47 * 10^{-4}$

It can be observed from **Table 10.3** that the geological parameters adopted for the assessment are conservative. Less conservative results were obtained for all scenarios using recommended default geological parameters provided to the RISC modelling package.

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10.8 Conclusion

There are several factors which may have caused the risk and hazard estimates provided in this risk assessment to be underestimated. However, it is more than likely that any underestimation caused by the risk assessment process and limitations of available data and modelling techniques has been overcome by the use of conservative assumptions throughout the assessment. Examples of conservative assumptions provided in this assessment include:

- Consideration of maximum values for contaminant concentrations in all risk assessment calculations;
- Conservative assumption of potential substantial leaching of seepage water from unsaturated soils and groundwater into basement car parks into areas accessible by adult and children residents;
- Omission of degradation of hydrocarbon vapours in the sub-surface in estimating rates of vapour migration;
- Used of a conservative modelling package and associated physical parameters to characterise COPCs;
- Allowance for additive effects of carcinogenic PAHs by assessment of benzo(a)pyrene by a TEF approach;
- Use of RME (reasonable maximum exposure) based exposure parameters for receptors where locally available data are not present; and
- Assumption of all potential pathways.

It is concluded that the risk estimates provided are overestimates of actual risk levels and can be used for future decision making for the site.

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11 Conclusions and Recommendations

A human health risk assessment (HHRA) has been completed for the assessment of soils and groundwater located within the Barangaroo Central development site. The HHRA has considered the proposed development of the Barangaroo Central as:

- Barangaroo Central Stage 1 Public Domain; and
- Combined high density residential / recreational development as consistent with the proposed Masterplan for Barangaroo.

The risk assessment has considered a range of human health exposure scenarios for the proposed future uses of the Barangaroo Central site. The key facets of the proposed developments that have been considered in the risk assessment include:

- Construction of basement car park with overlying residential building;
- Recreational / open space areas; and
- Sub-surface services / infrastructure over the open space area of Barangaroo Central typically to a maximum depth of 0.5 m.

On the basis of the risk assessment calculations, the limitations provided as **Section 12**, and considering the recommendations as made within *Data Gap Investigation Barangaroo Central*, JBS Environmental, July 2012 (JBS 2012a) it is concluded:

- The Barangaroo Central site does not pose an unacceptable level of human health risk for a proposed recreational / open space use subject to growing media soils being imported for near surface use in vegetated areas of the site and pavement / surface cover being provided to remaining site areas;
- The site is not considered appropriate from a human health perspective for the proposed residential development with basements where:
    - Soils currently located above the depth of groundwater with a level of benzo(a)pyrene (assessed as a toxicity equivalent factor considering all carcinogenic polycyclic aromatic hydrocarbons) exceeding 1.2 mg/kg are located in sufficiently close proximity of proposed basements that leachate from the soils accumulates in accessible areas of the basements; or
    - Groundwater entering the basements as seepage has a maximum level of benzo(a)pyrene exceeding 0.7 µg/L or an average level of benzene exceeding 0.02 mg/L or an average naphthalene exceeding 0.23 mg/L.

It is recommended that a Remedial Action Plan is prepared to make the site suitable for the proposed residential use.

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12 Limitations

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Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements and site history, not on sampling and analysis of all media at all locations for all potential contaminants.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS Environmental Pty Ltd reserves the right to review the report in the context of the additional information.

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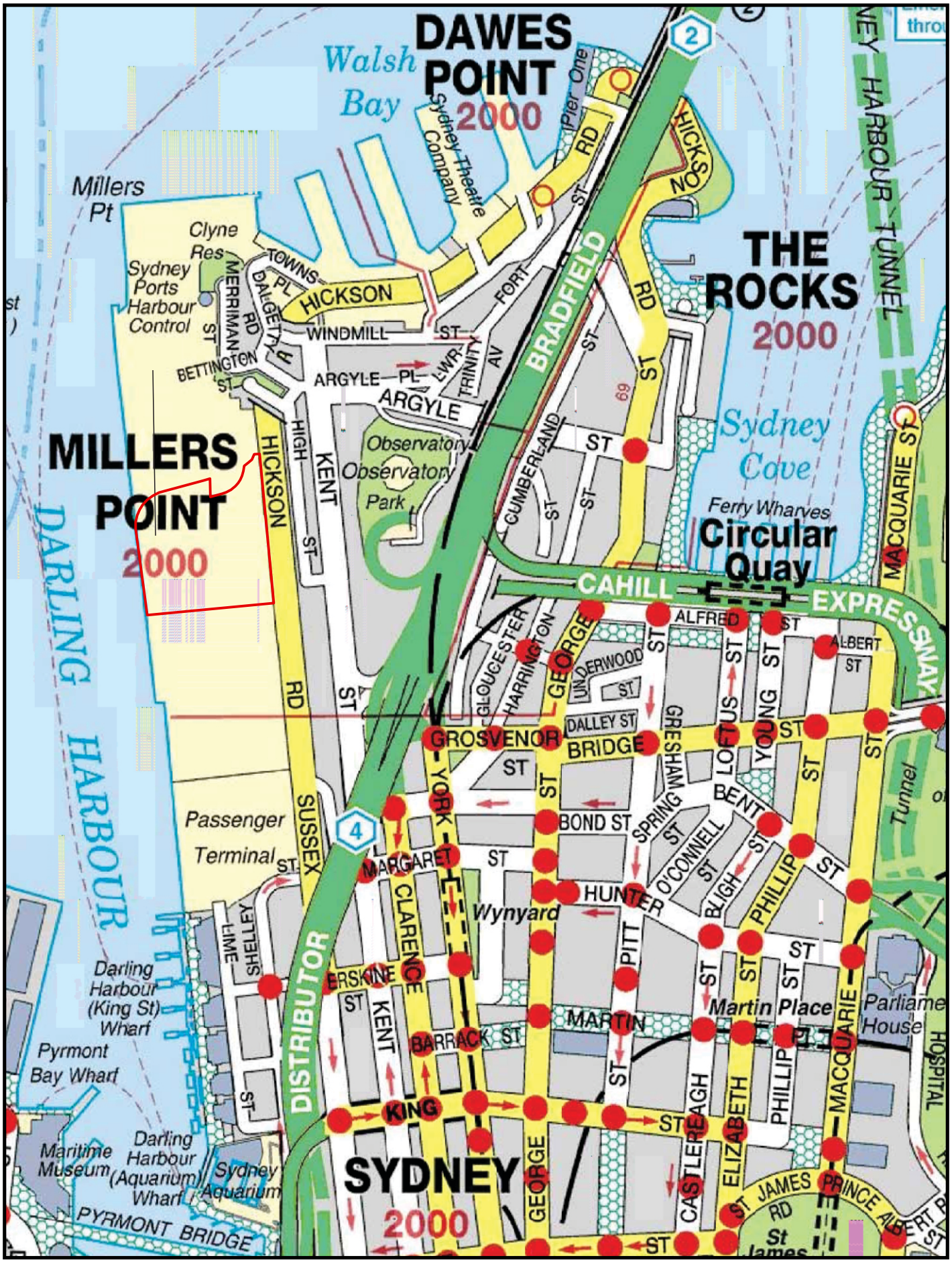
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0 75 125 250 m

Scale: Approximate

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date
A4			
A	Issue - R04	RF	25-6-2012

Legend:

Approximate Boundary - Barangaroo Central

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Figure 1: Site Location

Client: Barangaroo Delivery Authority

Project: Barangaroo Central

Job No: 42021 File Name: 42021_01



Source: Base Image www.nearmap.com (23-10-2011)

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0 15 30 60 m

Scale: 1:1,500

Datum: MGA94 Zone 56 - AHD

A4			
A	Original Issue - R04	RF	25-6-2012
Rev	Description	Drn.	Date:

Legend:

- Approximate Site Boundary - Barangaroo Central
- Inaccessible for soil and groundwater sampling

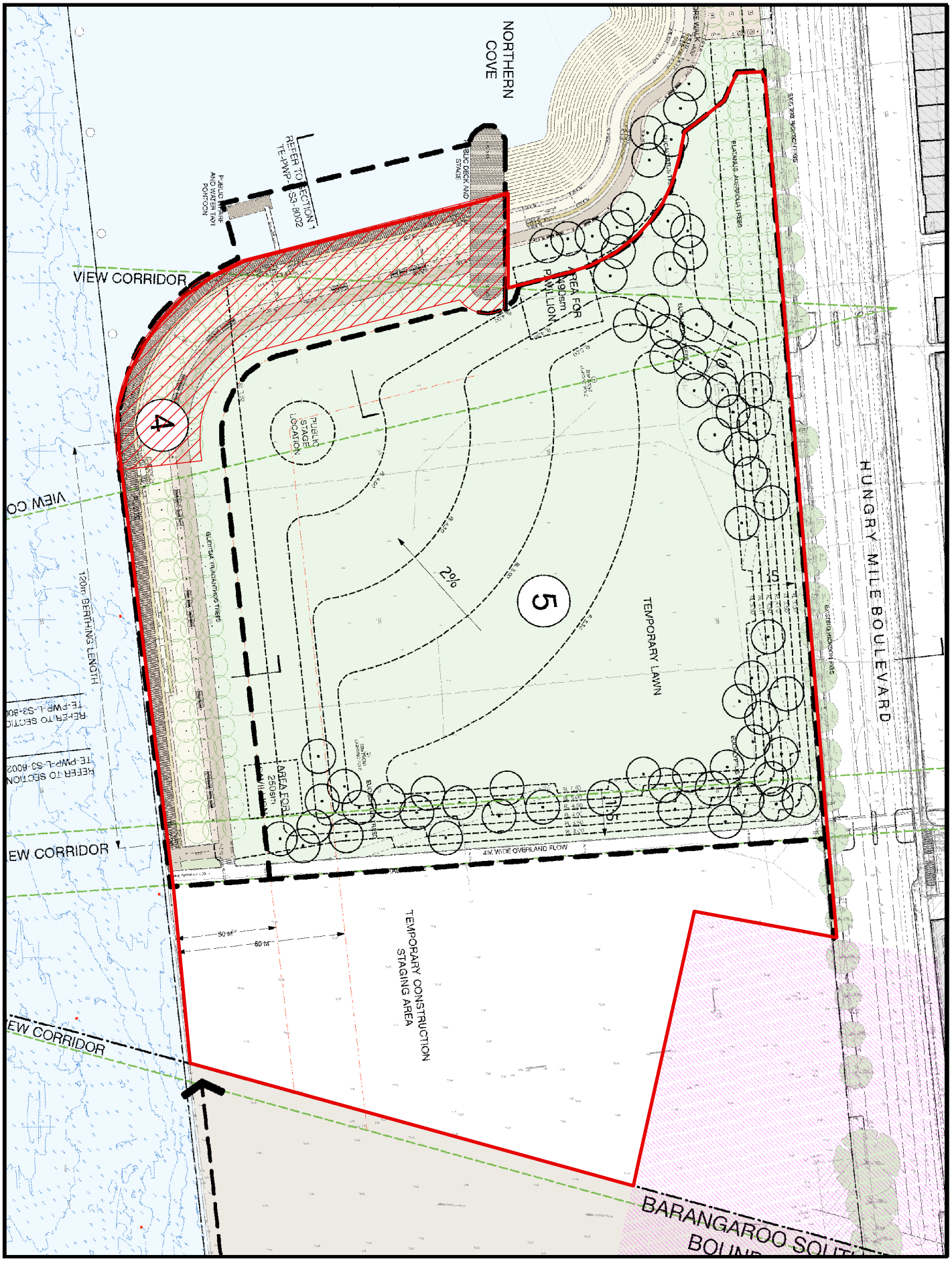
JBS ENVIRONMENTAL

Figure 2: Barangaroo Central Site Plan

Client: Barangaroo Delivery Authority

Project: Barangaroo - Central

Job No: 42021 File Name: 42021_02



Source: JPW / PWP 120315 8001 Areas (UPDATED TENDER)

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0 15 30 60 m

Scale: 1:1,500

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
A	Original Issue - R04	RF	25-6-2012

Legend:

- Approximate Site Boundary - Barangaroo Central
- Overlap of Area Already Assessed (Headland Park)

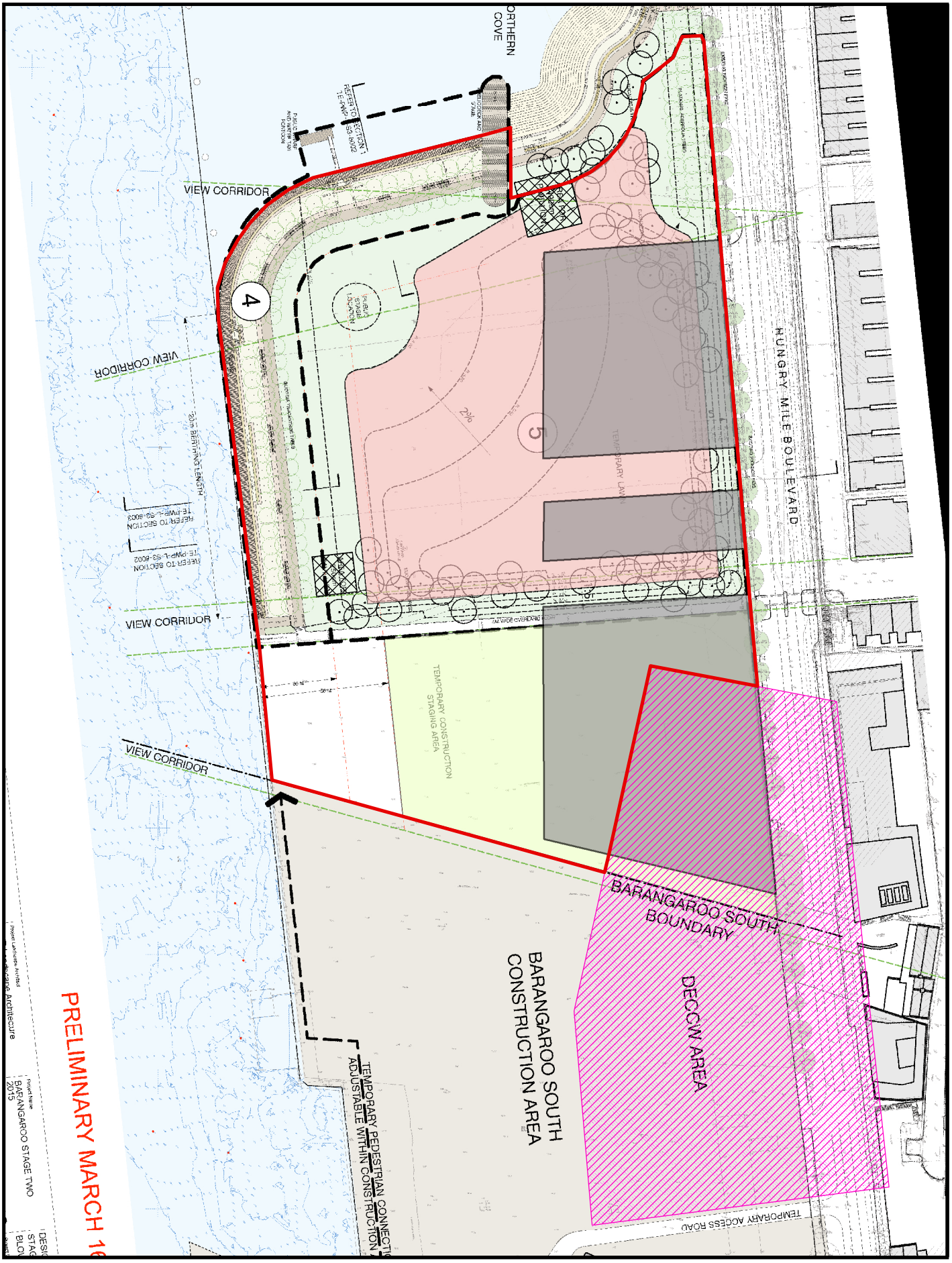
JBS ENVIRONMENTAL

Figure 3: Barangaroo Central Concept Plan - Barangaroo Central Stage 1 Public Domain

Client: Barangaroo Delivery Authority

Project: Barangaroo - Central

Job No: 42021 File Name: 42021_03



Source: JPW / PWP 120315 8001 Areas (UPDATED TENDER)

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0 20 40 80 m

Scale: 1:2,000

Datum: MGA94 Zone 56 - AHD

Rev	Description	Drn.	Date:
A4			
A	Original Issue - R04	RF	25-6-2012

Legend:

- Approximate Site Boundary - Barangaroo Central
- DECCW Area - Approximate Extent
- Area for Pavillion
- Residential Building Basements / Carparks
- Temporary Lawn
- Temporary Construction Staging Area

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Figure 4: Barangaroo Central Concept Plan - Barangaroo Residential / Open Space Development

Client: Barangaroo Delivery Authority

Project: Barangaroo - Central

Job No: 42021 File Name: 42021_04

Appendix A

RISC Equations

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Appendix A

Vadose Zone Model

A.1 MODEL DESCRIPTION

The Vadose Zone model in RISC simulates contaminant transport through unsaturated soil. The transport equations are solved using the analytical solutions of the one-dimensional advective-dispersive solute transport equation (van Genuchten and Alves, 1982). The model considers the following fate and transport processes: (i) a well-mixed finite-mass source zone, (ii) pseudo steady-state volatilization and diffusive vapor transport from the source to ground surface, (iii) leaching from the source zone, (iv) advective dissolved-phase transport, (v) dissolved-phase dispersion, (vi) adsorption, and vii) first-order decay in the leachate.

This model is similar to the vadose zone model presented by Unlü et al. (1992) with the exception of several significant differences that are discussed. The most significant change is that the Vadose Zone transport model in RISC allows for the presence of a second soil layer located between the source zone and the ground surface; this layer may have soil properties different from the rest of the vadose zone which can dramatically affect vapor emissions to the surface.

The purpose of the Vadose Zone model is to predict (1) loading to groundwater and (2) volatilization losses. The groundwater loading term may be used as a source input to the saturated zone model (Appendix B). The volatilization losses may be used as a source for the box air model to calculate concentrations in outdoor air (Appendix F). Figure A-1 shows the processes simulated by the Vadose Zone model.

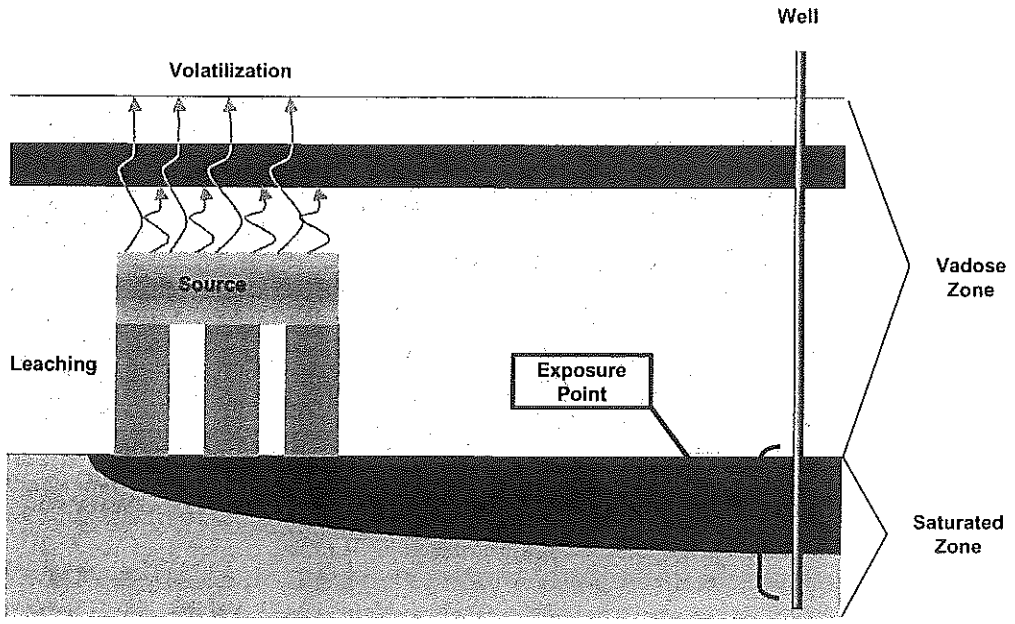


FIGURE A-1. Schematic of the Vadose Zone Model.

This appendix describes the equations used to predict volatile losses from a vadose zone source, leaching/mass loading rates from the source to groundwater and concentration distributions in the vadose zone. Appendix B describes the model used for the saturated zone (including groundwater transport).

A.2 APPLICATIONS OF THIS MODEL

This is a partial list of the main applications and limitations of the model:

- This model estimates the mass loading to groundwater from a vadose zone source. The model accounts for source depletion due to volatilization and leaching. The volatilization flux is only used to estimate losses from the source; it is not linked with an indoor or outdoor air model.
- This model does not simulate the movement of NAPL (free phase product). It is a dissolved phase-only model. Volatilization losses from the source are accounted for, however, the vapor phase concentrations with depth are not estimated. The volatile losses are assumed to be instantaneous and irreversible.

- Degradation is considered in the dissolved phase for the region between the source and the water table.
- The vadose zone model is automatically linked with the dissolved phase model in RISC so that concentrations in groundwater may be estimated.
- The model accounts for the presence of NAPL by limiting the dissolved phase concentration in the source region to the chemicals' effective solubility limit. This is important for two reasons:
    1. Otherwise the leachate and groundwater concentrations may be greatly over-estimated.
    2. Limiting the leachate concentrations to effective solubility limits may cause the source to deplete at a slower rate, thereby increasing the length of time for loading to groundwater. Depending on the problem being simulated, this approach may be more conservative than ignoring solubility limitations because it increases the exposure duration and hence the estimate of long-term cancer risk.

- The source is assumed to be located in the vadose zone. The region in the vadose zone below the source and the groundwater aquifer itself is assumed to be "clean" at the start of the simulation. This means that the vertical extent of the contamination in the vadose zone must be known. If the groundwater is already contaminated there are several ways to model the situation. Here are two ideas:
    1. Assume that the start of the simulation coincides with the date that the spill occurred ("back it up in time"). Run the model through the present day using the current site information to calibrate the model (e.g. make the model predict the current distribution of contaminants in the soil and groundwater).
    2. Skip the vadose zone portion and model the site with one of the groundwater models. If there is still a large amount of contamination in the vadose zone but the system appears to be at steady-state (i.e. the groundwater concentrations are not increasing with time) then use the dissolved phase model with a constant source.

- It is important to choose the source concentration and size of the source carefully. The best approach is to estimate (roughly) the amount of mass thought to be in the vadose zone. The average concentration multiplied by the source size should not exceed the estimated mass. This seems obvious, however, it is very easy to use an unreasonably large source mass especially if maximum concentrations and the maximum extent of detection are used simultaneously.

- The size of the source in the vadose zone is "mapped" onto the water table and becomes the footprint of the groundwater source size. If the receptor well is close to the source region, it may be more conservative to use a smaller source size and a larger source concentration than to average the concentrations across a large source region. More concentrated (but smaller) sources in the groundwater yield higher concentrations along the centerline of the plume when the receptor point is close to the source region.

A.3 FATE AND TRANSPORT PROCESSES

RISC's vadose zone transport model uses a "compartmental" approach; in other words, different models are used to describe the source zone, the vadose zone above the source, and the vadose zone between the source and groundwater.

The source zone is described as being a well-mixed finite source that depletes with time, while the vadose zone above the source is treated as being one-dimensional and at pseudo-steady state.

Beneath the source zone, solute transport of leachate occurs via advection and dispersion, and mass loss may occur through a first-order degradation reaction. The one-dimensional transport equation (including adsorption) in this zone is given by:

$$R\frac{\partial C_w}{\partial t} = D_x\frac{\partial^2 C_w}{\partial x^2} - \bar{v}\frac{\partial C_w}{\partial x} - \mu C_w \qquad \text{(A-1)}$$

where

C_w = dissolved phase concentration of chemical [mg/L]

D_x = dispersion coefficient in the unsaturated zone [cm^2/d]

$\bar{v}$ = seepage velocity (or interstitial velocity) [cm/d]

μ = first-order decay coefficient for chemical [1/d]

x = distance below the source (measured positively downward) [cm]

t = time [d]

R = retardation factor (defined in Equation A-31) [-]

The x-axis is assumed to be aligned with the direction of fluid flow; in the vadose zone that direction is vertically downward. The model considers dispersion in the downward direction only (longitudinal dispersion). The advection-dispersion equation is used to solve for aqueous-phase concentration with depth below the source. This concentration at the water table will be used with the infiltration rate to estimate mass loading to groundwater.

A note on nomenclature: In this appendix the variable, C (C_w, C_v, *or* C_T), will always refer to the concentration of the individual chemical being modeled (not the TPH mixture). If the concentration of TPH is being referenced, the variable C_{TPH} will be used. The same applies to all chemical properties. For example, D_{eff} refers to the chemical-specific diffusion coefficient, MW refers to the chemical-specific molecular weight, and MW_{TPH} refers to the molecular weight of the TPH mixture.

A.3.1 Initial and Boundary Conditions

Below the source it is assumed that concentrations are zero at time = 0:

$$C_w(x, 0) = 0 \qquad \textbf{(A-2)}$$

The leachate concentration leaving the source zone is assumed to decay exponentially with time

$$C_w(0, t) = C_{w_0} e^{-\beta t} \qquad \textbf{(A-3)}$$

where

C_{wo} = dissolved phase concentration of chemical in the source at the beginning of the simulation [mg/L]

β, = source depletion term [-]

The source depletion term, β, is described in equations A-19 and A-23. At a "long distance" below the source the concentration gradient is always zero.

$$\frac{\partial C_w}{\partial x}(\infty, t) = 0 \tag{A-4}$$

The solution for the advection-dispersion equation (A-1) with the above boundary conditions is given by van Genuchten and Alves (1982)

$$C_w(x,t) = C_0 e^{-\beta t} B(x,t) \tag{A-5}$$

where

$$B(x,t) = \frac{1}{2}\exp\left[\frac{(\bar{v} - w)x}{2D_x}\right] erfc\left[\frac{Rx - wt}{2\sqrt{D_x Rt}}\right] + \frac{1}{2}\exp\left[\frac{(\bar{v} + w)x}{2D_x}\right] erfc\left[\frac{Rx + wt}{2\sqrt{D_x Rt}}\right] \tag{A-6}$$

and

$$w = \bar{v}\sqrt{1 + \frac{4D_x}{\bar{v}^2}[\mu - R\beta]} \tag{A-7}$$

where

$C_w(x,t)$ = dissolved phase concentration of chemical at distance x (in cm) below the source and time (in days) [mg/L]

β = source zone depletion coefficient (loss term) defined in equations A-19 and A-23 [-]

In order to solve the above set of equations, the first-order source decay rate must be determined.

A.4 SOURCE TERM

Depletion of the source is assumed to occur due to volatilization and leaching losses. Note that the source is not assumed to undergo microbial decay, or biodegradation, on the assumption that high soil concentrations are toxic to the microorganisms. In terms of a molar balance this can be written as

$$\frac{dm}{dt} = -\frac{J_w}{MW} - \frac{J_v}{MW} \qquad \text{(A-8)}$$

where

m = number of moles of chemical per unit area in the hydrocarbon source [moles/cm^2]

MW = molecular weight of chemical [g/mol]

J_w = rate of mass depletion per area due to percolating water [g/cm^2/d]

J_v = rate of mass depletion per area due to volatilization [g/cm^2/d]

t = time [d]

A.4.1 Aqueous Losses

The leaching loss is assumed to be purely advective (due to water percolating through the source)

$$J_w = qC_{ws}\left(\frac{L}{1000cm^3}\right)\cdot\left(\frac{g}{1000mg}\right) \qquad \text{(A-9)}$$

where

J_w = rate of mass depletion per area due to percolating water [g/cm^2/d]

q = net recharge or infiltration rate [cm/d]

C_{ws} = dissolved phase concentration in the source [mg/L]

In the RISC model, the dissolved phase concentration, C_{ws}, is checked for solubility limitations and therefore is calculated differently depending on whether or not residual phase hydrocarbon (NAPL) is present (see Sections A.4.5 through A.4.7). (Unlü et al., 1992, assumes that the source always contains immiscible phase hydrocarbons.)

A.4.2 Volatilization Losses (Incorporating Lens)

The diffusive vapor loss is estimated using Fick's Law, assuming a linear concentration drop from the source area to the soil surface. Source zone volatilization losses are calculated using a pseudo-steady state vapor flux model based on Fick's Law. In this approach, the steady-state solution for vapor transport is coupled with a source zone concentration that is changing with time. It is assumed that vapor transport reaches steady conditions much faster than the rate at which the source zone concentration changes with time. It is also assumed that vapor concentrations at ground surface are much less than those at the source zone. The mass depletion rate of the source due to volatilization (the volatile losses) is calculated from:

$$J_v = D_{eff} \frac{C_{vs}}{L_d} \left(\frac{86400s}{d} \right) \qquad \textbf{(A-10)}$$

where

J_v = rate of mass depletion per area due to volatilization [g/cm^2/d]

D_{eff} = effective diffusion coefficient in soil [cm^2/s]

C_{vs} = vapor-phase concentration of chemical in the source area [g chemical/cm^3 vapor]

L_d = diffusion path length [cm]

Equation A-10 is Fick's Law applied to the concentration gradient from the source to the ground surface. The concentration of chemical in vapor at the soil surface is assumed to be equal to zero (or very small compared to the source vapor phase concentration). The diffusion path length is assumed to be equal to the distance from the soil surface to the center of the source.

The vapor concentration in the source zone is calculated from Henry's Law:

$$C_{vs} = K_H C_{ws} \left(\frac{L}{1000cm^3} \right) \left(\frac{g}{1000mg} \right) \qquad \textbf{(A-11)}$$

where

K_H = Henry's Law Constant for chemical [(mg/l vapor)/(mg/l water)]

A.4.3 Effective Diffusion Coefficients

The effective diffusion coefficient in vadose zone soil and the lens soil is estimated using the Millington-Quirk relationships:

$$D_{eff\,v} = D_{air} \left(\frac{\theta_{a_v}^{10/3}}{\theta_{T_v}^{2}} \right) + D_{water} \frac{1}{K_H} \left(\frac{\theta_{W_v}^{10/3}}{\theta_{T_v}^{2}} \right) \qquad \textbf{(A-12a)}$$

$$D_{eff\,lens} = D_{air} \left(\frac{\theta_{a\,lens}^{10/3}}{\theta_{T\,lens}^{2}} \right) + D_{water} \frac{1}{K_H} \left(\frac{\theta_{W\,lens}^{10/3}}{\theta_{T\,lens}^{2}} \right) \qquad \textbf{(A-12b)}$$

where

$D_{eff\,v}$ = effective diffusion coefficient for the vadose zone above the source (not including the lens) [cm^2/s]

$D_{eff\,lens}$ = effective diffusion coefficient for the lens [cm^2/s]

D_{air} = molecular diffusion coefficient for chemical in air [cm^2/s]

D_{water} = molecular diffusion coefficient for chemical in water [cm^2/s]

θ_{a_v} = air-filled porosity in the vadose zone [cm^3 air/cm^3 soil]

θ_{w_v} = water-filled porosity in the vadose zone [cm^3 water/cm^3 soil]

θ_{T_v} = total porosity in the vadose zone [cm^3 pores/cm^3 soil]

$\theta_{a\,lens}$ = air-filled porosity in the lens [cm^3 air/cm^3 soil]

$\theta_{w lens}$ = water-filled porosity in the lens [cm^3 water/cm^3 soil]

$\theta_{T lens}$ = total porosity in the lens [cm^3 pores/cm^3 soil]

K_H = Henry's Law Constant for chemical [(mg/l vapor)/(mg/l water)]

Note, the above porosity terms used by the diffusion equations should be total porosity rather than effective porosity. The total effective diffusion coefficient for the vadose zone and lens combined is estimated as the depth-weighted average (Johnson and Ettinger, 1995):

$$D_{eff} = \frac{(h_v + h_{lens})}{\frac{h_{lens}}{D_{eff\ lens}} + \frac{h_v}{D_{eff\ v}}} \quad \textbf{(A-13)}$$

where

D_{eff} = depth-weighted average effective diffusion coefficient for the vadose zone in between the source and the soil surface [cm^2/s]

h_v = thickness of the vadose zone above the source (minus the lens thickness) [cm]

h_{lens} = thickness of the lens [cm]

As a consequence of the modeling assumptions, one can actually account for more than one lens above the source zone, as long as each lens has the same material properties (total porosity, moisture content, etc.). If this is the case, then the user simply sets h_{lens} equal to the combined thickness of all the lenses and h_v is the remaining thickness of the vadose zone.

A.4.4 Overall Source Depletion Rate

Combining equations A-8 through A-11 yields:

$$\frac{dm}{dt} = -\beta m = -\left[\bar{v}\theta_w + \frac{K_H D_{eff}}{L_d}\right] C_w \quad \textbf{(A-14)}$$

where β is a loss term accounting for both dissolution and volatile losses. The loss term is calculated differently depending on whether or not residual phase is present.

A.4.5 Calculating Whether or Not Residual Phase Hydrocarbon is Present

To determine if residual phase hydrocarbon is present, the following condition for multiple chemicals must be met:

$$1 > \sum_{i=1}^{N} \frac{C_{T_i}\rho_b}{S_i\left(\rho_b K_{oc_i} F_{oc} + \theta_w + \theta_a K_{H_i}\right)} \qquad \textbf{(A-15)}$$

where

N	=	total number of chemicals in mixture
$C_{T\,i}$	=	total concentration of chemical i in soil [mg/kg]
S_i	=	liquid phase solubility for chemical i [mg/l or kg/m^3]
ρ_b	=	soil bulk density of the source area [g/cm^3]
F_{oc}	=	fraction organic carbon in soil [g oc/g soil]
$K_{oc\,i}$	=	organic carbon partition coefficient for chemical i [ml/g]
$K_{H\,i}$	=	Henry's Law Constant for chemical i [(mg/l vapor)/(mg/l water)]

This partitioning equation assumes that the total soil concentration for each chemical, $C_{T\,i}$, can be accounted for by summing the mass in the solid, liquid, and vapor phases (i.e. no residual is present). However, equation A-15 requires that all of the chemicals in the mixture are accounted for in the sum. In risk assessments, more often the number of chemicals of concern (and characterized with respect to their concentration) is a small subset of the total number of chemicals present in the mixture. The vadose zone model checks the following equation for each chemical used in the model

$$C_w = \frac{C_T\rho_b}{\rho_b K_{oc} F_{oc} + \theta_w + \theta_a K_H} \qquad \textbf{(A-16)}$$

Again, it is assumed that C_T can be accounted for by summing the mass in the solid, liquid, and vapor phases (i.e. no residual is present). If the liquid phase concentration, C_W, calculated with equation A-15a exceeds the effective solubility of the compound, then it is assumed that residual phase is present (and equation A-15a does not apply).

A.4.6 Source -- When Residual Phase Hydrocarbon is Present

If there is residual phase hydrocarbon present in the source, the aqueous concentration, C_w, will be calculated from

$$C_w = xS \tag{A-17}$$

where

S = aqueous solubility of pure component [mg/l or kg/m^3]

x = mole fraction of component in the hydrocarbon mixture [mol/mol]

The mole fraction is calculated from

$$x = \frac{m}{m_{TPH}} \tag{A-18}$$

$$x = \frac{F_i MW_{TPH}}{MW_i F_{TPH}} \tag{A-19}$$

where

m = total moles of component [mol] $(\frac{\rho_b L_w F_i}{MW_i} A)$

m_{TPH} = total moles of hydrocarbon mixture [mol] $(\frac{\rho_b L_w F_{TPH}}{MW_{TPH}} A)$

L_w = thickness of the source area [cm]

A = area (plan view) of the source [cm^2]

MW_{TPH} = average molecular weight of hydrocarbon [g/mol]

MWi = average molecular weight of component i [g/mol]

F_{TPH} = mass fraction (concentration) of hydrocarbon mixture in the soil source [TPH concentration) [g/g]

F_i = mass fraction (concentration) of component *i* in the soil source [component concentration) [g/g]

As long as there is immiscible phase present, the aqueous phase concentration is given by Equation A-16. Once immiscible phase has been depleted, then the remaining amount of each compound is depleted from the source according with the decay rate given in Equation A-22. In the RISC model, however, it is assumed that if immiscible phase is present initially, then it is present for all time, Thus the approximation developed below is for the case of a more soluble compound leaching from a less soluble mixture, (e.g., benzene from a petroleum fuel mixture).

The source zone depletion coefficient (loss term), β, for the residual case is given by

$$\beta = \frac{qMW_{TPH}S}{\rho_b L_w F_{TPH} MW} + \frac{D_{eff} K_H MW_{TPH} S}{\rho_b L_d L_w F_{TPH} MW} = \beta_w + \beta_v \qquad \textbf{(A-20)}$$

The source zone depletion coefficient is the sum of the leachate losses (β_w) and the vapor losses (β_v). If it is assumed that F_{TPH} is constant (this assumption is only approximate since the source does deplete slowly over time) equation A-8 may be solved analytically to obtain

$$m = m_0 \exp(-\beta t) \qquad \textbf{(A-21)}$$

where

m_0 = initial moles of chemical per area [mol/cm^2]

The aqueous concentration decreases similarly

$$C_w = C_{w0} \exp(-\beta t) \qquad \textbf{(A-22)}$$

where

C_{w0} = initial aqueous concentration of species defined in equation A-16 [mg/l]

Unlü et al. (1992) assumes there is always residual phase hydrocarbon present and uses equation A-19 to estimate losses from the source. This approach is realistic for the types of waste zones that Unlü et al. equations were developed for -- waste sludge pits with high levels of hydrocarbons. However, RISC also allows the user to estimate the behavior of sources for which immiscible phase is not initially present (e.g., equation A-15a is satisfied).

A.4.7 Source -- When Residual Phase Hydrocarbon is Not Present

When an immiscible phase is not present it is assumed that the concentrations of the chemical in each phase are in equilibrium. The equilibrium partitioning equation is:

$$C_{ws} = \frac{C_T \rho_b}{(\rho_b K_{oc} F_{oc} + \theta_w + \theta_a K_H)} \quad \text{(A-23)}$$

which when inserted into Equation A-14 yields:

$$\beta = \frac{q}{(\rho_b K_{oc} F_{oc} + \theta_w + \theta_a K_H) L_w} + \frac{D_{eff} K_H}{(\rho_b K_{oc} F_{oc} + \theta_w + \theta_a K_H) L_d L_w} = \beta_w + \beta_v \quad \text{(A-24)}$$

where all the variables are as defined previously.

A.5 LEACHING AND PERCOLATION RATE

Following Unlü et al. (1992), the RISC Vadose Zone model uses a unit hydraulic gradient approximation, estimating the unsaturated hydraulic conductivity with the Brooks and Corey (1964) model. The unit gradient approach assumes that the pressure (suction) head in the soil profile is constant, as is the moisture content. This is a major simplification of the real processes that control flow in the unsaturated zone. However, the goal in modeling the concentration is to estimate average conditions over long time periods (for purposes of risk assessment: 7 to 30 years). For

this objective, the unit gradient approach has been shown to work reasonably well (Unlü et al., 1992).

A.5.1 Unit Gradient Approach

For more information on this subject the reader is referred to the two papers mentioned above as well as Carsel and Parrish (1988). Briefly, Darcy's equation for the unit gradient case may be written as:

$$q = k_r K_{su} \qquad \text{(A-25)}$$

where

q = infiltration rate or net recharge rate [cm/d]

k_r = relative permeability [unitless]

K_{su} = hydraulic conductivity of the unsaturated zone if it were fully saturated [cm/d]

When using RISC, the user is asked to input the infiltration rate, q, and the unsaturated zone's hydraulic conductivity (K_{su}). This term, K_{su}, is the hydraulic conductivity of the unsaturated zone if it were assumed to be fully saturated, i.e. no air-filled porosity. In many applications of RISC, K_{su} is assumed equal to the hydraulic conductivity of the soil below the water table. If the value entered for the infiltration rate exceeds K_{su}, then q is set to K_{su} assuming that the excess flow will be diverted as runoff.

Having values for q and K_{su}, Equation A-25 is used to solve for the relative permeability, k_r:

$$k_r = \frac{K_{su}}{q} \qquad \text{(A-26)}$$

where the terms are as defined for Equation A-24.

A.5.2 Estimating the Unsaturated Zone Hydraulic Conductivity

In the unsaturated zone, the hydraulic conductivity varies as a function of the moisture content. It is assumed that this relationship can be described by the Brooks and Corey (1964) model

$$k_r = \left[\frac{\theta_w - \theta_r}{\theta_T - \theta_r}\right]^{\gamma} \qquad \text{(A-27)}$$

where

θ_T = total porosity in unsaturated zone [-]

θ_w = volumetric water content or water-filled porosity [cm^3 water/cm^3 soil]

θ_r = irreducible water content [cm^3 water/cm^3 soil]

γ = pore size distribution parameter [-]

The pore size distribution parameter is estimated from the van Genuchten *"n"* parameter using the following relationship (Lenhard et al., 1989)

$$\gamma = 3 + \frac{2}{(n-1)(1-0.5^{\frac{n}{(n-1)}})} \qquad \text{(A-28)}$$

The model requires the user to enter n. Carsel and Parrish (1988) have a large database of van Genuchten's *"n"* for various soil types. This database is also available in the RISC software.

A.5.3 Estimating Moisture Content and Seepage Velocity

The water-filled porosity, θ_w, is calculated using Equation A-26 since values of all the other terms are either specified or previously derived. The calculated water-filled porosity is then used to estimate the seepage velocity, $\bar{v}$:

$$\bar{v} = \frac{q}{\theta_w} \qquad \text{(A-29)}$$

where

$\bar{v}$ = seepage velocity (actual water flowrate through vadose zone) [cm/d]

q = infiltration rate (recharge rate to groundwater) [cm/d]

θ_w = volumetric water content or water-filled porosity [cm^3 water/cm^3 soil]

The seepage velocity, $\bar{v}$, is the average rate of flow that the model uses for the water percolating through the vadose zone.

The water content for the lens may differ from the vadose zone and is also calculated from the same equations as presented above using the lens properties. The values of the estimated moisture contents are presented in the RISC model output. The moisture content is not calculated by the volatilization models (Appendices D, E, J and K) since it is assumed that for soils under a house or building, the infiltration rate is close to zero. In these models the user is requested to specify the average moisture content in the vadose zone. If the vadose zone is subject to infiltration, the above algorithm may be run using the vadose zone model to estimate likely ranges of moisture content. The moisture content can then be entered in the air models.

A.6 UNSATURATED ZONE TRANSPORT

Equations A-5 through A-7 are used to calculate the dissolved phase concentrations in the unsaturated zone from the bottom of the source zone to the groundwater aquifer.

A.6.1 Mass Loading To Groundwater

The mass flux of contaminant at the water table is calculated using Equation A-5 solved at the water table multiplied by the infiltration rate:

$$Q(L_u, t) = q\ C(L_u, t) \cdot \left(\frac{L}{1000cm^2} \right) \qquad \text{(A-30)}$$

where

$Q(L_u,t)$ = mass flux at the water table as a function of time [g/cm^2/d]

$C(L_u,t)$ = dissolved phase concentration of contaminant at the water table as a function of time [mg/L]

L_u = the distance from the source to the water table [cm]

q = net infiltration rate [cm/d]

The mass flux, Q, is used as the time-varying source for the saturated zone model described in Appendix B.

A.6.2 Retardation

The retardation factor for the unsaturated zone, R, is estimated using

$$R = 1 + \frac{\rho_b F_{oc} K_{oc}}{\theta_w} \qquad \text{(A-31)}$$

where

F_{oc} = fraction organic carbon in dry soil [g/g]

K_{oc} = organic carbon normalized partition coefficient [ml/g]

This retardation equation is assumed to be valid when $F_{oc} > 0.001$. [Below values of 0.001 the retardation is estimated to be equal to 1 -- essentially non-retarded.)

A.6.3 Degradation

Degradation is assumed to be a first-order reaction occurring only in the aqueous phase as the leachate is carried from the source to the water table.

A.6.4 Dispersion

The dispersion coefficient is assumed to be a linear function of the seepage velocity, $\bar{v}$, (defined in Equation A-27)

$$D = \alpha_L \left(\bar{v} \cdot \frac{m}{100cm} \right) \qquad \textbf{(A-32)}$$

where

α_L = longitudinal dispersivity [m]

The longitudinal dispersivity is calculated using data from Gelhar et al. (1985) as a function of the vertical distance from the source:

$$\ln \alpha_L = -4.933 + 3.811 \ln x_m \quad x_m \leq 2m \qquad \textbf{(A-33a)}$$

$$\ln \alpha_L = -2.727 + 0.584 \ln x_m \quad x_m \geq 2m \qquad \textbf{(A-33b)}$$

where

x_m = distance from the source to the observation location [m]

A.7 DATA REQUIREMENTS

The data required to run the Vadose Zone model are shown in Table A-1.

Table A-1. Data Requirements for the Vadose Zone Model

		Typical Range of Values	
	Units	**Minimum**	**Maximum**
MEDIA-SPECIFIC PARAMETERS			
Porosity	cm^3/cm^3	0.01	0.5
Irreducible Water Content	cm^3/cm^3	0	porosity
Fraction Organic Carbon	g oc/g soil	0.001	0.05
Hydraulic Conductivity	m/day	1.00E-07	100
Soil Bulk Density	fraction	1.4	2.2
van Genuchten Parameter	dimensionless	~1	~3
Unsaturated Zone Thickness	m	site-specific	site-specific
SOURCE PARAMETERS			
Length of Source (x-direction)	m	site-specific	site-specific
Width of Source (y-direction)	m	site-specific	site-specific
Thickness of Source (z-direction)	m	site-specific	site-specific
TPH DATA			
Molecular Weight of TPH	g/mol	80	120
Concentration of TPH	mg/kg	site-specific	site-specific
CHEMICAL SPECIFIC DATA (individual chemical component)			
Molecular Weight	g/mol	chem-specific	chem-specific
Source Concentration	mg/kg	site-specific	site-specific
Solubility	mg/l	chem-specific	chem-specific
Diffusion Coefficient in Air	cm^2/s	chem-specific	chem-specific
Diffusion Coefficient in Water	cm^2/s	chem-specific	chem-specific
K_{oc}	ml/g	chem-specific	chem-specific
Degradation Rate	1/d	site-specific	site-specific
Henry's Law Constant	(mg/l)/(mg/l)	chem-specific	chem-specific

A.8 ASSUMPTIONS AND LIMITATIONS OF THE VADOSE ZONE MODEL

1. The Vadose Zone model simulates the transport of dissolved phase contaminants downward, and vapor phase contaminants upward. It does not simulate the movement of non-aqueous phase liquids (NAPLs).

2. The Vadose Zone model is a one-dimensional model (from the source to the water table) and accounts for volatile and leachability losses from the source.

3. The vadose zone is considered to be homogeneous and uniform below the source (a lens may be modeled above the source). The hydraulic conductivity is calculated as a function of moisture content, however, this derived moisture content is assumed to be constant for the entire depth of the soil column.

4. The contaminant source has a uniform concentration across the user-specified source volume.

5. Water table fluctuations are not considered. The depth to the aquifer is considered fixed.

A.9 REFERENCES

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Appendix D

Vapor Transport From Soil Into Buildings Without Biodegradation

D.1 MODEL DESCRIPTION

The vapor transport model for soil estimates emissions into a building from a soil source located either below or laterally adjacent to the building. This model is based on the paper entitled "Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings" by Johnson and Ettinger (1991). This vapor transport model combines a model for both diffusive and advective transport through the soil with a simple model of transport through a building foundation.

Figure D-1 illustrates the problem geometry. Advection is caused by a slightly reduced pressure (versus atmospheric pressure) inside a building due to temperature differences, wind, barometric pressure fluctuations or a slight vacuum created by a basement heating system during operation. The pressure gradient is entered as an input parameter.

This is the basically the same model as the one used in the Tier 1 spreadsheet to calculate risk-based screening levels in soil that are protective of indoor inhalation. The enhancements made by the RISC software are twofold: (1) multiple soil horizons may be considered by using the lens and (2) the model calculates the effective solubility and limits the soil gas concentration at the source if residual levels are exceeded. This second option is an important consideration for chemicals that are part of mixtures such as petroleum hydrocarbons in fuel. The example equations presented in the ASTM RBCA guidance are identical to the Johnson and Ettinger model if the building under-pressurization is equal to zero (no advection).

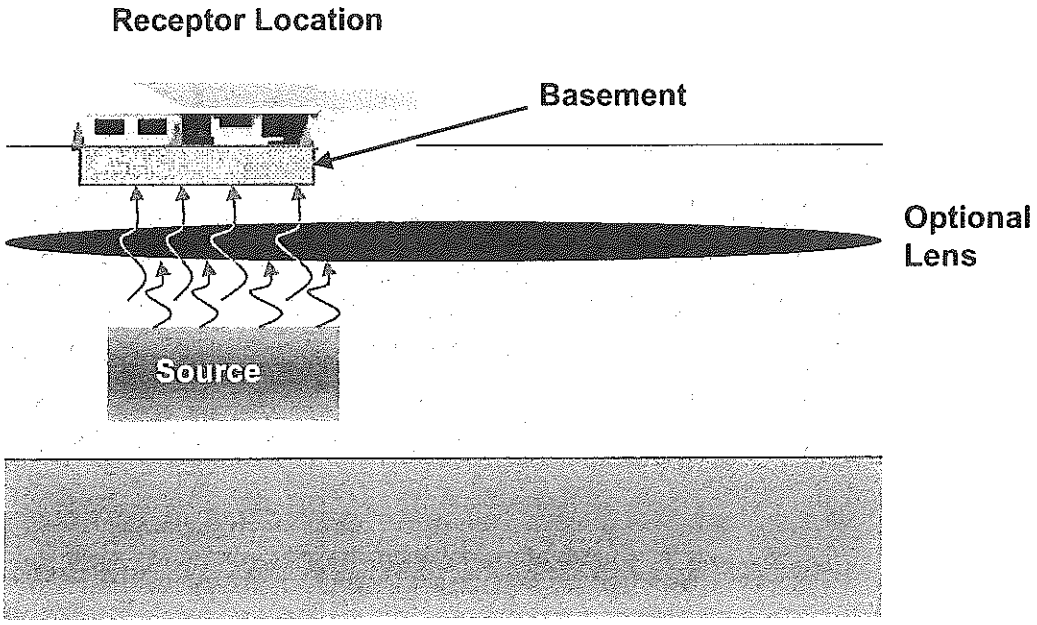


Figure D-1. Schematic of the Vapor Transport Model (from Soil into Buildings).

D.2 APPLICATIONS OF THIS MODEL

This is a partial list of the main applications of the model:

- This is a steady-state model. The source concentration is constant and the size does not deplete with time (i.e. an infinite source). This assumption is valid if the source is large compared to the mass flux rate into the building.
- This model is not linked with any other fate and transport model in RISC. The soil leaching to groundwater model is assumed to have a separate (depleting) source.
- Biodegradation of the chemical vapors is not considered. This is appropriate for chemicals that do not degrade readily, for very short diffusion distances, and/or for screening level calculations. BTEX constituents can have very high degradation rates (higher than in groundwater) under certain conditions. In this case it may be appropriate to use one of the other two vapor transport models in RISC that incorporate degradation.
- The source is located in the vadose zone. For sources located in the saturated zone the volatilization from groundwater model would be more appropriate.
- The likelihood of the building under-pressurization affecting the vapor transport should be evaluated. Often, the reason that advective transport

becomes important is the case where part of the building is sub-grade (e.g. basement) and the path of least resistance from the source is in the direction of the basement. This situation can occur for a laterally offset source if the preferential vapor flow pathways are horizontal (e.g. there are lower permeability units between the source and the ground surface). If the building is not large and does not have a sub-grade basement it is unlikely that the building under-pressurization is affecting the advection processes from an offset soil vapor source. The path of least resistance may be directly out through the ground surface.

- A building on a slab foundation can have advective effects if under-pressurization is present, the source is directly below and close to the foundation, and no partial low permeability lens is available to direct the vapors laterally away from the foundation. But a pier and beam house (where a crawl space is located under the house) would not be subject to advection (and may in fact have only limited diffusion as well if it is vented).

Appendix K.1.2 discusses vertical soil gas profile types and the applicability of the models in RISC to model different soil gas profiles.

D.3 TRANSPORT EQUATIONS AND PROCESSES

The Johnson-Ettinger model assumes that away from the structure, (i.e. out of the influence of pressure-driven flow), the contaminant transport is diffusive only and can be described using Fick's Law:

$$E = \frac{A_B \left(C_{vs} - C_{vf}\right) D_{eff}}{L_T} \qquad \text{(D-1)}$$

where

E = mass transport rate toward the structure [g/s]

D_{eff} = "overall" effective diffusion coefficient [cm^2/s]

C_{vs} = vapor concentration at the source [g/cm^3]

C_{vf} = vapor concentration in the soil just outside the building foundation [g/cm^3]

L_T = distance from source to basement [cm]

A_B = cross-sectional area of foundation available for vapor flux [cm^2]

Note, the effective diffusion coefficient is calculated using the Millington-Quirk relationship (Millington and Quirk, 1961, and described in Appendix A) which accounts for the amount of air vs. water-filled porosity in the soil. Furthermore, a lens can be incorporated in the vapor model so the "overall" effective diffusion coefficient can consider a different soil unit between the source and the house. A clay lens with a high water content can dramatically reduce the overall diffusion coefficient and can result in much lower vapor concentrations inside the house.

Adjacent to the foundation, the transport of contaminants is assumed to occur by a combination of advective and diffusive transport mechanisms through cracks in the foundation slab. The steady-state, one-dimensional solution to the advection-dispersion equation for vapor transport through a crack (just another type of porous media) is given by:

$$E = Q_{soil} C_{vf} - \frac{Q_{soil}\left(C_{vf} - C_{indoor}\right)}{\left[1 - \exp\left(\frac{Q_{soil} L_{crack}}{D_{crack} A_{crack}}\right)\right]} \qquad \text{(D-2)}$$

where

E = entry rate of contaminant into the building [g/s]

Q_{soil} = volumetric flow rate of soil gas into the building [cm^3/s]

C_{indoor} = indoor air concentration in the building [g/cm^3]

C_{vf} = vapor concentration in the soil just outside the building foundation [g/cm^3]

D_{crack} = effective diffusion coefficient in foundation cracks [cm^2/s]

L_{crack} = thickness of the foundation [cm]

A_{crack} = area of cracks or openings through which vapors enter building [cm^2]

The above two equations are assumed to be equal at steady state allowing the contaminant concentration in the soil just outside the foundation to be calculated. Setting Equations D-1 and D-2 equal to each other and rearranging to solve for C_{vf}:

$$C_{vf} = \frac{\left[C_{vs}\left[\frac{D_{eff}A_B}{Q_{soil}L_T}\right]\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)-1\right]+C_{indoor}\right]}{\left[\left[\frac{D_{eff}A_B}{Q_{soil}L_T}\right]\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)-1\right]+\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)\right]} \qquad \textbf{(D-3)}$$

Substituting D-3 into equation D-2 yields:

$$E = \frac{\left[\left[\frac{D_t^{eff}A_BC_{vs}}{L_T}\right]\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)-\left[\frac{C_{indoor}}{C_{vs}}\right]\right]\right]}{\left[\left[\frac{D_T^{eff}A_B}{Q_{soil}L_T}\right]\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)-1\right]+\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)\right]} \qquad \textbf{(D-4)}$$

In equation D-3, the only unknown variable (not entered by the user) is the concentration in the building, C_{indoor}. This concentration can be estimated from a mass balance equation assuming no other contaminant sources or sinks in the building (sorption to walls or furniture). Assuming a well-mixed building this mass balance equation can be written as:

$$Q_B C_{indoor} = E \qquad \textbf{(D-5)}$$

where

Q_B = building ventilation rate (calculated from the number of air exchanges per day and the volume of the building) [m^3/s]

where all the variables have been defined previously. Note, the emission rate, E, is calculated from equation D-4; the building ventilation rate, Q_B, is calculated from user input variables. Substituting Equation D-5 into Equation D-4 yields

$$C_{indoor} = \frac{C^*_{indoor}\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)\right]}{\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)+\left[\frac{D_{eff}A_B}{Q_B L_T}\right]+\left[\frac{D_{eff}A_B}{Q_{soil}L_T}\right]\left[\exp\left(\frac{Q_{soil}L_{crack}}{D_{crack}A_{crack}}\right)-1\right]\right]} \qquad \textbf{(D-6)}$$

where

$$C^*_{indoor} = \frac{D_{eff}A_B C_{vs}}{Q_B L_T} \qquad \textbf{(D-7)}$$

C^*_{indoor} represents the indoor vapor concentration corresponding to the case where vapors diffuse from the source through a bare soil foundation.

The volumetric soil gas flow rate into the basement, Q_{soil}, may be specified by the user or it is calculated from the area of cracks, A_{crack}, soil type and stratigraphy, pressure difference between atmospheric and building pressure, and basement geometry. If Q_{soil} is specified in RISC to be equal to zero, the vapor transport model will calculate it from (Johnson and Ettinger, 1991):

$$Q_{soil} = \frac{2\pi(\Delta P)k_v X_{crack}}{\mu \ln[2Z_{crack}/r_{crack}]} \qquad \frac{r_{crack}}{Z_{crack}} << 1 \qquad \textbf{(D-8)}$$

This equation is based on flow through a cylinder of length X_{crack} and radius r_{crack} located a depth Z_{crack} below ground surface. The rest of the variables used in D-8 are:

ΔP = pressure gradient between building and outside [g/cm-s^2]
Z_{crack} = depth below ground surface to foundation cracks [cm]
k_v = permeability of the soil to vapor flow [cm^2]
μ = viscosity of vapor [g/cm-s]

The crack length, X_{crack} , is an input parameter and can be conservatively assumed to be the total floor/wall seam perimeter distance. r_{crack} is defined as:

$$r_{crack} = \frac{\eta A_B}{X_{crack}} \qquad \textbf{(D-9)}$$

where

η = the ratio: A_{crack}/A_B so that $0 =< \eta =< 1$

For intrinsic permeabilities of vapor flow, k_v, of less than 1E-8 cm^2 (fine sand soils), the soil gas flow rate through the cracks becomes so low that diffusion is the dominant transport mechanism and the solution is independent of k_v. For "larger" values of k_v, (greater than 1E-8 cm^2) the solution is dominated by the advective contribution. In the model output, the contribution from diffusion is estimated by setting k_v to a very low value.

D.4 SOURCE TERM

The source may be specified by entering total soil concentrations or by entering soil vapor concentrations. Using measured soil vapor concentrations has the following advantages:

- It eliminates the uncertainty in the model of estimating the source vapor concentrations from the equilibrium partitioning equation. This can be significant because of the complexities of partitioning when the chemicals are part of a mixture and because the soil properties like soil moisture and porosity are rarely known.
- The soil vapor concentration may be measured in the vadose zone between the source and the building. This approach can directly account for attenuation processes such as degradation and diffusion through different soil horizons (whose soil properties are not known) that the model may under-estimate. This can be very significant and many US State risk-based corrective action programs are developing protocols for starting with soil vapor concentrations rather than total soil concentrations.

Note that if the location of the soil vapor measurement is not close to the source, it is important to evaluate whether or not the soil vapor concentration has yet reached equilibrium. For example, if a recent subsurface chemical spill occurred in a silty clay and the soil vapor measurement point were 3 meters away, the vapor concentrations may not have yet reached their maximum values.

If there is no residual phase hydrocarbon present, the source vapor concentration is calculated from the total soil concentration using the following equation presented by Jury (1983, 1984, and 1990):

$$C_{vs} = \frac{C_T \rho_b K_H}{\theta_a K_H + \theta_w + \rho_b F_{oc} K_{oc}} \left(\frac{kg}{1E6mg} \right) \qquad \textbf{(D-10)}$$

where

C_{vs} = vapor concentration at the source [g/cm^3]

C_T = total soil concentration of chemical *i* [mg/kg]

ρ_b = soil bulk density of the source area [g/cm^3]

F_{oc} = fraction organic carbon in soil [g oc/g soil]

K_{oc} = chemical-specific organic carbon partition coefficient [ml/g m^3/kg]

K_H = Henry's law constant [(mg/l)/(mg/l)]

θ_a = air-filled porosity of vadose zone [cm^3 of air/cm^3 total soil volume]

θ_w = water-filled porosity of vadose zone [cm^3 of water/cm^3 total soil volume]

If residual phase hydrocarbon (NAPL) is present, Raoult's Law is used with the component mole fraction

$$C_{vs} = \frac{x_i P_v^{\,i} MW_i}{RT} \qquad \textbf{(D-11)}$$

where

x_i = mole fraction of component i in the hydrocarbon [mol/mol]

P_i^v = pure component vapor pressure of component i [atm]

MW_i = molecular weight of component i [g/mol]

R = the universal gas constant (82.1) [cm^3-atm/mol-K]

T = absolute temperature [K]

The model checks to see if residual-phase hydrocarbon is present and then calculates the source term accordingly. (The method for determining the residual limit is discussed in more detail in Appendix A, starting with Equation A-15.)

The mole fraction, x_i, is calculated from

$$x_i = \left(\frac{C_T}{C_{TPH}}\right)\left(\frac{MW_{TPH}}{MW}\right) \qquad \textbf{(D-12)}$$

where

C_T = total soil concentration of chemical i [mg/kg]

C_{TPH} = total soil concentration of TPH mixture [mg/kg]

MW_{TPH} = molecular weight of the mixture [g/mol]

MW_i = average molecular weight of component i [g/mol]

If the molecular weights of the component, i, and the mixture are similar, this roughly translates to the concentration of the component, i, over the concentration of total petroleum hydrocarbons (TPH) in the source.

D.5 DATA REQUIREMENTS OF THE SOIL VAPOR MODEL

The input data requirements for this model are presented in Table D-1.

Table D-1. Data Requirements for the Soil Vapor Model for Indoor Air
(Page 1 of 2)

	Units	Typical Range of Values	
		Minimum	Maximum
UNSATURATED ZONE			
Porosity	cm^3/cm^3	0.01	0.5
Water content in diffusion zone	cm^3/cm^3	0	porosity
Hydraulic conductivity of the soil surrounding the foundation (used to estimate soil vapor flow)	m/day	1.0E-07	100
Soil Bulk Density	fraction	1.4	2.2
LENS (Optional)			
Porosity	cm^3/cm^3	0.01	0.5
Water content of lens	cm^3/cm^3	0	porosity
Lens thickness	m	site-specific	site-specific
TPH DATA (Optional)			
Molecular weight of TPH	g/mol	80	120
Concentration of TPH	mg/kg	site-specific	site-specific
FOUNDATION PARAMETERS			
Distance to foundation	m	site-specific	site-specific
Cross-sectional area of foundation perpendicular to vapor flow	m^2	site-specific	site-specific
Volume of house	m^3	site-specific	site-specific
Number of air exchanges per day	d^{-1}	residential: 12 industrial: 20	location/site-specific
Thickness of foundation	m	0	site-specific
Fraction of cracks in foundation	cm^3/cm^3	0	1

Table D-1. Data Requirements for the Soil Vapor Model for Indoor Air
(Page 2 of 2)

	Units	Typical Range of Values	
		Minimum	Maximum
PARAMETERS USED TO CALCULATE PRESSURE-DRIVEN FLOW			
Soil Gas Flow Rate Into Building (Q_{soil}) (**or** next three parameters)	cm^3/s	*>0*	*location/site-specific*
Length of Foundation Perimeter (not needed if Q_{soil} specified)	m	0	site-specific
Depth Below Ground Surface of Foundation (not needed if Q_{soil} specified)	m	0	site-specific
Pressure Difference From Indoors to Outdoors (not needed if Q_{soil} specified)	g/cm^2-s	0	site-specific
CHEMICAL SPECIFIC DATA (individual chemical component)			
Molecular Weight	g/mol	chem-specific	chem-specific
Source Concentration: Soil Vapor Concentration, or Total Soil Concentration	mg/m^3 mg/kg	site-specific	site-specific
Solubility	mg/l	chem-specific	chem-specific
Diffusion Coefficient in Air	cm^2/s	chem-specific	chem-specific
Diffusion Coefficient in Water	cm^2/s	chem-specific	chem-specific
Henry's Law coefficient	(mg/l)/(mg/l)	chem-specific	chem-specific

D.6 LIMITATIONS OF THE SOIL VAPOR MODEL

1. This is a steady-state, constant and one-dimensional model. The source does not deplete due to vapor losses so mass is not conserved. This assumption has only a minor impact on the risk due to non-carcinogens (unless the source is

very small) since the highest seven-year running average intake is compared to the reference dose. It can have a more significant impact however on carcinogens (such as benzene) since the cumulative exposure over a long exposure duration (up to 30 years) forms the basis for the risk calculation.

2. There is no biodegradation of the vapors as they migrate through the soil.

D.7 REFERENCES

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Appendix B

Calculation of Vapour Emissions from Pooled Water in Car Park

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Vapour Emissions from Pooled Water in Car Park

The equations used to estimate vapour concentrations above pooled water in the car park / basement have been estimated from those described for impoundments and wastewater treatment tanks in *Air Emissions Models for Waste and Wastewater*, US EPA, 1994 as attached.

Mass transfer of volatile chemicals from open liquid surface to air

$E = KAC_L$

Where, E – air emissions from the liquid surface (g/s);

K – overall mass transfer coefficient (m/s);

A – liquid surface area (m^2)

C_L – concentration of constituent in liquid phase (g/m^3)

The 'overall mass transfer coefficient' (K) is estimated from a two-phase resistance model that is based on the liquid-phase mass transfer coefficient (k_L, m/s), the gas phase mass transfer coefficient (k_G, m/s), and Henry's Law constant in the form of a partition coefficient (Keq). The two resistances act in series and the overall resistance is expressed as:

$1/K = 1/k_L + 1/(k_G.Keq)$

Where: K – overall mass transfer coefficient (m/s);

k_L – liquid-phase mass transfer coefficient (m/s);

k_G – gas-phase mass transfer coefficient (m/s); and

Keq – equilibrium constant or partition coefficient, concentration in gas phase / concentration in liquid phase where both concentrations are in the same units.

Henry's law constant in units of '$atm.m^3/g.mol$' is reported to be estimated for the constituents of interest by dividing the constituents vapour pressure (in atmospheres) by its solubility in water (in $g\ mol/m^3$). This has been undertaken by using the unitless Henry's Law constants in **Table 8.14** in the following relationship.

Henrys Law ($atm.m^3/g.mol$) = (T / 12186) * HL (unitless)

Where: 12186 is a conversion factor to adjust untiless Henry's Law to ($atm.m^3/g.mol$);

T – Temperature of water (degrees kelvin), assumed to be 20°C / 293 K;

HL – unitless Henry's Law constant

Values used are summarised in **Table B1** following.

Table B1: Summary of Parameters to Estimate Henry's Law Constant ($atm.m^3/g.mol$)

COPC	Henry's Law Constant (unitless)	Henry's Law Constant ($atm.m^3/g.mol$)	Comments
Ammonia	$6.58*10^{-4}$	$1.58*10^{-5}$	
Arsenic	-	-	
Lead	-	-	
Nickel	-	-	
Benzene	0.227	$5.46*10^{-3}$	
Toluene	0.271	$6.52*10^{-3}$	
Ethylbenzene	0.322	$7.74*10^{-3}$	
Xylenes	0.212	$5.10*10^{-3}$	
1,2,4-trimethylbenzene	0.252	$6.06*10^{-3}$	

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COPC	Henry's Law Constant (unitless)	Henry's Law Constant ($atm.m^3/g.mol$)	Comments
Styrene	0.112	$2.69*10^{-3}$	
Acenaphthene	$7.52*10^{-3}$	$1.81*10^{-4}$	
Acenaphthylene	$4.66*10^{-3}$	$1.12*10^{-4}$	
Anthracene	$2.27*10^{-3}$	$5.46*10^{-5}$	
Benzo(a)pyrene	-	-	Non volatile, not assessed.
Fluoranthene	-	-	Non volatile, not assessed.
Fluorene	$3.93*10^{-3}$	$9.45*10^{-5}$	
Naphthalene	$1.80*10^{-2}$	$4.33*10^{-4}$	
Phenanthrene	$1.73*10^{-3}$	$4.16*10^{-5}$	
Pyrene	$4.87*10^{-4}$	$1.17*10^{-5}$	

The equilibrium constant Keq is estimated by:

$Keq = H/RT$

Where: H – Henry's Law constant ($atm.m^3/g.mol$);

R – universal gas constant, $8.21 * 10^{-5}$ ($atm.m^3/g.mol.K$); and

T – temperature (K).

The units associated with Keq are the ratio of the gas-phase to liquid-phase concentrations, and requires that both be expressed in the same units of mass/volume.

The equation for calculation the individual mass transfer coefficient for volatilization of organic solutes from quiescent surface impoundments is provided following for liquid phase and gas phase. A choice of equations are provided for the range of potential wind speeds above the surface. The wind speed within the car park has been estimated using the rate of ventilation of the Car Park as equal to 3.5 volume changes per hour. Using a ceiling height of 3m, this equates to a typical air velocity of 0.003m/s in any area of the car park, assuming uniform mixing of air velocity.

Liquid phase

$K_L = 2.78 *10^{-6}.(D_w / D_{ether})^{2/3}$

Where: D_w – diffusivity of constituent in water (cm^2/s);

D_{ether} – diffusivity of ether in water = $9.36*10^{-6}$ (cm^2/s) as per US Department of Energy Risk Assessment Information System as accessed on 12th August 2011.

Is only valid where the wind speed at 10m above the liquid surface is below 3.25m/s. The estimated wind speed for the car park is more than likely well below this, based on the rate of ventilation required.

Gas Phase

$K_G = 4.82*10^{-3}.U^{0.78}.Sc_G^{-0.67}.d_e^{-0.11}$

Where: U – wind speed (m/s);

Sc_G – Schmidt number on gas side

d_e – effective diameter of impoundment (m^2)

The Schmidt number (Sc_G) is estimated by the following:

$Sc_G = \mu_G / (\rho_G.D_a)$

Where: μ_G – viscosity of air = $1.86*10^{-4}$ (g/cm.s);

ρ_G – density of air = $1.29*10^{-3}$ g/cm^3; and

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D_a – diffusivity of constituent in air (cm^2/s).

The effective diameter of the impoundment (d_e) is defined as:

$d_e = (4A / 3.14592)^{0.5}$

where: A – area of impoundment / pooled water (m^2)

Values used for D_a and D_w are summarised in **Table B2** following.

Table B2: Diffusivity estimates for Constituents

COPC	Diffusivity in air D_a (cm^2/s)	Diffusivity in water D_w (cm^2/s)
Ammonia	0.1	$1*10^{-5}$
Benzene	$8.95*10^{-2}$	$1.03*10^{-5}$
Toluene	$7.78*10^{-2}$	$9.2*10^{-6}$
Ethylbenzene	$6.85*10^{-2}$	$8.46*10^{-6}$
Xylenes	$8.74*10^{-2}$	$9.90*10^{-6}$
1,2,4-trimethylbenzene	$6.07*10^{-2}$	$7.92*10^{-6}$
Styrene	$7.11*10^{-2}$	$8.78*10^{-6}$
Acenaphthene	$5.06*10^{-2}$	$8.33*10^{-6}$
Acenaphthylene	$4.50*10^{-2}$	$6.98*10^{-6}$
Anthracene	$3.90*10^{-2}$	$7.85*10^{-6}$
Benzo(a)pyrene	$4.3*10^{-2}$	$9.0*10^{-6}$
Fluoranthene	$3.0*10^{-2}$	$6.4*10^{-6}$
Fluorene	$4.40*10^{-2}$	$7.89*10^{-6}$
Naphthalene	$6.05*10^{-2}$	$8.38*10^{-6}$
Phenanthrene	$3.45*10^{-2}$	$6.69*10^{-6}$
Pyrene	$2.87*10^{-2}$	$7.25*10^{-6}$

The flow model assumed for quiescent compounds and tanks with no biodegradation is that the contents of the system are well mixed and that the bulk concentration (driving force) in the system is equal to the effluent concentration (C_L). A material balance around the system yields:

$C_L = (Q.C_i) / (KA + Q)$

Where: C_L – equilibrium or bulk concentration in the impoundment (g/m^3);

Q – volumetric flow rate (m^3/s);

C_i – initial concentration in the waste / pooled water (g/m^3); and

K – overall mass transfer coefficient (m/s);

A – liquid surface area (m^2)

For the purposes of the calculations here and consistent with the back calculation objectives of the overall risk assessment, C_L has been required to be set as per two scenarios:

- Leaching of impact from unsaturated soils into basement; and
- Discharge of groundwater into basements.

Constituent levels in seepage water as caused by leaching of unsaturated soils into basements has been assessed by the maximum concentrations of each constituent as reported in unsaturated soils as multiplied by the leaching relationship for the constituent, using the leaching relationships as presented in JBS (2012b). This is summarised in **Table B3** following.

Table B3: Estimation of Constituent Levels in Seepage Water from Unsaturated Soils

COPC	Maximum Concentration in Unsaturated Soils (mg/kg)	Estimated Leachability (mg/l / mg/kg)	Estimated Maximum Level in Seepage Water from Unsaturated Soils (mg/L)
Ammonia	-	13	-
Arsenic	49	$5.0*10^{-4}$	$2.5*10^{-2}$
Lead	1000	$9.5*10^{-5}$	$9.5*10^{-2}$

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COPC	Maximum Concentration in Unsaturated Soils (mg/kg)	Estimated Leachability (mg/l / mg/kg)	Estimated Maximum Level in Seepage Water from Unsaturated Soils (mg/L)
Nickel	99	$3.3*10^{-4}$	$3.3*10^{-2}$
Acenaphthene	1.9	$3.0*10^{-3}$	$5.7*10^{-3}$
Acenaphthylene	8.7	$1.7*10^{-3}$	$1.5*10^{-2}$
Anthracene	11	$5.9*10^{-4}$	$6.5*10^{-3}$
Benzo(a)pyrene (TEF)	40.4	$5.7*10^{-4}$	$2.3*10^{-2}$
Fluoranthene	5.9	$1.7*10^{-4}$	$1.0*10^{-3}$
Fluorene	64	$2.6*10^{-3}$	0.17
Naphthalene	4.2	$8.7*10^{-3}$	$3.7*10^{-2}$
Phenanthrene	33	$1.0*10^{-3}$	$3.3*10^{-2}$
Pyrene	61	$1.5*10^{-4}$	$9.2*10^{-3}$

Levels of COPCs in seepage water as may occur from discharge of groundwater into the Basement are summarised in **Table B4** following.

Table B4: Constituent Levels in Seepage Water from Groundwater Infiltration into Basement

Constituent	Maximum Concentration in Seepage Water (mg/L)
Arsenic	0.14
Lead	$1.4*10^{-2}$
Nickel	$8.0*10^{-2}$
Ammonia (as N)	42
Acenaphthene	$3.4*10^{-2}$
Acenaphthylene	$9.7*10^{-2}$
Anthracene	$5.6*10^{-2}$
Benzo(a)pyrene (TEF)	$6.7*10^{-2}$
Fluorene	0.12
Fluoranthene	$8.1*10^{-2}$
Naphthalene	1.9
Phenanthrene	0.17
Pyrene	0.12
Benzene	4.3
Toluene	1.9
Ethylbenzene	$7.8*10^{-2}$
Xylenes	0.76
Trimethylbenzenes	0.115
Styrene	$7.0*10^{-3}$

Area of Puddles

This length of the basement wall along the northern and western extents is estimated as being 300m. It has been assumed that the complete length of these walls have puddles of infiltrating seepage water present. The width of the puddles has been assumed to be equal to 100mm, typical of the width of the base of a spoon drain. This is equal to an area of $30m^2$.

Estimating Airborne Concentration

Emission rates are estimated for the whole of the Car Park by this procedure. The actual concentration of constituents in the Car park will be a function of the emission rates and the ventilation (i.e. wind speed) of the Car Park. The airborne concentration of constituents in the car park has been estimated using a box model. The following equation is provided for estimation using a box model to RISC v.4 Users Manual.

$A_c = (F * L) / (U * H)$

Where: A_c – airborne concentration of constituent (g/m^3);

F – flux of constituent ($g/s.m^2$). Assumed to be E divided by the car park area;

L – length of box (m), assumed to be the square root of the area of the car park (240m * 60m = 14 $400m^2$) = 77.5m;

U – wind speed (m/s); and

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H – height of box, equal to 3m (height of car park).

Airborne concentrations as caused by the infiltration of seepage water from unsaturated soils and groundwater seepage are summarised in **Table B5** following.

Table B5: Summary of Potential Maximum Airborne Concentrations of Constituents in Basements

Constituent	Airborne Concentration from Unsaturated Zone Soils Leaching into Basement (mg/m^3)	Airborne Concentration from Groundwater Seepage into Basement (mg/m^3)
Arsenic	-	-
Lead	-	-
Nickel	-	-
Ammonia (as N)	-	$2.5*10^{-2}$
Acenaphthene	$2.4*10^{-5}$	$1.4*10^{-4}$
Acenaphthylene	$3.6*10^{-5}$	$2.4*10^{-4}$
Anthracene	$7.1*10^{-6}$	$6.1*10^{-5}$
Benzo(a)pyrene (TEF)	-	-
Fluorene	$3.5*10^{-4}$	$2.4*10^{-4}$
Fluoranthene	-	-
Naphthalene	$3.8*10^{-4}$	$1.9*10^{-2}$
Phenanthrene	$2.6*10^{-5}$	$1.3*10^{-4}$
Pyrene	$1.8*10^{-6}$	$2.3*10^{-5}$
Benzene	-	0.25
Toluene	-	0.11
Ethylbenzene	-	$4.3*10^{-3}$
Xylenes	-	$4.2*10^{-2}$
Trimethylbenzenes	-	$5.6*10^{-3}$
Styrene	-	$2.5*10^{-4}$

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Unsaturated Zone Soils

	HL	HL	T	Keq	Da	Dw	K(L)	Sc(G)	Puddle Area	de	U	K(G)	K	C(L)	E	Car Park area	Flux (F)	Car Park Length	Car Park Height	A(c)	A(c)
Units	unitless	(atm.m3/g.mol)	(K)	unitless	cm2/s	cm2/s	m/s	(unitless)	m2	m	m/s	m/s	m/s	g/m3	g/s	m2	g/m2.s	m	m	g/m3	mg/m3
Acenaphthene	7.52E-03	1.81E-04	293	7.52E-03	5.06E-02	8.33E-06	2.57E-06	2.85E+00	3.00E+01	6.18E+00	3.00E-03	2.11E-05	1.49E-07	5.70E-03	2.55E-08	1.44E+04	1.77E-12	1.20E+02	3	2.36E-08	2.4E-05
Acenaphthylene	4.66E-03	1.12E-04	293	4.66E-03	4.50E-02	6.98E-06	2.29E-06	3.20E+00	3.00E+01	6.18E+00	3.00E-03	1.95E-05	8.72E-08	1.50E-02	3.93E-08	1.44E+04	2.73E-12	1.20E+02	3	3.63E-08	3.6E-05
Anthracene	2.27E-03	5.46E-05	293	2.27E-03	3.90E-02	7.85E-06	2.47E-06	3.70E+00	3.00E+01	6.18E+00	3.00E-03	1.77E-05	3.95E-08	6.50E-03	7.70E-09	1.44E+04	5.35E-13	1.20E+02	3	7.13E-09	7.1E-06
Fluorene	3.93E-03	9.45E-05	293	3.93E-03	4.40E-02	7.89E-06	2.48E-06	3.28E+00	3.00E+01	6.18E+00	3.00E-03	1.92E-05	7.31E-08	1.70E-01	3.73E-07	1.44E+04	2.59E-11	1.20E+02	3	3.45E-07	3.5E-04
Naphthalene	1.80E-02	4.33E-04	293	1.80E-02	6.05E-02	8.38E-06	2.58E-06	2.38E+00	3.00E+01	6.18E+00	3.00E-03	2.37E-05	3.67E-07	3.70E-02	4.07E-07	1.44E+04	2.83E-11	1.20E+02	3	3.77E-07	3.8E-04
Phenanthrene	1.73E-03	4.16E-05	293	1.73E-03	3.45E-02	6.69E-06	2.22E-06	4.18E+00	3.00E+01	6.18E+00	3.00E-03	1.63E-05	2.78E-08	3.30E-02	2.75E-08	1.44E+04	1.91E-12	1.20E+02	3	2.55E-08	2.6E-05
Pyrene	4.87E-04	1.17E-05	293	4.87E-04	2.87E-02	7.25E-06	2.34E-06	5.02E+00	3.00E+01	6.18E+00	3.00E-03	1.44E-05	6.99E-09	9.20E-03	1.93E-09	1.44E+04	1.34E-13	1.20E+02	3	1.79E-09	1.8E-06

Groundwater Infiltration

	HL	HL	T	Keq	Da	Dw	K(L)	Sc(G)	Puddle Area	de	U	K(G)	K	C(L)	E	Car Park area	Flux (F)	Car Park Length	Car Park Height	A(c)	A(c)
Units	unitless	(atm.m3/g.mol)	(K)	unitless	cm2/s	cm2/s	m/s	(unitless)	m2	m	m/s	m/s	m/s	g/m3	g/s	m2	g/m2.s	m	m	g/m3	mg/m3
Ammonia	6.58E-04	1.58E-05	293	6.58E-04	0.1	1.00E-05	2.91E-06	1.44E+00	3.00E+01	6.18E+00	3.00E-03	3.32E-05	2.17E-08	4.20E+01	2.73E-05	1.44E+04	1.90E-09	1.20E+02	3	2.53E-05	2.5E-02
Benzene	2.27E-01	5.46E-03	293	2.27E-01	8.95E-02	1.03E-05	2.96E-06	1.61E+00	3.00E+01	6.18E+00	3.00E-03	3.09E-05	2.08E-06	4.30E+00	2.69E-04	1.44E+04	1.87E-08	1.20E+02	3	2.49E-04	2.5E-01
Toluene	2.71E-01	6.52E-03	293	2.71E-01	7.78E-02	9.20E-06	2.75E-06	1.85E+00	3.00E+01	6.18E+00	3.00E-03	2.81E-05	2.02E-06	1.90E+00	1.15E-04	1.44E+04	7.99E-09	1.20E+02	3	1.07E-04	1.1E-01
Ethylbenzene	3.22E-01	7.74E-03	293	3.22E-01	6.85E-02	8.46E-06	2.60E-06	2.10E+00	3.00E+01	6.18E+00	3.00E-03	2.58E-05	1.98E-06	7.80E-02	4.63E-06	1.44E+04	3.22E-10	1.20E+02	3	4.29E-06	4.3E-03
Xylenes	2.12E-01	5.10E-03	293	2.12E-01	8.74E-02	9.90E-06	2.89E-06	1.65E+00	3.00E+01	6.18E+00	3.00E-03	3.04E-05	1.99E-06	7.60E-01	4.54E-05	1.44E+04	3.15E-09	1.20E+02	3	4.21E-05	4.2E-02
trimethylbenzene	2.52E-01	6.06E-03	293	2.52E-01	6.07E-02	7.92E-06	2.49E-06	2.38E+00	3.00E+01	6.18E+00	3.00E-03	2.38E-05	1.76E-06	1.15E-01	6.06E-06	1.44E+04	4.21E-10	1.20E+02	3	5.61E-06	5.6E-03
styrene	1.12E-01	2.69E-03	293	1.12E-01	6.07E-02	7.92E-06	2.49E-06	2.38E+00	3.00E+01	6.18E+00	3.00E-03	2.38E-05	1.29E-06	7.00E-03	2.70E-07	1.44E+04	1.88E-11	1.20E+02	3	2.50E-07	2.5E-04
Acenaphthene	7.52E-03	1.81E-04	293	7.52E-03	5.06E-02	8.33E-06	2.57E-06	2.85E+00	3.00E+01	6.18E+00	3.00E-03	2.11E-05	1.49E-07	3.40E-02	1.52E-07	1.44E+04	1.06E-11	1.20E+02	3	1.41E-07	1.4E-04
Acenaphthylene	4.66E-03	1.12E-04	293	4.66E-03	4.50E-02	6.98E-06	2.29E-06	3.20E+00	3.00E+01	6.18E+00	3.00E-03	1.95E-05	8.72E-08	9.70E-02	2.54E-07	1.44E+04	1.76E-11	1.20E+02	3	2.35E-07	2.4E-04
Anthracene	2.27E-03	5.46E-05	293	2.27E-03	3.90E-02	7.85E-06	2.47E-06	3.70E+00	3.00E+01	6.18E+00	3.00E-03	1.77E-05	3.95E-08	5.60E-02	6.64E-08	1.44E+04	4.61E-12	1.20E+02	3	6.14E-08	6.1E-05
Fluorene	3.93E-03	9.45E-05	293	3.93E-03	4.40E-02	7.89E-06	2.48E-06	3.28E+00	3.00E+01	6.18E+00	3.00E-03	1.92E-05	7.31E-08	1.20E-01	2.63E-07	1.44E+04	1.83E-11	1.20E+02	3	2.44E-07	2.4E-04
Naphthalene	1.80E-02	4.33E-04	293	1.80E-02	6.05E-02	8.38E-06	2.58E-06	2.38E+00	3.00E+01	6.18E+00	3.00E-03	2.37E-05	3.67E-07	1.90E+00	2.09E-05	1.44E+04	1.45E-09	1.20E+02	3	1.93E-05	1.9E-02
Phenanthrene	1.73E-03	4.16E-05	293	1.73E-03	3.45E-02	6.69E-06	2.22E-06	4.18E+00	3.00E+01	6.18E+00	3.00E-03	1.63E-05	2.78E-08	1.70E-01	1.42E-07	1.44E+04	9.86E-12	1.20E+02	3	1.31E-07	1.3E-04
Pyrene	4.87E-04	1.17E-05	293	4.87E-04	2.87E-02	7.25E-06	2.34E-06	5.02E+00	3.00E+01	6.18E+00	3.00E-03	1.44E-05	6.99E-09	1.20E-01	2.52E-08	1.44E+04	1.75E-12	1.20E+02	3	2.33E-08	2.3E-05

Appendix C

RISC Outputs

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Summary of Vapour Modelling Results

Constituent (mg/m3)	Source Conc. (GW)	Soil-Outdoors-unpaved-0.5m	Soil-Outdoors-Paved-0.1m	GW-Outdoors-Unpaved-2.0m	GW-Outdoors-Paved-2.0m	Soil-Outdoors-Excavation-0.1m	Soil - Outdoors - Excavation - Particulates	GW-Outdoors-Excavation-1.5m	Soil-Basement-0.1m	Seepage (Unsat) - Basement	Seepage (GW) - Basement	Background conc.	Maximum Airborne Conc (aesthetic assessment)
Acenaphthene	0.25568	3.89E-06	1.79E-06	2.63E-07	1.76E-07	7.78E-04	1.71E-07	1.40E-05	1.90E-04	2.40E-05	1.40E-04		7.78E-04
Acenaphthylene	0.45202	9.82E-06	5.01E-06	4.14E-07	2.87E-07	1.96E-03	7.83E-07	2.21E-05	5.34E-04	3.60E-05	2.40E-04		1.96E-03
Ammonia	27.636			5.62E-05	2.84E-05			3.00E-03			2.50E-02		2.50E-02
Anthracene	0.12712	3.13E-07	1.81E-07	1.01E-07	7.30E-08	6.25E-05	9.90E-07	5.38E-06	1.94E-05	7.10E-06	6.10E-05		6.25E-05
Arsenic												5.10E-07	0.00E+00
Benzene	976.1			1.78E-03	9.48E-04			9.48E-02			0.25	1.30E-03	2.50E-01
Benzo(a)pyrene (TEF)							0.000003636						3.64E-06
Ethylbenzene	25.116			3.50E-05	2.10E-05			1.87E-03			4.30E-03	2.20E-03	4.30E-03
Fluoranthene							0.000000531						5.31E-07
Fluorene	0.4716	2.38E-05	1.24E-05	4.22E-07	2.95E-07	4.76E-03	5.76E-06	2.25E-05	1.32E-03	3.50E-04	2.40E-04		4.76E-03
Lead							9.00E-05					4.80E-05	9.00E-05
Naphthalene	34.2	7.99E-05	3.12E-05	4.21E-05	2.65E-05	1.60E-02	3.78E-07	2.24E-03	3.29E-03	3.80E-04	1.90E-02		1.90E-02
Nickel													0.00E+00
Phenanthrene	0.2941	3.20E-06	2.07E-06	2.06E-07	1.54E-07	6.39E-04	2.97E-06	1.10E-05	2.22E-04	2.60E-05	1.30E-04		6.39E-04
Pyrene	0.05844	1.49E-07	1.16E-07	3.31E-08	2.60E-08	2.98E-05	5.49E-06	1.76E-06	1.25E-05	1.80E-06	2.30E-05		2.98E-05
Styrene	0.784			1.13E-06	6.69E-07			6.04E-05			2.50E-04	4.00E-04	2.50E-04
Toluene	514.9			8.15E-04	4.63E-04			4.35E-02			0.11	1.54E-02	1.10E-01
Trimethylbenzene	28.98			3.58E-05	2.25E-05			1.91E-03			5.60E-03	5.00E-04	5.60E-03
Xylenes	161.12			2.78E-04	1.52E-04			1.48E-02			4.20E-02	1.31E-02	4.20E-02

Summary of Vapour Modelling Results

Constituent (mg/m3)	Risk/HI	Inhalation Tox (mg/m3) or (mg/m3)-1	Recreational Outdoor			Comm / Ind Outdoor			Maintenance Worker				Resident
			RAGS F	Air Conc.	Risk / HI	RAGS F	Air Conc.	Risk / HI	RAGS F	Air Conc.	Inh. Risk / HI	Oral + Derm Risk/HI	RAGS F - Basement (adult)
Acenaphthene	HI	0.21	6.1E-02	3.9E-06	1.1E-06	2.2E-01	3.9E-06	4.1E-06	1.4E-02	7.8E-04	5.1E-05	2.0E-05	4.2E-02
Acenaphthylene	HI	0.21	6.1E-02	9.8E-06	2.8E-06	2.2E-01	9.8E-06	1.0E-05	1.4E-02	2.0E-03	1.3E-04	9.2E-05	4.2E-02
Ammonia	HI	0.07	6.1E-02	5.6E-05	4.9E-05	2.2E-01	5.6E-05	1.8E-04	1.4E-02	3.0E-03	5.9E-04		4.2E-02
Anthracene	HI	1.1	6.1E-02	3.1E-07	1.7E-08	2.2E-01	3.1E-07	6.2E-08	1.4E-02	6.3E-05	7.9E-07	2.3E-05	4.2E-02
Arsenic	HI	1.50E-05	6.1E-02	5.1E-07	2.1E-03	2.2E-01	5.1E-07	7.4E-03	1.4E-02	5.1E-07	4.7E-04		4.2E-02
Benzene	Risk	6.00E-03	6.1E-02	1.8E-03	6.5E-07	9.3E-02	1.8E-03	1.0E-06	2.0E-03	9.5E-02	1.1E-06		3.2E-02
Benzene	HI	1.00E-02	6.1E-02	3.1E-03	1.9E-02	2.2E-01	3.1E-03	6.7E-02	1.4E-02	9.6E-02	1.3E-01		4.2E-02
Benzo(a)pyrene (TEF)	Risk	87	6.1E-02	0.0E+00	0.0E+00	9.3E-02	0.0E+00	0.0E+00	2.0E-03	3.6E-06	6.2E-07	6.4E-06	3.2E-02
Ethylbenzene	HI	0.27	6.1E-02	2.2E-03	5.0E-04	2.2E-01	2.2E-03	1.8E-03	1.4E-02	4.1E-03	2.1E-04		4.2E-02
Fluoranthene	HI	0.14	6.1E-02	0.0E+00	0.0E+00	2.2E-01	0.0E+00	0.0E+00	1.4E-02	5.3E-07	5.2E-08	9.4E-05	4.2E-02
Fluorene	HI	0.14	6.1E-02	2.4E-05	1.0E-05	2.2E-01	2.4E-05	3.7E-05	1.4E-02	4.8E-03	4.7E-04	1.0E-03	4.2E-02
Lead	HI	5.00E-04	6.1E-02	4.8E-05	5.8E-03	2.2E-01	4.8E-05	2.1E-02	1.4E-02	1.4E-04	3.8E-03	3.5E-01	4.2E-02
Naphthalene	HI	3.50E-03	6.1E-02	8.0E-05	1.4E-03	2.2E-01	8.0E-05	5.0E-03	1.4E-02	1.6E-02	6.3E-02	1.3E-04	4.2E-02
Nickel	Risk	0.4	6.1E-02	0.0E+00	0.0E+00	9.3E-02	0.0E+00	0.0E+00	2.0E-03	0.0E+00	0.0E+00		3.2E-02
	HI		6.1E-02	3.2E-06		2.2E-01	3.2E-06		1.4E-02	6.4E-04			4.2E-02
Phenanthrene	HI	1.1	6.1E-02	1.5E-07	8.2E-09	2.2E-01	1.5E-07	3.0E-08	1.4E-02	3.5E-05	4.4E-07	7.0E-05	4.2E-02
Pyrene	HI	0.1	6.1E-02	4.0E-04	2.4E-04	2.2E-01	4.0E-04	8.8E-04	1.4E-02	4.6E-04	6.3E-05	1.3E-03	4.2E-02
Styrene	HI	0.85	6.1E-02	1.6E-02	1.2E-03	2.2E-01	1.6E-02	4.2E-03	1.4E-02	5.9E-02	9.5E-04		4.2E-02
Toluene	HI	5	6.1E-02	5.4E-04	6.5E-06	2.2E-01	5.4E-04	2.3E-05	1.4E-02	2.4E-03	6.6E-06		4.2E-02
Trimethylbenzene	HI	0.22	6.1E-02	1.3E-02	3.7E-03	2.2E-01	1.3E-02	1.3E-02	1.4E-02	2.8E-02	1.7E-03		4.2E-02
Xylenes	HI	0.87	6.1E-02	0.0E+00	0.0E+00	2.2E-01	0.0E+00	0.0E+00	1.4E-02	0.0E+00	0.0E+00		4.2E-02
		HI Sum			3.4E-02			1.2E-01			2.0E-01	3.5E-01	
		Risk Sum			6.5E-07			1.0E-06			1.7E-06	6.4E-06	

Summary of Vapour Modelling Resul

Constituent (mg/m3)	Risk/HI								**Comm / Ind (Car Park)**		
		RAGS F - Basement (child)	Air Conc. - Basement	RAGS F - Building	Air Conc. - Building	Inh. Risk / HI	Dermal Risk / HI (Child)	Dermal Risk / HI (Adult)	RAGS F	Air Conc.	Risk / HI
Acenaphthene	HI	2.1E-02	1.9E-04	8.3E-01	1.7E-04	7.0E-04	3.8E-05	4.1E-05	2.2E-01	1.9E-04	2.0E-04
Acenaphthylene	HI	2.1E-02	5.3E-04	8.3E-01	4.7E-04	2.0E-03	1.1E-04	1.3E-04	2.2E-01	5.3E-04	5.6E-04
Ammonia	HI	2.1E-02	2.5E-02	8.3E-01	2.2E-02	2.8E-01			2.2E-01	2.5E-02	7.8E-02
Anthracene	HI	2.1E-02	6.1E-05	8.3E-01	5.3E-05	4.3E-05	2.1E-05	2.3E-05	2.2E-01	6.1E-05	1.2E-05
Arsenic	HI	2.1E-02	5.1E-07	8.3E-01	4.5E-07	2.6E-02	3.0E-01	3.0E-01	2.2E-01	5.1E-07	7.4E-03
Benzene	Risk	4.8E-03	2.5E-01	8.3E-01	2.2E-01	1.1E-03	3.3E-07	1.5E-06	9.3E-02	2.5E-01	1.4E-04
Benzene	HI	2.1E-02	2.5E-01	8.3E-01	2.2E-01	1.9E+01	1.0E-01	1.1E-01	2.2E-01	2.5E-01	5.5E+00
Benzo(a)pyrene (TEF)	Risk	4.8E-03	0.0E+00	8.3E-01	0.0E+00	0.0E+00	1.8E-04	7.8E-04	9.3E-02	0.0E+00	0.0E+00
Ethylbenzene	HI	2.1E-02	6.5E-03	8.3E-01	5.7E-03	1.9E-02	3.1E-05	3.4E-05	2.2E-01	6.5E-03	5.3E-03
Fluoranthene	HI	2.1E-02	0.0E+00	8.3E-01	0.0E+00	0.0E+00	4.9E-04	5.3E-04	2.2E-01	0.0E+00	0.0E+00
Fluorene	HI	2.1E-02	1.3E-03	8.3E-01	1.2E-03	7.3E-03	2.6E-04	2.8E-04	2.2E-01	1.3E-03	2.1E-03
Lead	HI	2.1E-02	4.8E-05	8.3E-01	4.2E-05	7.4E-02	2.0E-01	2.0E-01	2.2E-01	4.8E-05	2.1E-02
Naphthalene	HI	2.1E-02	1.9E-02	8.3E-01	1.7E-02	4.2E+00	3.5E-03	3.8E-03	2.2E-01	1.9E-02	1.2E+00
Nickel	Risk	4.8E-03	0.0E+00	8.3E-01	0.0E+00	0.0E+00			9.3E-02	0.0E+00	0.0E+00
	HI	2.1E-02	2.2E-04	8.3E-01	1.9E-04		6.2E-05	6.8E-05	2.2E-01	2.2E-04	
Phenanthrene	HI	2.1E-02	2.3E-05	8.3E-01	2.0E-05	1.6E-05	6.4E-05	6.9E-05	2.2E-01	2.3E-05	4.6E-06
Pyrene	HI	2.1E-02	6.5E-04	8.3E-01	5.7E-04	5.0E-03	6.3E-04	6.8E-05	2.2E-01	6.5E-04	1.4E-03
Styrene	HI	2.1E-02	1.3E-01	8.3E-01	1.1E-01	1.1E-01	2.6E-04	2.9E-04	2.2E-01	1.3E-01	3.2E-02
Toluene	HI	2.1E-02	6.1E-03	8.3E-01	5.3E-03	9.4E-04	2.1E-04	2.3E-04	2.2E-01	6.1E-03	2.7E-04
Trimethylbenzene	HI	2.1E-02	5.5E-02	8.3E-01	4.8E-02	1.9E-01	3.8E-03	4.2E-03	2.2E-01	5.5E-02	5.5E-02
Xylenes	HI	2.1E-02	0.0E+00	8.3E-01	0.0E+00	0.0E+00	1.6E-04	1.7E-04	2.2E-01	0.0E+00	0.0E+00
						2.4E+01	6.1E-01	6.2E-01			6.9E+00
						1.1E-03	1.8E-04	7.8E-04			1.4E-04

Appendix C – Model Outputs

Soil – Vapour – Outdoors – Unpaved – 0.5m Migration Distance

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger model for outdoor air
with volatile emissions from soil

Title:
Soils - Unpaved - Outdoors - 0.5m

Simulation time (years). 70

Soil Source for Vapor Model

Total porosity in source (cm3/cm3).	0.38
Water content in source (cm3/cm3)	5.30E-02
Fraction organic carbon in source(mg/mg)	3.00E-03
Soil bulk density in source (g/cm3).	1.7

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to surface (m)	0.50

OUTDOOR AIR PARAMETERS

Height of box (breathing zone) (m)	2.0
Length of box (m).	10.
Wind speed (m/s)	2.0

TPH Data for Vapor Model Source

Concentration of TPH (mg/kg)	0.0
Molecular weight of TPH (g/mol).	0.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 1.9

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

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Source conc. in soil for outdoor air model (mg/kg) 8.7

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s) 0.10
Diffusion coefficient in water (cm2/s) 1.00E-05
Solubility (mg/l) 4.82E+05
Vapor pressure (mmHg) 7.51E+03
Kd (partition coefficient) (L/kg) 0.40
Henry's Law coefficient (-). 6.58E-04
Molecular weight (g/mol). 17.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s) 3.90E-02
Diffusion coefficient in water (cm2/s) 7.85E-06
Solubility (mg/l) 4.34E-02
Vapor pressure (mmHg) 6.53E-06
KOC (L/kg). 1.64E+04
Henry's Law coefficient (-). 2.27E-03
Molecular weight (g/mol). 1.78E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 11.

CHEMICAL DATA FOR: Arsenic

Diffusion coefficient in air (cm2/s) 0.0
Diffusion coefficient in water (cm2/s) 0.0
Solubility (mg/l) 0.0
Vapor pressure (mmHg) 0.0
Kd (partition coefficient) (L/kg) 29.
Henry's Law coefficient (-). 0.0
Molecular weight (g/mol). 78.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s) 8.95E-02
Diffusion coefficient in water (cm2/s) 1.03E-05
Solubility (mg/l) 1.79E+03
Vapor pressure (mmHg) 95.
KOC (L/kg). 1.46E+02
Henry's Law coefficient (-). 0.23
Molecular weight (g/mol). 78.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Benzo(a)pyrene

Diffusion coefficient in air (cm2/s) 4.30E-02
Diffusion coefficient in water (cm2/s) 9.00E-06
Solubility (mg/l) 1.62E-03
Vapor pressure (mmHg) 5.49E-09

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KOC (L/kg). 5.87E+05
Henry's Law coefficient (-). 1.87E-05
Molecular weight (g/mol). 2.52E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s) 6.85E-02
Diffusion coefficient in water (cm2/s) 8.46E-06
Solubility (mg/l) 1.69E+02
Vapor pressure (mmHg) 9.6
KOC (L/kg). 4.46E+02
Henry's Law coefficient (-). 0.32
Molecular weight (g/mol). 1.06E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Fluoranthene

Diffusion coefficient in air (cm2/s) 3.00E-02
Diffusion coefficient in water (cm2/s) 6.40E-06
Solubility (mg/l) 0.26
Vapor pressure (mmHg) 9.22E-06
KOC (L/kg). 5.55E+04
Henry's Law coefficient (-). 3.62E-04
Molecular weight (g/mol). 2.02E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s) 4.40E-02
Diffusion coefficient in water (cm2/s) 7.89E-06
Solubility (mg/l) 1.7
Vapor pressure (mmHg) 6.00E-04
KOC (L/kg). 9.16E+03
Henry's Law coefficient (-). 3.93E-03
Molecular weight (g/mol). 1.66E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 64.

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s) 6.05E-02
Diffusion coefficient in water (cm2/s) 8.38E-06
Solubility (mg/l) 31.
Vapor pressure (mmHg) 8.50E-02
KOC (L/kg). 1.54E+03
Henry's Law coefficient (-). 1.80E-02
Molecular weight (g/mol). 1.28E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 4.2

CHEMICAL DATA FOR: Nickel

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Diffusion coefficient in air (cm2/s) 0.0
Diffusion coefficient in water (cm2/s) 0.0
Solubility (mg/l) 1.73E+05
Vapor pressure (mmHg) 0.0
Kd (partition coefficient) (L/kg) 65.
Henry's Law coefficient (-). 0.0
Molecular weight (g/mol). 59.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Phenanthrene

Diffusion coefficient in air (cm2/s) 3.45E-02
Diffusion coefficient in water (cm2/s) 6.69E-06
Solubility (mg/l) 1.1
Vapor pressure (mmHg) 1.21E-04
KOC (L/kg). 1.67E+04
Henry's Law coefficient (-). 1.73E-03
Molecular weight (g/mol). 1.78E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 33.

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s) 2.78E-02
Diffusion coefficient in water (cm2/s) 7.25E-06
Solubility (mg/l) 0.14
Vapor pressure (mmHg) 4.50E-06
KOC (L/kg). 5.43E+04
Henry's Law coefficient (-). 4.87E-04
Molecular weight (g/mol). 2.02E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 61.

CHEMICAL DATA FOR: Styrene

Diffusion coefficient in air (cm2/s) 7.10E-02
Diffusion coefficient in water (cm2/s) 8.00E-06
Solubility (mg/l) 3.10E+02
Vapor pressure (mmHg) 6.4
KOC (L/kg). 4.46E+02
Henry's Law coefficient (-). 0.11
Molecular weight (g/mol). 1.04E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s) 7.78E-02
Diffusion coefficient in water (cm2/s) 9.20E-06
Solubility (mg/l) 5.26E+02
Vapor pressure (mmHg) 28.
KOC (L/kg). 2.34E+02
Henry's Law coefficient (-). 0.27
Molecular weight (g/mol). 92.

Source Concentrations:

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Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s)	6.07E-02
Diffusion coefficient in water (cm2/s)	7.92E-06
Solubility (mg/l)	57.
Vapor pressure (mmHg)	2.1
KOC (L/kg).	7.18E+02
Henry's Law coefficient (-).	0.25
Molecular weight (g/mol).	1.69E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

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Soil – Vapour – Outdoors – Paved – 0.1m Migration Distance

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger Indoor air model
with volatile emissions from soil

Title:
Soil - Paved Outdoors - 0.1m

Simulation time (years). 70

Soil Source for Vapor Model

Total porosity in source (cm3/cm3).	0.38
Water content in source (cm3/cm3)	5.30E-02
Fraction organic carbon in source(mg/mg)	3.00E-03
Soil bulk density in source (g/cm3).	1.7

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to building (m)	0.10

Building Parameters

Cross-sect. area of basement (m2).	1.00E+02
Volume of building (m3).	2.00E+02
Number of air changes per day.	1.73E+04
Foundation thickness (m)	5.00E-02
Flow rate of soil gas into building (cm3/s)	83.

TPH Data for Vapor Model Source

Concentration of TPH (mg/kg)	0.0
Molecular weight of TPH (g/mol).	0.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 1.9

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

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Source conc. in soil for vapor model (mg/kg) 8.7

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s) 0.10
Diffusion coefficient in water (cm2/s) 1.00E-05
Solubility (mg/l) 4.82E+05
Vapor pressure (mmHg) 7.51E+03
Kd (partition coefficient) (L/kg) 0.40
Henry's Law coefficient (-). 6.58E-04
Molecular weight (g/mol). 17.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s) 3.90E-02
Diffusion coefficient in water (cm2/s) 7.85E-06
Solubility (mg/l) 4.34E-02
Vapor pressure (mmHg) 6.53E-06
KOC (L/kg). 1.64E+04
Henry's Law coefficient (-). 2.27E-03
Molecular weight (g/mol). 1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 11.

CHEMICAL DATA FOR: Arsenic

Diffusion coefficient in air (cm2/s) 0.0
Diffusion coefficient in water (cm2/s) 0.0
Solubility (mg/l) 0.0
Vapor pressure (mmHg) 0.0
Kd (partition coefficient) (L/kg) 29.
Henry's Law coefficient (-). 0.0
Molecular weight (g/mol). 78.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s) 8.95E-02
Diffusion coefficient in water (cm2/s) 1.03E-05
Solubility (mg/l) 1.79E+03
Vapor pressure (mmHg) 95.
KOC (L/kg). 1.46E+02
Henry's Law coefficient (-). 0.23
Molecular weight (g/mol). 78.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Benzo(a)pyrene

Diffusion coefficient in air (cm2/s) 4.30E-02
Diffusion coefficient in water (cm2/s) 9.00E-06
Solubility (mg/l) 1.62E-03
Vapor pressure (mmHg) 5.49E-09

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KOC (L/kg). 5.87E+05
Henry's Law coefficient (-). 1.87E-05
Molecular weight (g/mol). 2.52E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s) 6.85E-02
Diffusion coefficient in water (cm2/s) 8.46E-06
Solubility (mg/l) 1.69E+02
Vapor pressure (mmHg) 9.6
KOC (L/kg). 4.46E+02
Henry's Law coefficient (-). 0.32
Molecular weight (g/mol). 1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Fluoranthene

Diffusion coefficient in air (cm2/s) 3.00E-02
Diffusion coefficient in water (cm2/s) 6.40E-06
Solubility (mg/l) 0.26
Vapor pressure (mmHg) 9.22E-06
KOC (L/kg). 5.55E+04
Henry's Law coefficient (-). 3.62E-04
Molecular weight (g/mol). 2.02E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s) 4.40E-02
Diffusion coefficient in water (cm2/s) 7.89E-06
Solubility (mg/l) 1.7
Vapor pressure (mmHg) 6.00E-04
KOC (L/kg). 9.16E+03
Henry's Law coefficient (-). 3.93E-03
Molecular weight (g/mol). 1.66E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 64.

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s) 6.05E-02
Diffusion coefficient in water (cm2/s) 8.38E-06
Solubility (mg/l) 31.
Vapor pressure (mmHg) 8.50E-02
KOC (L/kg). 1.54E+03
Henry's Law coefficient (-). 1.80E-02
Molecular weight (g/mol). 1.28E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 4.2

CHEMICAL DATA FOR: Nickel

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Diffusion coefficient in air (cm2/s) 0.0
Diffusion coefficient in water (cm2/s) 0.0
Solubility (mg/l) 1.73E+05
Vapor pressure (mmHg) 0.0
Kd (partition coefficient) (L/kg) 65.
Henry's Law coefficient (-). 0.0
Molecular weight (g/mol). 59.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Phenanthrene

Diffusion coefficient in air (cm2/s) 3.45E-02
Diffusion coefficient in water (cm2/s) 6.69E-06
Solubility (mg/l) 1.1
Vapor pressure (mmHg) 1.21E-04
KOC (L/kg). 1.67E+04
Henry's Law coefficient (-). 1.73E-03
Molecular weight (g/mol). 1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 33.

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s) 2.78E-02
Diffusion coefficient in water (cm2/s) 7.25E-06
Solubility (mg/l) 0.14
Vapor pressure (mmHg) 4.50E-06
KOC (L/kg). 5.43E+04
Henry's Law coefficient (-). 4.87E-04
Molecular weight (g/mol). 2.02E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 61.

CHEMICAL DATA FOR: Styrene

Diffusion coefficient in air (cm2/s) 7.10E-02
Diffusion coefficient in water (cm2/s) 8.00E-06
Solubility (mg/l) 3.10E+02
Vapor pressure (mmHg) 6.4
KOC (L/kg). 4.46E+02
Henry's Law coefficient (-). 0.11
Molecular weight (g/mol). 1.04E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s) 7.78E-02
Diffusion coefficient in water (cm2/s) 9.20E-06
Solubility (mg/l) 5.26E+02
Vapor pressure (mmHg) 28.
KOC (L/kg). 2.34E+02
Henry's Law coefficient (-). 0.27
Molecular weight (g/mol). 92.

Source Concentrations:

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Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s) 6.07E-02
Diffusion coefficient in water (cm2/s) 7.92E-06
Solubility (mg/l) 57.
Vapor pressure (mmHg) 2.1
KOC (L/kg). 7.18E+02
Henry's Law coefficient (-). 0.25
Molecular weight (g/mol). 1.69E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s) 8.47E-02
Diffusion coefficient in water (cm2/s) 9.90E-06
Solubility (mg/l) 1.06E+02
Vapor pressure (mmHg) 8.0
KOC (L/kg). 3.83E+02
Henry's Law coefficient (-). 0.21
Molecular weight (g/mol). 1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

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Groundwater – Vapour – Outdoors – Unpaved – 2.0m Migration Distance

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger model for outdoor air
with volatile emissions from soil gas

Title:
Groundwater - Outdoors Unpaved - 2.0m

Simulation time (years). 70

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to surface (m)	2.0

OUTDOOR AIR PARAMETERS

Height of box (breathing zone) (m)	2.0
Length of box (m).	10.
Wind speed (m/s)	2.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.26

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.45

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	4.82E+05
Vapor pressure (mmHg)	7.51E+03
Kd (partition coefficient) (L/kg)	0.40
Henry's Law coefficient (-).	6.58E-04
Molecular weight (g/mol).	17.

Source Concentrations:

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Source conc. for outdoor air model (mg/m3) 28.

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s) 3.90E-02
Diffusion coefficient in water (cm2/s) 7.85E-06
Solubility (mg/l) 4.34E-02
Vapor pressure (mmHg) 6.53E-06
KOC (L/kg). 1.64E+04
Henry's Law coefficient (-). 2.27E-03
Molecular weight (g/mol). 1.78E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.13

CHEMICAL DATA FOR: Arsenic

Diffusion coefficient in air (cm2/s) 0.0
Diffusion coefficient in water (cm2/s) 0.0
Solubility (mg/l) 0.0
Vapor pressure (mmHg) 0.0
Kd (partition coefficient) (L/kg) 29.
Henry's Law coefficient (-). 0.0
Molecular weight (g/mol). 78.

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s) 8.95E-02
Diffusion coefficient in water (cm2/s) 1.03E-05
Solubility (mg/l) 1.79E+03
Vapor pressure (mmHg) 95.
KOC (L/kg). 1.46E+02
Henry's Law coefficient (-). 0.23
Molecular weight (g/mol). 78.

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 9.76E+02

CHEMICAL DATA FOR: Benzo(a)pyrene

Diffusion coefficient in air (cm2/s) 4.30E-02
Diffusion coefficient in water (cm2/s) 9.00E-06
Solubility (mg/l) 1.62E-03
Vapor pressure (mmHg) 5.49E-09
KOC (L/kg). 5.87E+05
Henry's Law coefficient (-). 1.87E-05
Molecular weight (g/mol). 2.52E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s) 6.85E-02
Diffusion coefficient in water (cm2/s) 8.46E-06
Solubility (mg/l) 1.69E+02
Vapor pressure (mmHg) 9.6
KOC (L/kg). 4.46E+02

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Henry's Law coefficient (-). 0.32
Molecular weight (g/mol). 1.06E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 25.

CHEMICAL DATA FOR: Fluoranthene

Diffusion coefficient in air (cm2/s) 3.00E-02
Diffusion coefficient in water (cm2/s) 6.40E-06
Solubility (mg/l) 0.26
Vapor pressure (mmHg) 9.22E-06
KOC (L/kg). 5.55E+04
Henry's Law coefficient (-). 3.62E-04
Molecular weight (g/mol). 2.02E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s) 4.40E-02
Diffusion coefficient in water (cm2/s) 7.89E-06
Solubility (mg/l) 1.7
Vapor pressure (mmHg) 6.00E-04
KOC (L/kg). 9.16E+03
Henry's Law coefficient (-). 3.93E-03
Molecular weight (g/mol). 1.66E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.47

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s) 6.05E-02
Diffusion coefficient in water (cm2/s) 8.38E-06
Solubility (mg/l) 31.
Vapor pressure (mmHg) 8.50E-02
KOC (L/kg). 1.54E+03
Henry's Law coefficient (-). 1.80E-02
Molecular weight (g/mol). 1.28E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 34.

CHEMICAL DATA FOR: Nickel

Diffusion coefficient in air (cm2/s) 0.0
Diffusion coefficient in water (cm2/s) 0.0
Solubility (mg/l) 1.73E+05
Vapor pressure (mmHg) 0.0
Kd (partition coefficient) (L/kg) 65.
Henry's Law coefficient (-). 0.0
Molecular weight (g/mol). 59.

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.0

CHEMICAL DATA FOR: Phenanthrene

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Diffusion coefficient in air (cm2/s) 3.45E-02
Diffusion coefficient in water (cm2/s) 6.69E-06
Solubility (mg/l) 1.1
Vapor pressure (mmHg) 1.21E-04
KOC (L/kg). 1.67E+04
Henry's Law coefficient (-). 1.73E-03
Molecular weight (g/mol). 1.78E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.29

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s) 2.78E-02
Diffusion coefficient in water (cm2/s) 7.25E-06
Solubility (mg/l) 0.14
Vapor pressure (mmHg) 4.50E-06
KOC (L/kg). 5.43E+04
Henry's Law coefficient (-). 4.87E-04
Molecular weight (g/mol). 2.02E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 5.84E-02

CHEMICAL DATA FOR: Styrene

Diffusion coefficient in air (cm2/s) 7.10E-02
Diffusion coefficient in water (cm2/s) 8.00E-06
Solubility (mg/l) 3.10E+02
Vapor pressure (mmHg) 6.4
KOC (L/kg). 4.46E+02
Henry's Law coefficient (-). 0.11
Molecular weight (g/mol). 1.04E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.78

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s) 7.78E-02
Diffusion coefficient in water (cm2/s) 9.20E-06
Solubility (mg/l) 5.26E+02
Vapor pressure (mmHg) 28.
KOC (L/kg). 2.34E+02
Henry's Law coefficient (-). 0.27
Molecular weight (g/mol). 92.

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 5.15E+02

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s) 6.07E-02
Diffusion coefficient in water (cm2/s) 7.92E-06
Solubility (mg/l) 57.
Vapor pressure (mmHg) 2.1
KOC (L/kg). 7.18E+02
Henry's Law coefficient (-). 0.25
Molecular weight (g/mol). 1.69E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 29.

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CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3)	1.61E+02

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Groundwater – Vapour – Outdoors – Paved – 2.0m Migration Distance

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger Indoor air model
with volatile emissions from soil gas

Title:
Groundwater - Paved Outdoors - 2.0m

Simulation time (years). 70

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to building (m)	2.0

Building Parameters

Cross-sect. area of basement (m2).	1.00E+02
Volume of building (m3).	2.00E+02
Number of air changes per day.	1.73E+04
Foundation thickness (m)	5.00E-02
Flow rate of soil gas into building (cm3/s)	83.

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. for vapor model (mg/m3)	0.26

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

Source conc. for vapor model (mg/m3)	0.45

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	4.82E+05
Vapor pressure (mmHg)	7.51E+03
Kd (partition coefficient) (L/kg)	0.40
Henry's Law coefficient (-).	6.58E-04
Molecular weight (g/mol).	17.

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Source Concentrations:

Source conc. for vapor model (mg/m3) 28.

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s) 3.90E-02
Diffusion coefficient in water (cm2/s) 7.85E-06
Solubility (mg/l) 4.34E-02
Vapor pressure (mmHg) 6.53E-06
KOC (L/kg). 1.64E+04
Henry's Law coefficient (-). 2.27E-03
Molecular weight (g/mol). 1.78E+02

Source Concentrations:

Source conc. for vapor model (mg/m3) 0.13

CHEMICAL DATA FOR: Arsenic

Diffusion coefficient in air (cm2/s) 0.0
Diffusion coefficient in water (cm2/s) 0.0
Solubility (mg/l) 0.0
Vapor pressure (mmHg) 0.0
Kd (partition coefficient) (L/kg) 29.
Henry's Law coefficient (-). 0.0
Molecular weight (g/mol). 78.

Source Concentrations:

Source conc. for vapor model (mg/m3) 0.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s) 8.95E-02
Diffusion coefficient in water (cm2/s) 1.03E-05
Solubility (mg/l) 1.79E+03
Vapor pressure (mmHg) 95.
KOC (L/kg). 1.46E+02
Henry's Law coefficient (-). 0.23
Molecular weight (g/mol). 78.

Source Concentrations:

Source conc. for vapor model (mg/m3) 9.76E+02

CHEMICAL DATA FOR: Benzo(a)pyrene

Diffusion coefficient in air (cm2/s) 4.30E-02
Diffusion coefficient in water (cm2/s) 9.00E-06
Solubility (mg/l) 1.62E-03
Vapor pressure (mmHg) 5.49E-09
KOC (L/kg). 5.87E+05
Henry's Law coefficient (-). 1.87E-05
Molecular weight (g/mol). 2.52E+02

Source Concentrations:

Source conc. for vapor model (mg/m3) 0.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s) 6.85E-02
Diffusion coefficient in water (cm2/s) 8.46E-06
Solubility (mg/l) 1.69E+02

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Vapor pressure (mmHg) 9.6
KOC (L/kg). 4.46E+02
Henry's Law coefficient (-). 0.32
Molecular weight (g/mol). 1.06E+02

Source Concentrations:

Source conc. for vapor model (mg/m3) 25.

CHEMICAL DATA FOR: Fluoranthene

Diffusion coefficient in air (cm2/s) 3.00E-02
Diffusion coefficient in water (cm2/s) 6.40E-06
Solubility (mg/l) 0.26
Vapor pressure (mmHg) 9.22E-06
KOC (L/kg). 5.55E+04
Henry's Law coefficient (-). 3.62E-04
Molecular weight (g/mol). 2.02E+02

Source Concentrations:

Source conc. for vapor model (mg/m3) 0.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s) 4.40E-02
Diffusion coefficient in water (cm2/s) 7.89E-06
Solubility (mg/l) 1.7
Vapor pressure (mmHg) 6.00E-04
KOC (L/kg). 9.16E+03
Henry's Law coefficient (-). 3.93E-03
Molecular weight (g/mol). 1.66E+02

Source Concentrations:

Source conc. for vapor model (mg/m3) 0.47

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s) 6.05E-02
Diffusion coefficient in water (cm2/s) 8.38E-06
Solubility (mg/l) 31.
Vapor pressure (mmHg) 8.50E-02
KOC (L/kg). 1.54E+03
Henry's Law coefficient (-). 1.80E-02
Molecular weight (g/mol). 1.28E+02

Source Concentrations:

Source conc. for vapor model (mg/m3) 34.

CHEMICAL DATA FOR: Nickel

Diffusion coefficient in air (cm2/s) 0.0
Diffusion coefficient in water (cm2/s) 0.0
Solubility (mg/l) 1.73E+05
Vapor pressure (mmHg) 0.0
Kd (partition coefficient) (L/kg) 65.
Henry's Law coefficient (-). 0.0
Molecular weight (g/mol). 59.

Source Concentrations:

Source conc. for vapor model (mg/m3) 0.0

CHEMICAL DATA FOR: Phenanthrene

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Diffusion coefficient in air (cm2/s)	3.45E-02
Diffusion coefficient in water (cm2/s)	6.69E-06
Solubility (mg/l)	1.1
Vapor pressure (mmHg)	1.21E-04
KOC (L/kg).	1.67E+04
Henry's Law coefficient (-).	1.73E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. for vapor model (mg/m3) 0.29

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s)	2.78E-02
Diffusion coefficient in water (cm2/s)	7.25E-06
Solubility (mg/l)	0.14
Vapor pressure (mmHg)	4.50E-06
KOC (L/kg).	5.43E+04
Henry's Law coefficient (-).	4.87E-04
Molecular weight (g/mol).	2.02E+02

Source Concentrations:

Source conc. for vapor model (mg/m3) 5.84E-02

CHEMICAL DATA FOR: Styrene

Diffusion coefficient in air (cm2/s)	7.10E-02
Diffusion coefficient in water (cm2/s)	8.00E-06
Solubility (mg/l)	3.10E+02
Vapor pressure (mmHg)	6.4
KOC (L/kg).	4.46E+02
Henry's Law coefficient (-).	0.11
Molecular weight (g/mol).	1.04E+02

Source Concentrations:

Source conc. for vapor model (mg/m3) 0.78

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s)	7.78E-02
Diffusion coefficient in water (cm2/s)	9.20E-06
Solubility (mg/l)	5.26E+02
Vapor pressure (mmHg)	28.
KOC (L/kg).	2.34E+02
Henry's Law coefficient (-).	0.27
Molecular weight (g/mol).	92.

Source Concentrations:

Source conc. for vapor model (mg/m3) 5.15E+02

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s)	6.07E-02
Diffusion coefficient in water (cm2/s)	7.92E-06
Solubility (mg/l)	57.
Vapor pressure (mmHg)	2.1
KOC (L/kg).	7.18E+02
Henry's Law coefficient (-).	0.25
Molecular weight (g/mol).	1.69E+02

Source Concentrations:

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Source conc. for vapor model (mg/m3) 29.

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. for vapor model (mg/m3) 1.61E+02

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Soil – Vapour – Outdoor Excavation – 0.1m Migration Distance

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger model for outdoor air
with volatile emissions from soil

Title:
Soils - Outdoor Excavation - 0.1m

Simulation time (years). 70

Soil Source for Vapor Model

Total porosity in source (cm3/cm3). 0.38
Water content in source (cm3/cm3) 5.30E-02
Fraction organic carbon in source(mg/mg) 3.00E-03
Soil bulk density in source (g/cm3). 1.7

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3) 0.38
Water content(cm3/cm3) 5.30E-02
Distance from source to surface (m) 0.10

OUTDOOR AIR PARAMETERS

Height of box (breathing zone) (m) 0.50
Length of box (m). 10.
Wind speed (m/s) 0.20

TPH Data for Vapor Model Source

Concentration of TPH (mg/kg) 0.0
Molecular weight of TPH (g/mol). 0.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s) 5.06E-02
Diffusion coefficient in water (cm2/s) 8.33E-06
Solubility (mg/l) 3.9
Vapor pressure (mmHg) 2.15E-03
KOC (L/kg). 5.03E+03
Henry's Law coefficient (-). 7.52E-03
Molecular weight (g/mol). 1.54E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 1.9

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s) 4.50E-02
Diffusion coefficient in water (cm2/s) 6.98E-06
Solubility (mg/l) 16.
Vapor pressure (mmHg) 6.68E-03
KOC (L/kg). 5.03E+03
Henry's Law coefficient (-). 4.66E-03
Molecular weight (g/mol). 1.52E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 8.7

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CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	4.82E+05
Vapor pressure (mmHg)	7.51E+03
Kd (partition coefficient) (L/kg)	0.40
Henry's Law coefficient (-).	6.58E-04
Molecular weight (g/mol).	17.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	0.0

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s)	3.90E-02
Diffusion coefficient in water (cm2/s)	7.85E-06
Solubility (mg/l)	4.34E-02
Vapor pressure (mmHg)	6.53E-06
KOC (L/kg).	1.64E+04
Henry's Law coefficient (-).	2.27E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	11.

CHEMICAL DATA FOR: Arsenic

Diffusion coefficient in air (cm2/s)	0.0
Diffusion coefficient in water (cm2/s)	0.0
Solubility (mg/l)	0.0
Vapor pressure (mmHg)	0.0
Kd (partition coefficient) (L/kg)	29.
Henry's Law coefficient (-).	0.0
Molecular weight (g/mol).	78.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	0.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s)	8.95E-02
Diffusion coefficient in water (cm2/s)	1.03E-05
Solubility (mg/l)	1.79E+03
Vapor pressure (mmHg)	95.
KOC (L/kg).	1.46E+02
Henry's Law coefficient (-).	0.23
Molecular weight (g/mol).	78.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	0.0

CHEMICAL DATA FOR: Benzo(a)pyrene

Diffusion coefficient in air (cm2/s)	4.30E-02
Diffusion coefficient in water (cm2/s)	9.00E-06
Solubility (mg/l)	1.62E-03
Vapor pressure (mmHg)	5.49E-09
KOC (L/kg).	5.87E+05
Henry's Law coefficient (-).	1.87E-05

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Molecular weight (g/mol). 2.52E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s) 6.85E-02
Diffusion coefficient in water (cm2/s) 8.46E-06
Solubility (mg/l) 1.69E+02
Vapor pressure (mmHg) 9.6
KOC (L/kg). 4.46E+02
Henry's Law coefficient (-). 0.32
Molecular weight (g/mol). 1.06E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Fluoranthene

Diffusion coefficient in air (cm2/s) 3.00E-02
Diffusion coefficient in water (cm2/s) 6.40E-06
Solubility (mg/l) 0.26
Vapor pressure (mmHg) 9.22E-06
KOC (L/kg). 5.55E+04
Henry's Law coefficient (-). 3.62E-04
Molecular weight (g/mol). 2.02E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s) 4.40E-02
Diffusion coefficient in water (cm2/s) 7.89E-06
Solubility (mg/l) 1.7
Vapor pressure (mmHg) 6.00E-04
KOC (L/kg). 9.16E+03
Henry's Law coefficient (-). 3.93E-03
Molecular weight (g/mol). 1.66E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 64.

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s) 6.05E-02
Diffusion coefficient in water (cm2/s) 8.38E-06
Solubility (mg/l) 31.
Vapor pressure (mmHg) 8.50E-02
KOC (L/kg). 1.54E+03
Henry's Law coefficient (-). 1.80E-02
Molecular weight (g/mol). 1.28E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 4.2

CHEMICAL DATA FOR: Nickel

Diffusion coefficient in air (cm2/s) 0.0

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Diffusion coefficient in water (cm2/s)	0.0
Solubility (mg/l)	1.73E+05
Vapor pressure (mmHg)	0.0
Kd (partition coefficient) (L/kg)	65.
Henry's Law coefficient (-).	0.0
Molecular weight (g/mol).	59.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Phenanthrene

Diffusion coefficient in air (cm2/s)	3.45E-02
Diffusion coefficient in water (cm2/s)	6.69E-06
Solubility (mg/l)	1.1
Vapor pressure (mmHg)	1.21E-04
KOC (L/kg).	1.67E+04
Henry's Law coefficient (-).	1.73E-03
Molecular weight (g/mol).	1.78E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 33.

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s)	2.78E-02
Diffusion coefficient in water (cm2/s)	7.25E-06
Solubility (mg/l)	0.14
Vapor pressure (mmHg)	4.50E-06
KOC (L/kg).	5.43E+04
Henry's Law coefficient (-).	4.87E-04
Molecular weight (g/mol).	2.02E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 61.

CHEMICAL DATA FOR: Styrene

Diffusion coefficient in air (cm2/s)	7.10E-02
Diffusion coefficient in water (cm2/s)	8.00E-06
Solubility (mg/l)	3.10E+02
Vapor pressure (mmHg)	6.4
KOC (L/kg).	4.46E+02
Henry's Law coefficient (-).	0.11
Molecular weight (g/mol).	1.04E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s)	7.78E-02
Diffusion coefficient in water (cm2/s)	9.20E-06
Solubility (mg/l)	5.26E+02
Vapor pressure (mmHg)	28.
KOC (L/kg).	2.34E+02
Henry's Law coefficient (-).	0.27
Molecular weight (g/mol).	92.

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg) 0.0

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CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s)	6.07E-02
Diffusion coefficient in water (cm2/s)	7.92E-06
Solubility (mg/l)	57.
Vapor pressure (mmHg)	2.1
KOC (L/kg).	7.18E+02
Henry's Law coefficient (-).	0.25
Molecular weight (g/mol).	1.69E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	0.0

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. in soil for outdoor air model (mg/kg)	0.0

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Groundwater – Vapour – Outdoor Excavation – 1.5m Migration Distance

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger model for outdoor air
with volatile emissions from soil gas

Title:
Groundwater - Outdoor Excavation - 1.5m

Simulation time (years). 70

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to surface (m)	1.5

OUTDOOR AIR PARAMETERS

Height of box (breathing zone) (m)	0.50
Length of box (m).	10.
Wind speed (m/s)	0.20

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.26

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.45

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s)	0.10
Diffusion coefficient in water (cm2/s)	1.00E-05
Solubility (mg/l)	4.82E+05
Vapor pressure (mmHg)	7.51E+03
Kd (partition coefficient) (L/kg)	0.40
Henry's Law coefficient (-).	6.58E-04
Molecular weight (g/mol).	17.

Source Concentrations:

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Source conc. for outdoor air model (mg/m3) 28.

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s) 3.90E-02
Diffusion coefficient in water (cm2/s) 7.85E-06
Solubility (mg/l) 4.34E-02
Vapor pressure (mmHg) 6.53E-06
KOC (L/kg). 1.64E+04
Henry's Law coefficient (-). 2.27E-03
Molecular weight (g/mol). 1.78E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.13

CHEMICAL DATA FOR: Arsenic

Diffusion coefficient in air (cm2/s) 0.0
Diffusion coefficient in water (cm2/s) 0.0
Solubility (mg/l) 0.0
Vapor pressure (mmHg) 0.0
Kd (partition coefficient) (L/kg) 29.
Henry's Law coefficient (-). 0.0
Molecular weight (g/mol). 78.

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s) 8.95E-02
Diffusion coefficient in water (cm2/s) 1.03E-05
Solubility (mg/l) 1.79E+03
Vapor pressure (mmHg) 95.
KOC (L/kg). 1.46E+02
Henry's Law coefficient (-). 0.23
Molecular weight (g/mol). 78.

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 9.76E+02

CHEMICAL DATA FOR: Benzo(a)pyrene

Diffusion coefficient in air (cm2/s) 4.30E-02
Diffusion coefficient in water (cm2/s) 9.00E-06
Solubility (mg/l) 1.62E-03
Vapor pressure (mmHg) 5.49E-09
KOC (L/kg). 5.87E+05
Henry's Law coefficient (-). 1.87E-05
Molecular weight (g/mol). 2.52E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s) 6.85E-02
Diffusion coefficient in water (cm2/s) 8.46E-06
Solubility (mg/l) 1.69E+02
Vapor pressure (mmHg) 9.6
KOC (L/kg). 4.46E+02

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Henry's Law coefficient (-). 0.32
Molecular weight (g/mol). 1.06E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 25.

CHEMICAL DATA FOR: Fluoranthene

Diffusion coefficient in air (cm2/s) 3.00E-02
Diffusion coefficient in water (cm2/s) 6.40E-06
Solubility (mg/l) 0.26
Vapor pressure (mmHg) 9.22E-06
KOC (L/kg). 5.55E+04
Henry's Law coefficient (-). 3.62E-04
Molecular weight (g/mol). 2.02E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s) 4.40E-02
Diffusion coefficient in water (cm2/s) 7.89E-06
Solubility (mg/l) 1.7
Vapor pressure (mmHg) 6.00E-04
KOC (L/kg). 9.16E+03
Henry's Law coefficient (-). 3.93E-03
Molecular weight (g/mol). 1.66E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.47

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s) 6.05E-02
Diffusion coefficient in water (cm2/s) 8.38E-06
Solubility (mg/l) 31.
Vapor pressure (mmHg) 8.50E-02
KOC (L/kg). 1.54E+03
Henry's Law coefficient (-). 1.80E-02
Molecular weight (g/mol). 1.28E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 34.

CHEMICAL DATA FOR: Nickel

Diffusion coefficient in air (cm2/s) 0.0
Diffusion coefficient in water (cm2/s) 0.0
Solubility (mg/l) 1.73E+05
Vapor pressure (mmHg) 0.0
Kd (partition coefficient) (L/kg) 65.
Henry's Law coefficient (-). 0.0
Molecular weight (g/mol). 59.

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.0

CHEMICAL DATA FOR: Phenanthrene

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Diffusion coefficient in air (cm2/s) 3.45E-02
Diffusion coefficient in water (cm2/s) 6.69E-06
Solubility (mg/l) 1.1
Vapor pressure (mmHg) 1.21E-04
KOC (L/kg). 1.67E+04
Henry's Law coefficient (-). 1.73E-03
Molecular weight (g/mol). 1.78E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.29

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s) 2.78E-02
Diffusion coefficient in water (cm2/s) 7.25E-06
Solubility (mg/l) 0.14
Vapor pressure (mmHg) 4.50E-06
KOC (L/kg). 5.43E+04
Henry's Law coefficient (-). 4.87E-04
Molecular weight (g/mol). 2.02E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 5.84E-02

CHEMICAL DATA FOR: Styrene

Diffusion coefficient in air (cm2/s) 7.10E-02
Diffusion coefficient in water (cm2/s) 8.00E-06
Solubility (mg/l) 3.10E+02
Vapor pressure (mmHg) 6.4
KOC (L/kg). 4.46E+02
Henry's Law coefficient (-). 0.11
Molecular weight (g/mol). 1.04E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 0.78

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s) 7.78E-02
Diffusion coefficient in water (cm2/s) 9.20E-06
Solubility (mg/l) 5.26E+02
Vapor pressure (mmHg) 28.
KOC (L/kg). 2.34E+02
Henry's Law coefficient (-). 0.27
Molecular weight (g/mol). 92.

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 5.15E+02

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s) 6.07E-02
Diffusion coefficient in water (cm2/s) 7.92E-06
Solubility (mg/l) 57.
Vapor pressure (mmHg) 2.1
KOC (L/kg). 7.18E+02
Henry's Law coefficient (-). 0.25
Molecular weight (g/mol). 1.69E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3) 29.

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CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s)	8.47E-02
Diffusion coefficient in water (cm2/s)	9.90E-06
Solubility (mg/l)	1.06E+02
Vapor pressure (mmHg)	8.0
KOC (L/kg).	3.83E+02
Henry's Law coefficient (-).	0.21
Molecular weight (g/mol).	1.06E+02

Source Concentrations:

Source conc. for outdoor air model (mg/m3)	1.61E+02

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Soil – Lateral Migration of Vapour – Basement – 0.1m Migration Distance

FATE AND TRANSPORT MODEL INPUT SUMMARY FILE

Model Description:
Johnson and Ettinger Indoor air model
with volatile emissions from soil

Title:
Soils - Lateral Migration to Basement - 0.1m

Simulation time (years). 70

Soil Source for Vapor Model

Total porosity in source (cm3/cm3).	0.38
Water content in source (cm3/cm3)	5.30E-02
Fraction organic carbon in source(mg/mg)	3.00E-03
Soil bulk density in source (g/cm3).	1.7

Unsaturated Zone Properties for Vapor Model

Total porosity (cm3/cm3)	0.38
Water content(cm3/cm3)	5.30E-02
Distance from source to building (m)	0.10

Building Parameters

Cross-sect. area of basement (m2).	1.50E+02
Volume of building (m3).	4.00E+02
Number of air changes per day.	84.
Foundation thickness (m)	0.15
Flow rate of soil gas into building (cm3/s)	83.

TPH Data for Vapor Model Source

Concentration of TPH (mg/kg)	0.0
Molecular weight of TPH (g/mol).	0.0

CHEMICAL DATA FOR: Acenaphthene

Diffusion coefficient in air (cm2/s)	5.06E-02
Diffusion coefficient in water (cm2/s)	8.33E-06
Solubility (mg/l)	3.9
Vapor pressure (mmHg)	2.15E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	7.52E-03
Molecular weight (g/mol).	1.54E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 1.9

CHEMICAL DATA FOR: Acenaphthylene

Diffusion coefficient in air (cm2/s)	4.50E-02
Diffusion coefficient in water (cm2/s)	6.98E-06
Solubility (mg/l)	16.
Vapor pressure (mmHg)	6.68E-03
KOC (L/kg).	5.03E+03
Henry's Law coefficient (-).	4.66E-03
Molecular weight (g/mol).	1.52E+02

Source Concentrations:

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Source conc. in soil for vapor model (mg/kg) 8.7

CHEMICAL DATA FOR: Ammonia / ammonium

Diffusion coefficient in air (cm2/s) 0.10
Diffusion coefficient in water (cm2/s) 1.00E-05
Solubility (mg/l) 4.82E+05
Vapor pressure (mmHg) 7.51E+03
Kd (partition coefficient) (L/kg) 0.40
Henry's Law coefficient (-). 6.58E-04
Molecular weight (g/mol). 17.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Anthracene

Diffusion coefficient in air (cm2/s) 3.90E-02
Diffusion coefficient in water (cm2/s) 7.85E-06
Solubility (mg/l) 4.34E-02
Vapor pressure (mmHg) 6.53E-06
KOC (L/kg). 1.64E+04
Henry's Law coefficient (-). 2.27E-03
Molecular weight (g/mol). 1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 11.

CHEMICAL DATA FOR: Arsenic

Diffusion coefficient in air (cm2/s) 0.0
Diffusion coefficient in water (cm2/s) 0.0
Solubility (mg/l) 0.0
Vapor pressure (mmHg) 0.0
Kd (partition coefficient) (L/kg) 29.
Henry's Law coefficient (-). 0.0
Molecular weight (g/mol). 78.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Benzene

Diffusion coefficient in air (cm2/s) 8.95E-02
Diffusion coefficient in water (cm2/s) 1.03E-05
Solubility (mg/l) 1.79E+03
Vapor pressure (mmHg) 95.
KOC (L/kg). 1.46E+02
Henry's Law coefficient (-). 0.23
Molecular weight (g/mol). 78.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Benzo(a)pyrene

Diffusion coefficient in air (cm2/s) 4.30E-02
Diffusion coefficient in water (cm2/s) 9.00E-06
Solubility (mg/l) 1.62E-03
Vapor pressure (mmHg) 5.49E-09

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KOC (L/kg). 5.87E+05
Henry's Law coefficient (-). 1.87E-05
Molecular weight (g/mol). 2.52E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Ethylbenzene

Diffusion coefficient in air (cm2/s) 6.85E-02
Diffusion coefficient in water (cm2/s) 8.46E-06
Solubility (mg/l) 1.69E+02
Vapor pressure (mmHg) 9.6
KOC (L/kg). 4.46E+02
Henry's Law coefficient (-). 0.32
Molecular weight (g/mol). 1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Fluoranthene

Diffusion coefficient in air (cm2/s) 3.00E-02
Diffusion coefficient in water (cm2/s) 6.40E-06
Solubility (mg/l) 0.26
Vapor pressure (mmHg) 9.22E-06
KOC (L/kg). 5.55E+04
Henry's Law coefficient (-). 3.62E-04
Molecular weight (g/mol). 2.02E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Fluorene

Diffusion coefficient in air (cm2/s) 4.40E-02
Diffusion coefficient in water (cm2/s) 7.89E-06
Solubility (mg/l) 1.7
Vapor pressure (mmHg) 6.00E-04
KOC (L/kg). 9.16E+03
Henry's Law coefficient (-). 3.93E-03
Molecular weight (g/mol). 1.66E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 64.

CHEMICAL DATA FOR: Naphthalene

Diffusion coefficient in air (cm2/s) 6.05E-02
Diffusion coefficient in water (cm2/s) 8.38E-06
Solubility (mg/l) 31.
Vapor pressure (mmHg) 8.50E-02
KOC (L/kg). 1.54E+03
Henry's Law coefficient (-). 1.80E-02
Molecular weight (g/mol). 1.28E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 4.2

CHEMICAL DATA FOR: Nickel

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Diffusion coefficient in air (cm2/s) 0.0
Diffusion coefficient in water (cm2/s) 0.0
Solubility (mg/l) 1.73E+05
Vapor pressure (mmHg) 0.0
Kd (partition coefficient) (L/kg) 65.
Henry's Law coefficient (-). 0.0
Molecular weight (g/mol). 59.

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Phenanthrene

Diffusion coefficient in air (cm2/s) 3.45E-02
Diffusion coefficient in water (cm2/s) 6.69E-06
Solubility (mg/l) 1.1
Vapor pressure (mmHg) 1.21E-04
KOC (L/kg). 1.67E+04
Henry's Law coefficient (-). 1.73E-03
Molecular weight (g/mol). 1.78E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 33.

CHEMICAL DATA FOR: Pyrene

Diffusion coefficient in air (cm2/s) 2.78E-02
Diffusion coefficient in water (cm2/s) 7.25E-06
Solubility (mg/l) 0.14
Vapor pressure (mmHg) 4.50E-06
KOC (L/kg). 5.43E+04
Henry's Law coefficient (-). 4.87E-04
Molecular weight (g/mol). 2.02E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 61.

CHEMICAL DATA FOR: Styrene

Diffusion coefficient in air (cm2/s) 7.10E-02
Diffusion coefficient in water (cm2/s) 8.00E-06
Solubility (mg/l) 3.10E+02
Vapor pressure (mmHg) 6.4
KOC (L/kg). 4.46E+02
Henry's Law coefficient (-). 0.11
Molecular weight (g/mol). 1.04E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Toluene

Diffusion coefficient in air (cm2/s) 7.78E-02
Diffusion coefficient in water (cm2/s) 9.20E-06
Solubility (mg/l) 5.26E+02
Vapor pressure (mmHg) 28.
KOC (L/kg). 2.34E+02
Henry's Law coefficient (-). 0.27
Molecular weight (g/mol). 92.

Source Concentrations:

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Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: 1,2,4-trimethylbenzene

Diffusion coefficient in air (cm2/s) 6.07E-02
Diffusion coefficient in water (cm2/s) 7.92E-06
Solubility (mg/l) 57.
Vapor pressure (mmHg) 2.1
KOC (L/kg). 7.18E+02
Henry's Law coefficient (-). 0.25
Molecular weight (g/mol). 1.69E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

CHEMICAL DATA FOR: Xylenes

Diffusion coefficient in air (cm2/s) 8.47E-02
Diffusion coefficient in water (cm2/s) 9.90E-06
Solubility (mg/l) 1.06E+02
Vapor pressure (mmHg) 8.0
KOC (L/kg). 3.83E+02
Henry's Law coefficient (-). 0.21
Molecular weight (g/mol). 1.06E+02

Source Concentrations:

Source conc. in soil for vapor model (mg/kg) 0.0

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Oral and Dermal Exposure – Soils – Sub-Surface Maintenance Worker – Excavation

Title:
Sub-Surface Maintenance Worker - Oral + Dermal
File not saved

Scenarios:
Worker - RME

Routes:
INGESTION OF SOIL
DERMAL CONTACT WITH SOIL

Chemicals:
- Acenaphthene
- Acenaphthylene
- Ammonia / ammonium
- Anthracene
- Arsenic
- Benzene
- Benzo(a)pyrene
- Ethylbenzene
- Fluoranthene
- Fluorene
- Lead
- Naphthalene
- Nickel
- Phenanthrene
- Pyrene
- Styrene
- Toluene
- 1,2,4-trimethylbenzene
- Xylenes

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1
LIFETIME AND BODY WEIGHT	
Body Weight (kg)	70.0
Lifetime (years)	70.0
INGESTION OF SOIL	
Soil Ingestion Rate (mg/day)	330.
Exp. Frequency Soil (events/year)	15.0
Exp. Duration Soil (years)	1.00
Absorption Adjustment Factor for Ingestion of Soil (-)	
Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0
Benzene	1.0
Benzo(a)pyrene	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Naphthalene	1.0
Nickel	1.0
Phenanthrene	1.0
Pyrene	1.0
Styrene	1.0
Toluene	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0
Soil Bioavailability (-)	
Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0

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Benzene 1.0
Benzo(a)pyrene 1.0
Ethylbenzene 1.0
Fluoranthene 1.0
Fluorene 1.0
Lead 1.0
Naphthalene 1.0
Nickel 1.0
Phenanthrene 1.0
Pyrene 1.0
Styrene 1.0
Toluene 1.0
1,2,4-trimethylbenzene 1.0
Xylenes 1.0

DERMAL CONTACT WITH SOIL
Total Skin Surface Area (cm^2) 3.870E+03
Fraction Skin Exposed to Soil (-) 1.00
Adherence Factor for Soil (mg/cm^2) 1.50
Exposure Freq. Soil (events/year) 15.0
Exposure Duration Soil (years) 1.00
Absorption Adjustment Factor for
Dermal Exposure to Soil (-)
Acenaphthene 0.13
Acenaphthylene 0.13
Ammonia / ammonium 1.0
Anthracene 0.13
Arsenic 3.00E-02
Benzene 1.0
Benzo(a)pyrene 0.13
Ethylbenzene 1.0
Fluoranthene 0.13
Fluorene 0.13
Lead 0.10
Naphthalene 0.13
Nickel 1.0
Phenanthrene 0.13
Pyrene 0.13
Styrene 1.0
Toluene 1.0
1,2,4-trimethylbenzene 1.0
Xylenes 1.0

Soil Bioavailability (-)
Acenaphthene 1.0
Acenaphthylene 1.0
Ammonia / ammonium 1.0
Anthracene 1.0
Arsenic 1.0
Benzene 1.0
Benzo(a)pyrene 1.0
Ethylbenzene 1.0
Fluoranthene 1.0
Fluorene 1.0
Lead 1.0
Naphthalene 1.0
Nickel 1.0
Phenanthrene 1.0
Pyrene 1.0
Styrene 1.0
Toluene 1.0
1,2,4-trimethylbenzene 1.0
Xylenes 1.0

MEDIA CONCENTRATIONS

Concentration in Surficial Soil (mg/kg)
- Used to calculate risk and hazard index.
Acenaphthene 1.9
Acenaphthylene 8.7
Ammonia / ammonium 0.0
Anthracene 11.
Arsenic 0.0
Benzene 0.0
Benzo(a)pyrene 40.

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Ethylbenzene	0.0
Fluoranthene	5.9
Fluorene	64.
Lead	1.00E+03
Naphthalene	4.2
Nickel	0.0
Phenanthrene	33.
Pyrene	61.
Styrene	0.0
Toluene	0.0
1,2,4-trimethylbenzene	0.0
Xylenes	0.0

SLOPE FACTORS AND REFERENCE DOSES

Ingestion Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND
Acenaphthylene	ND
Ammonia / ammonium	ND
Anthracene	ND
Arsenic	ND
Benzene	3.50E-02
Benzo(a)pyrene	0.50
Ethylbenzene	ND
Fluoranthene	ND
Fluorene	ND
Lead	ND
Naphthalene	ND
Nickel	ND
Phenanthrene	ND
Pyrene	ND
Styrene	ND
Toluene	ND
1,2,4-trimethylbenzene	ND
Xylenes	ND

Ingestion Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02
Acenaphthylene	6.00E-02
Ammonia / ammonium	ND
Anthracene	0.30
Arsenic	2.00E-03
Benzene	5.00E-04
Benzo(a)pyrene	ND
Ethylbenzene	9.70E-02
Fluoranthene	4.00E-02
Fluorene	4.00E-02
Lead	3.50E-03
Naphthalene	2.00E-02
Nickel	5.00E-03
Phenanthrene	0.30
Pyrene	3.00E-02
Styrene	7.70E-04
Toluene	0.22
1,2,4-trimethylbenzene	2.00E-03
Xylenes	0.18

Dermal Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND
Acenaphthylene	ND
Ammonia / ammonium	ND
Anthracene	ND
Arsenic	ND
Benzene	3.50E-02
Benzo(a)pyrene	25.
Ethylbenzene	ND
Fluoranthene	ND
Fluorene	ND
Lead	ND
Naphthalene	ND
Nickel	ND
Phenanthrene	ND
Pyrene	ND
Styrene	ND

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Toluene	ND
1,2,4-trimethylbenzene	ND
Xylenes	ND

Dermal Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02
Acenaphthylene	6.00E-02
Ammonia / ammonium	ND
Anthracene	0.30
Arsenic	2.00E-03
Benzene	5.00E-04
Benzo(a)pyrene	ND
Ethylbenzene	9.70E-02
Fluoranthene	4.00E-02
Fluorene	4.00E-02
Lead	3.50E-03
Naphthalene	2.00E-02
Nickel	2.00E-04
Phenanthrene	0.30
Pyrene	3.00E-02
Styrene	7.70E-04
Toluene	0.22
1,2,4-trimethylbenzene	2.00E-03
Xylenes	0.18

SUMMARY OF RESULTS

INGESTION OF SOIL

Daily Doses and Risk for : Acenaphthene

CADD (mg/kg-day)	3.68E-07
LADD (mg/kg-day)	5.26E-09
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.135E-06

Daily Doses and Risk for : Acenaphthylene

CADD (mg/kg-day)	1.69E-06
LADD (mg/kg-day)	2.41E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.809E-05

Daily Doses and Risk for : Ammonia / ammonium

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Anthracene

CADD (mg/kg-day)	2.13E-06
LADD (mg/kg-day)	3.04E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.104E-06

Daily Doses and Risk for : Arsenic

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Benzo(a)pyrene

CADD (mg/kg-day)	7.83E-06
LADD (mg/kg-day)	1.12E-07
Cancer Risk (-)	5.591E-08
Hazard Index (-)	0.000E+00

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Daily Doses and Risk for : Ethylbenzene

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Fluoranthene

CADD (mg/kg-day)	1.14E-06
LADD (mg/kg-day)	1.63E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.858E-05

Daily Doses and Risk for : Fluorene

CADD (mg/kg-day)	1.24E-05
LADD (mg/kg-day)	1.77E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.100E-04

Daily Doses and Risk for : Lead

CADD (mg/kg-day)	1.94E-04
LADD (mg/kg-day)	2.77E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	5.535E-02

Daily Doses and Risk for : Naphthalene

CADD (mg/kg-day)	8.14E-07
LADD (mg/kg-day)	1.16E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.068E-05

Daily Doses and Risk for : Nickel

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Phenanthrene

CADD (mg/kg-day)	6.39E-06
LADD (mg/kg-day)	9.13E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.131E-05

Daily Doses and Risk for : Pyrene

CADD (mg/kg-day)	1.18E-05
LADD (mg/kg-day)	1.69E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.939E-04

Daily Doses and Risk for : Styrene

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Toluene

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : 1,2,4-trimethylbenzene

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Xylenes

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

DERMAL CONTACT WITH SOIL

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Daily Doses and Risk for : Acenaphthene

CADD (mg/kg-day)	8.42E-07
LADD (mg/kg-day)	1.20E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.403E-05

Daily Doses and Risk for : Acenaphthylene

CADD (mg/kg-day)	3.85E-06
LADD (mg/kg-day)	5.51E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.424E-05

Daily Doses and Risk for : Ammonia / ammonium

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Anthracene

CADD (mg/kg-day)	4.87E-06
LADD (mg/kg-day)	6.96E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.624E-05

Daily Doses and Risk for : Arsenic

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Benzo(a)pyrene

CADD (mg/kg-day)	1.79E-05
LADD (mg/kg-day)	2.56E-07
Cancer Risk (-)	6.392E-06
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Ethylbenzene

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Fluoranthene

CADD (mg/kg-day)	2.61E-06
LADD (mg/kg-day)	3.73E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.535E-05

Daily Doses and Risk for : Fluorene

CADD (mg/kg-day)	2.84E-05
LADD (mg/kg-day)	4.05E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	7.089E-04

Daily Doses and Risk for : Lead

CADD (mg/kg-day)	3.41E-04
LADD (mg/kg-day)	4.87E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	9.737E-02

Daily Doses and Risk for : Naphthalene

CADD (mg/kg-day)	1.86E-06
LADD (mg/kg-day)	2.66E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	9.304E-05

Daily Doses and Risk for : Nickel

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00

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Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Phenanthrene

CADD (mg/kg-day)	1.46E-05
LADD (mg/kg-day)	2.09E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.873E-05

Daily Doses and Risk for : Pyrene

CADD (mg/kg-day)	2.70E-05
LADD (mg/kg-day)	3.86E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	9.009E-04

Daily Doses and Risk for : Styrene

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Toluene

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : 1,2,4-trimethylbenzene

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Xylenes

CADD (mg/kg-day)	0.00E+00
LADD (mg/kg-day)	0.00E+00
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

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Dermal Exposure – Seepage Water – Child – Seepage Water in Basement

Title:
Resident in Basement (Child) - Dermal Exposure to Seepage Water
File not saved

Scenarios:
Child Resident - RME
Child Resident - Typical

Routes:
DERMAL CONTACT WHILE SWIMMING

Chemicals:
- Acenaphthene
- Acenaphthylene
- Ammonia / ammonium
- Anthracene
- Arsenic
- Benzene
- Benzo(a)pyrene
- Ethylbenzene
- Fluoranthene
- Fluorene
- Lead
- Naphthalene
- Nickel
- Phenanthrene
- Pyrene
- Styrene
- Toluene
- 1,2,4-trimethylbenzene
- Xylenes

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1	2
LIFETIME AND BODY WEIGHT		
Body Weight (kg)	13.2	34.5
Lifetime (years)	70.0	70.0
DERMAL CONTACT WHILE SWIMMING		
Total Skin Surface Area (cm^2)	313.	603.
Time in Surface Water (hour/day)	0.500	0.500
Exp. Freq Surface Water (events/yr)	24.0	24.0
Exp. Duration Surface Water (years)	6.00	10.0
Dermal Permeability Surface Water (cm/hour)		
Acenaphthene	8.60E-02	8.60E-02
Acenaphthylene	9.11E-02	9.11E-02
Ammonia / ammonium	1.00E-03	1.00E-03
Anthracene	0.14	0.14
Arsenic	1.00E-03	1.00E-03
Benzene	1.49E-02	1.49E-02
Benzo(a)pyrene	0.71	0.71
Ethylbenzene	4.93E-02	4.93E-02
Fluoranthene	0.31	0.31
Fluorene	0.11	0.11
Lead	1.00E-04	1.00E-04
Naphthalene	4.66E-02	4.66E-02
Nickel	2.00E-04	2.00E-04
Phenanthrene	0.14	0.14
Pyrene	0.20	0.20
Styrene	3.72E-02	3.72E-02
Toluene	3.11E-02	3.11E-02
1,2,4-trimethylbenzene	8.57E-02	8.57E-02
Xylenes	4.71E-02	4.71E-02
Absorption Adjustment Factor for Dermal Exposure to Water (-)		
Acenaphthene	1.0	1.0
Acenaphthylene	1.0	1.0
Ammonia / ammonium	1.0	1.0
Anthracene	1.0	1.0

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Arsenic	1.0	1.0
Benzene	1.0	1.0
Benzo(a)pyrene	1.0	1.0
Ethylbenzene	1.0	1.0
Fluoranthene	1.0	1.0
Fluorene	1.0	1.0
Lead	1.0	1.0
Naphthalene	1.0	1.0
Nickel	1.0	1.0
Phenanthrene	1.0	1.0
Pyrene	1.0	1.0
Styrene	1.0	1.0
Toluene	1.0	1.0
1,2,4-trimethylbenzene	1.0	1.0
Xylenes	1.0	1.0

MEDIA CONCENTRATIONS

Concentration in Surface Water (mg/l)

- Used to calculate risk and hazard index.

Acenaphthene	3.40E-02	3.40E-02
Acenaphthylene	9.70E-02	9.70E-02
Ammonia / ammonium	42.	42.
Anthracene	5.60E-02	5.60E-02
Arsenic	0.14	0.14
Benzene	4.3	4.3
Benzo(a)pyrene	6.70E-02	6.70E-02
Ethylbenzene	7.80E-02	7.80E-02
Fluoranthene	8.10E-02	8.10E-02
Fluorene	0.12	0.12
Lead	1.40E-02	1.40E-02
Naphthalene	1.9	1.9
Nickel	8.00E-02	8.00E-02
Phenanthrene	0.17	0.17
Pyrene	0.12	0.12
Styrene	7.00E-03	7.00E-03
Toluene	1.9	1.9
1,2,4-trimethylbenzene	0.12	0.12
Xylenes	0.76	0.76

SLOPE FACTORS AND REFERENCE DOSES

Dermal Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND	ND
Acenaphthylene	ND	ND
Ammonia / ammonium	ND	ND
Anthracene	ND	ND
Arsenic	ND	ND
Benzene	3.50E-02	3.50E-02
Benzo(a)pyrene	25.	25.
Ethylbenzene	ND	ND
Fluoranthene	ND	ND
Fluorene	ND	ND
Lead	ND	ND
Naphthalene	ND	ND
Nickel	ND	ND
Phenanthrene	ND	ND
Pyrene	ND	ND
Styrene	ND	ND
Toluene	ND	ND
1,2,4-trimethylbenzene	ND	ND
Xylenes	ND	ND

Dermal Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02	6.00E-02
Acenaphthylene	6.00E-02	6.00E-02
Ammonia / ammonium	ND	ND
Anthracene	0.30	0.30
Arsenic	2.00E-03	2.00E-03
Benzene	5.00E-04	5.00E-04
Benzo(a)pyrene	ND	ND
Ethylbenzene	9.70E-02	9.70E-02
Fluoranthene	4.00E-02	4.00E-02
Fluorene	4.00E-02	4.00E-02

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Lead	3.50E-03	3.50E-03
Naphthalene	2.00E-02	2.00E-02
Nickel	2.00E-04	2.00E-04
Phenanthrene	0.30	0.30
Pyrene	3.00E-02	3.00E-02
Styrene	7.70E-04	7.70E-04
Toluene	0.22	0.22
1,2,4-trimethylbenzene	2.00E-03	2.00E-03
Xylenes	0.18	0.18

SUMMARY OF RESULTS	SCENARIO: 1	2	Added

DERMAL CONTACT WHILE SWIMMING

Daily Doses and Risk for : Acenaphthene			
CADD (mg/kg-day)	2.28E-06	1.68E-06	
LADD (mg/kg-day)	1.95E-07	2.40E-07	4.35E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.799E-05	2.800E-05	
Daily Doses and Risk for : Acenaphthylene			
CADD (mg/kg-day)	6.89E-06	5.08E-06	
LADD (mg/kg-day)	5.90E-07	7.25E-07	1.32E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.148E-04	8.463E-05	
Daily Doses and Risk for : Ammonia / ammonium			
CADD (mg/kg-day)	3.27E-05	2.41E-05	
LADD (mg/kg-day)	2.81E-06	3.45E-06	6.25E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	0.000E+00	0.000E+00	
Daily Doses and Risk for : Anthracene			
CADD (mg/kg-day)	6.20E-06	4.57E-06	
LADD (mg/kg-day)	5.31E-07	6.53E-07	1.18E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.066E-05	1.523E-05	
Daily Doses and Risk for : Arsenic			
CADD (mg/kg-day)	1.09E-07	8.04E-08	
LADD (mg/kg-day)	9.35E-09	1.15E-08	2.08E-08
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	5.457E-05	4.022E-05	
Daily Doses and Risk for : Benzene			
CADD (mg/kg-day)	4.99E-05	3.68E-05	
LADD (mg/kg-day)	4.28E-06	5.26E-06	9.54E-06
Cancer Risk (-)	1.498E-07	1.841E-07	3.339E-07
Hazard Index (-)	9.989E-02	7.363E-02	
Daily Doses and Risk for : Benzo(a)pyrene			
CADD (mg/kg-day)	3.72E-05	2.75E-05	
LADD (mg/kg-day)	3.19E-06	3.92E-06	7.11E-06
Cancer Risk (-)	7.980E-05	9.804E-05	1.778E-04
Hazard Index (-)	0.000E+00	0.000E+00	
Daily Doses and Risk for : Ethylbenzene			
CADD (mg/kg-day)	3.00E-06	2.21E-06	
LADD (mg/kg-day)	2.57E-07	3.16E-07	5.73E-07
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.090E-05	2.278E-05	
Daily Doses and Risk for : Fluoranthene			
CADD (mg/kg-day)	1.94E-05	1.43E-05	
LADD (mg/kg-day)	1.67E-06	2.05E-06	3.72E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	4.862E-04	3.584E-04	
Daily Doses and Risk for : Fluorene			
CADD (mg/kg-day)	1.03E-05	7.59E-06	
LADD (mg/kg-day)	8.82E-07	1.08E-06	1.97E-06

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Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.573E-04	1.896E-04	

Daily Doses and Risk for : Lead

CADD (mg/kg-day)	1.09E-09	8.04E-10	
LADD (mg/kg-day)	9.35E-11	1.15E-10	2.08E-10
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.118E-07	2.299E-07	

Daily Doses and Risk for : Naphthalene

CADD (mg/kg-day)	6.90E-05	5.09E-05	
LADD (mg/kg-day)	5.92E-06	7.27E-06	1.32E-05
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.451E-03	2.544E-03	

Daily Doses and Risk for : Nickel

CADD (mg/kg-day)	1.25E-08	9.19E-09	
LADD (mg/kg-day)	1.07E-09	1.31E-09	2.38E-09
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	6.237E-05	4.597E-05	

Daily Doses and Risk for : Phenanthrene

CADD (mg/kg-day)	1.91E-05	1.41E-05	
LADD (mg/kg-day)	1.64E-06	2.01E-06	3.65E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	6.361E-05	4.689E-05	

Daily Doses and Risk for : Pyrene

CADD (mg/kg-day)	1.88E-05	1.39E-05	
LADD (mg/kg-day)	1.61E-06	1.98E-06	3.59E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	6.268E-04	4.620E-04	

Daily Doses and Risk for : Styrene

CADD (mg/kg-day)	2.03E-07	1.50E-07	
LADD (mg/kg-day)	1.74E-08	2.14E-08	3.88E-08
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.636E-04	1.943E-04	

Daily Doses and Risk for : Toluene

CADD (mg/kg-day)	4.61E-05	3.40E-05	
LADD (mg/kg-day)	3.95E-06	4.85E-06	8.80E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	2.066E-04	1.523E-04	

Daily Doses and Risk for : 1,2,4-trimethylbenzene

CADD (mg/kg-day)	7.68E-06	5.66E-06	
LADD (mg/kg-day)	6.59E-07	8.09E-07	1.47E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	3.842E-03	2.832E-03	

Daily Doses and Risk for : Xylenes

CADD (mg/kg-day)	2.79E-05	2.06E-05	
LADD (mg/kg-day)	2.39E-06	2.94E-06	5.33E-06
Cancer Risk (-)	0.000E+00	0.000E+00	0.000E+00
Hazard Index (-)	1.559E-04	1.149E-04	

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Dermal Exposure – Seepage Water – Adult – Seepage Water in Basement

Title:
Resident in Basement (Adult) - Dermal Exposure to Seepage Water
File not saved

Scenarios:
Adult Resident - RME

Routes:
DERMAL CONTACT WHILE SWIMMING

Chemicals:
- Acenaphthene
- Acenaphthylene
- Ammonia / ammonium
- Anthracene
- Arsenic
- Benzene
- Benzo(a)pyrene
- Ethylbenzene
- Fluoranthene
- Fluorene
- Lead
- Naphthalene
- Nickel
- Phenanthrene
- Pyrene
- Styrene
- Toluene
- 1,2,4-trimethylbenzene
- Xylenes

SUMMARY OF INPUT PARAMETERS	SCENARIO: 1
LIFETIME AND BODY WEIGHT	
Body Weight (kg)	70.0
Lifetime (years)	70.0
DERMAL CONTACT WHILE SWIMMING	
Total Skin Surface Area (cm^2)	904.
Time in Surface Water (hour/day)	1.00
Exp. Freq Surface Water (events/yr)	24.0
Exp. Duration Surface Water (years)	54.0
Dermal Permeability Surface Water (cm/hour)	
Acenaphthene	8.60E-02
Acenaphthylene	9.11E-02
Ammonia / ammonium	1.00E-03
Anthracene	0.14
Arsenic	1.00E-03
Benzene	1.49E-02
Benzo(a)pyrene	0.71
Ethylbenzene	4.93E-02
Fluoranthene	0.31
Fluorene	0.11
Lead	1.00E-04
Naphthalene	4.66E-02
Nickel	2.00E-04
Phenanthrene	0.14
Pyrene	0.20
Styrene	3.72E-02
Toluene	3.11E-02
1,2,4-trimethylbenzene	8.57E-02
Xylenes	4.71E-02
Absorption Adjustment Factor for Dermal Exposure to Water (-)	
Acenaphthene	1.0
Acenaphthylene	1.0
Ammonia / ammonium	1.0
Anthracene	1.0
Arsenic	1.0

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Benzene	1.0
Benzo(a)pyrene	1.0
Ethylbenzene	1.0
Fluoranthene	1.0
Fluorene	1.0
Lead	1.0
Naphthalene	1.0
Nickel	1.0
Phenanthrene	1.0
Pyrene	1.0
Styrene	1.0
Toluene	1.0
1,2,4-trimethylbenzene	1.0
Xylenes	1.0

MEDIA CONCENTRATIONS

Concentration in Surface Water (mg/l)

- Used to calculate risk and hazard index.

Acenaphthene	3.40E-02
Acenaphthylene	9.70E-02
Ammonia / ammonium	42.
Anthracene	5.60E-02
Arsenic	0.14
Benzene	4.3
Benzo(a)pyrene	6.70E-02
Ethylbenzene	7.80E-02
Fluoranthene	8.10E-02
Fluorene	0.12
Lead	1.40E-02
Naphthalene	1.9
Nickel	8.00E-02
Phenanthrene	0.17
Pyrene	0.12
Styrene	7.00E-03
Toluene	1.9
1,2,4-trimethylbenzene	0.12
Xylenes	0.76

SLOPE FACTORS AND REFERENCE DOSES

Dermal Slope Factor [1/(mg/kg-day)]

Acenaphthene	ND
Acenaphthylene	ND
Ammonia / ammonium	ND
Anthracene	ND
Arsenic	ND
Benzene	3.50E-02
Benzo(a)pyrene	25.
Ethylbenzene	ND
Fluoranthene	ND
Fluorene	ND
Lead	ND
Naphthalene	ND
Nickel	ND
Phenanthrene	ND
Pyrene	ND
Styrene	ND
Toluene	ND
1,2,4-trimethylbenzene	ND
Xylenes	ND

Dermal Reference Dose (mg/kg-day)

Acenaphthene	6.00E-02
Acenaphthylene	6.00E-02
Ammonia / ammonium	ND
Anthracene	0.30
Arsenic	2.00E-03
Benzene	5.00E-04
Benzo(a)pyrene	ND
Ethylbenzene	9.70E-02
Fluoranthene	4.00E-02
Fluorene	4.00E-02
Lead	3.50E-03

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Naphthalene	2.00E-02
Nickel	2.00E-04
Phenanthrene	0.30
Pyrene	3.00E-02
Styrene	7.70E-04
Toluene	0.22
1,2,4-trimethylbenzene	2.00E-03
Xylenes	0.18

SUMMARY OF RESULTS

DERMAL CONTACT WHILE SWIMMING

Daily Doses and Risk for : Acenaphthene

CADD (mg/kg-day)	2.48E-06
LADD (mg/kg-day)	1.92E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.138E-05

Daily Doses and Risk for : Acenaphthylene

CADD (mg/kg-day)	7.50E-06
LADD (mg/kg-day)	5.79E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.251E-04

Daily Doses and Risk for : Ammonia / ammonium

CADD (mg/kg-day)	3.57E-05
LADD (mg/kg-day)	2.75E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Anthracene

CADD (mg/kg-day)	6.75E-06
LADD (mg/kg-day)	5.21E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.251E-05

Daily Doses and Risk for : Arsenic

CADD (mg/kg-day)	1.19E-07
LADD (mg/kg-day)	9.17E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	5.944E-05

Daily Doses and Risk for : Benzene

CADD (mg/kg-day)	5.44E-05
LADD (mg/kg-day)	4.20E-05
Cancer Risk (-)	1.469E-06
Hazard Index (-)	1.088E-01

Daily Doses and Risk for : Benzo(a)pyrene

CADD (mg/kg-day)	4.06E-05
LADD (mg/kg-day)	3.13E-05
Cancer Risk (-)	7.823E-04
Hazard Index (-)	0.000E+00

Daily Doses and Risk for : Ethylbenzene

CADD (mg/kg-day)	3.27E-06
LADD (mg/kg-day)	2.52E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.366E-05

Daily Doses and Risk for : Fluoranthene

CADD (mg/kg-day)	2.12E-05
LADD (mg/kg-day)	1.63E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	5.296E-04

Daily Doses and Risk for : Fluorene

CADD (mg/kg-day)	1.12E-05
LADD (mg/kg-day)	8.65E-06
Cancer Risk (-)	0.000E+00

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Hazard Index (-)	2.802E-04

Daily Doses and Risk for : Lead

CADD (mg/kg-day)	1.19E-09
LADD (mg/kg-day)	9.17E-10
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.397E-07

Daily Doses and Risk for : Naphthalene

CADD (mg/kg-day)	7.52E-05
LADD (mg/kg-day)	5.80E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	3.759E-03

Daily Doses and Risk for : Nickel

CADD (mg/kg-day)	1.36E-08
LADD (mg/kg-day)	1.05E-08
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.793E-05

Daily Doses and Risk for : Phenanthrene

CADD (mg/kg-day)	2.08E-05
LADD (mg/kg-day)	1.60E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.929E-05

Daily Doses and Risk for : Pyrene

CADD (mg/kg-day)	2.05E-05
LADD (mg/kg-day)	1.58E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	6.827E-04

Daily Doses and Risk for : Styrene

CADD (mg/kg-day)	2.21E-07
LADD (mg/kg-day)	1.71E-07
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.872E-04

Daily Doses and Risk for : Toluene

CADD (mg/kg-day)	5.02E-05
LADD (mg/kg-day)	3.87E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	2.250E-04

Daily Doses and Risk for : 1,2,4-trimethylbenzene

CADD (mg/kg-day)	8.37E-06
LADD (mg/kg-day)	6.46E-06
Cancer Risk (-)	0.000E+00
Hazard Index (-)	4.184E-03

Daily Doses and Risk for : Xylenes

CADD (mg/kg-day)	3.04E-05
LADD (mg/kg-day)	2.34E-05
Cancer Risk (-)	0.000E+00
Hazard Index (-)	1.698E-04

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