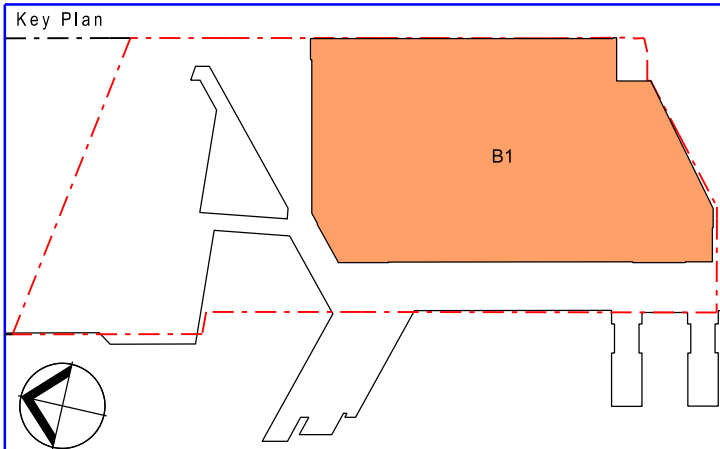
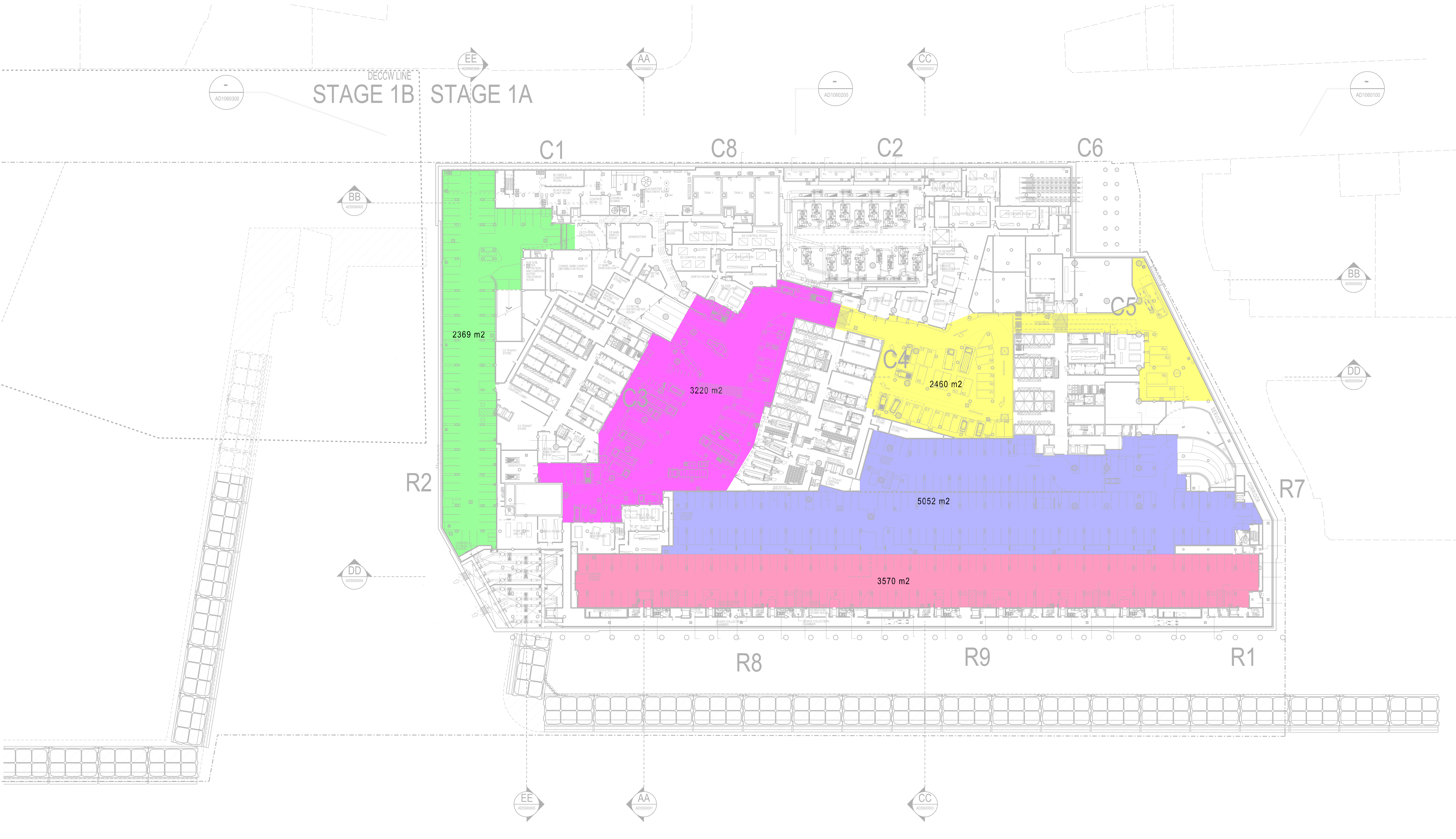
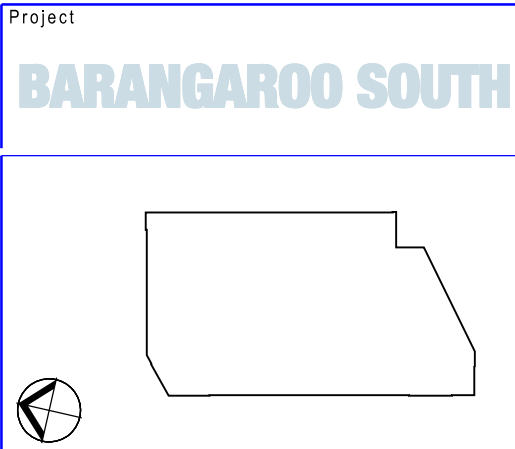




Rev.	Item	Revision Description	Date	Rev.	Item	Revision Description	Date
07		ISSUED FOR REVIEW	20.03.12				
08		ISSUED FOR SERVICES CO-ORDINATION	03.02.12				
05		ISSUED FOR REVIEW AND INFORMATION	13.01.12				
04		ISSUED FOR REVIEW AND INFORMATION	30.11.11				
03		ISSUED FOR REVIEW AND INFORMATION	21.09.11				
02		ISSUED FOR CONTRACT PRICE	25.07.11				
01		ISSUED FOR CLIENT REVIEW	09.06.11				

Lead Architects	RSH Australia Pty Ltd RSHA Principal Architect RAHA NSW ARB 8484 Sydney NSW 2000
Collaborating Architects	Lend Lease Graham W Jones Principal Architect FRANA NSW ARB 4500 ABN 97 080 098 162
Consultant	

Principal	Lend Lease
Developer	Lend Lease
Project Management & Construction	Lend Lease
Design	Lend Lease
3D The Bond 3D Mickson Road Mickson NSW 2000	www.lendlease.com



PRELIMINARY

INDICATIVE LAYOUT ONLY

PLAN
FLOOR PLAN
BASEMENT LEVEL 2

Drawn By: 04/10/11 Date: 04/10/11 Purpose: FOR INFO Approved By: N/A

SCALE 1:500 @ B1 1:1250 @ A3

Project No. 161804 Site No. BB1 AD0000008 Drawing No. 07

Enclosure B

Revised SSTC Calculations Scenario 1 and Scenario 2

1. General Information:

Site:Barangaroo

Address:Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Client:Lend Lease

Scenario:Scenario 1 - Lower Basement with Commercial Worker (Risk Based Calculations)

Header Colour (Defaults = Blue):

Blue

2. Select Receptor:

Commercial/Industrial

3. Select Exposure Pathways to Include:

Enter "x" in box, or select from dropdown box.

Soil Pathways

Incidental Ingestion of Soil

Dermal Contact with Soil

Inhalation of Surface Soil-Derived Dust in Indoor Air

Inhalation of Surface Soil-Derived Dust in Outdoor Air

Inhalation of Surface Soil-Derived Vapours in Outdoor Air

Inhalation of Soil-Derived Vapours From Excavation (USEPA 2002 method)

Inhalation of Subsurface Soil-Derived Vapours in Indoor Air

Inhalation of Subsurface Soil-Derived Vapours in Outdoor Air

Groundwater Pathways

Inhalation of Groundwater-Derived Vapours in Indoor Air

Inhalation of Groundwater-Derived Vapours in Outdoor Air

Ingestion of Potable Groundwater

Incidental Ingestion of Groundwater (Bathing or Excavation)

Dermal Contact with Groundwater (Bathing or Excavation)

Inhalation of Groundwater Vapours during Irrigation/ Showering

Ingestion of Vegetables Irrigated with Groundwater

Inhalation of Groundwater Vapours (Where GW Enters Trench)

x

Inhalation of vapour emissions from flowing water (groundwater in basement)

Inhalation of Soil Vapour-Derived Vapours in Indoor Air

Inhalation of Soil Vapour-Derived Vapours in Outdoor Air

Y

Soil RBSLs saturation limited?

Y

Groundwater RBSLs solubility limited?

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

4. Select Chemicals for Quantitative Assessment:	Target Hazard Index	Target Cancer Risk	5. Enter Chemical Concentrations (if only calculating RBSLs, enter 1 for media for which you want RBSLs):	
	default = 1 (or manually overwrite)	default = 1x10 ⁻⁵ (or manually overwrite)	Soil (mg/kg)	Groundwater (mg/L)
Acenaphthene	0.2	1.00E-05	511	4.48
Acenaphthylene	0.2	1.00E-05	1700	43.2
Ammonia	1	1.00E-05		348
Aniline	1	1.00E-05		0.212
Anthracene	0.2	1.00E-05	2150	15.4
Arsenic, Inorganic	1	1.00E-05		0.024
Barium	1	1.00E-05		2.23
Benz(a)anthracene			1470	12.6
Benzene	0.25	1.00E-05	1510	40.2
Benzo(a)pyrene			652	9.26
Benzo(b)fluoranthene			587	8.33
Benzo(g,h,i)perylene			305	4.22
Benzo(k)fluoranthene			231	2.93
Bis(2-ethylhexyl)phalate	1	1.00E-05		0.03
Cadmium (Water)	1	1.00E-05		0.108
Chromium(III), Insoluble Salts	1	1.00E-05	210	0.102
Chromium(VI)	1	1.00E-05	2.3	0.102
Chrysene			771	9.78
Cobalt	1	1.00E-05		0.057
Cresol, m-&p-	1	1.00E-05	2290	436
Cresol, o-	1	1.00E-05		182
Blank				
Dibenz(a,h)anthracene			71.4	0.822
Dibenzofuran	1	1.00E-05	277	10.2
Dimethylphenol, 2,4-	1	1.00E-05		38
Ethylbenzene	0.25	1.00E-05	261	3.02
Fluoranthene			2440	25.9
Fluorene	0.2	1.00E-05	2100	21.1
Indeno(1,2,3-cd)pyrene			247	3.05
Iron	1	1.00E-05	60600	187
Lead and Compounds	1	1.00E-05	13600	0.555
Manganese	1	1.00E-05		4.89
Methylnaphthalene, 2-	0.2	1.00E-05	7650	105
Naphthalene	0.2	1.00E-05	10200	283
Nickel Soluble Salts	1	1.00E-05		0.303
Phenanthrene	0.2	1.00E-05	5180	74.1
Phenol	1	1.00E-05		249
Pyrene	0.2	1.00E-05	2640	27.9
Styrene	1	1.00E-05		0.194
Toluene	0.25	1.00E-05	2650	17.6
TPH C06-C09 aliphatic	0.125	1.00E-05	593	6.08
TPH C10-C14 aliphatic	0.125	1.00E-05	69400	1730
TPH C10-C14 aromatic	0.125	1.00E-05	69400	1730
TPH C15-C28 aliphatic	0.125	1.00E-05	93200	1520
TPH C15-C28 aromatic	0.125	1.00E-05	93200	1520
TPH C29-C36 aliphatic	0.125	1.00E-05	20600	332
TPH C29-C36 aromatic	0.125	1.00E-05	20600	332
Trimethylbenzene, 1,2,4-	1	1.00E-05	220	0.92
Vanadium and compounds	1	1.00E-05	248	0.0228
Xylenes (total)	0.25	1.00E-05	2576	6.7

6. Confirm/Modify Exposure Parameters:

		Site-Specific Value (leave blank to use default value)		Value Used in Calculations	
		Adult	Child	Adult	Child
General receptor parameters: Units					
Body weight	kg	70	13	70	13
Exposure duration	yr	30	6	30	6
Averaging time (carcinogens)	yr	70	70	70	70
Averaging time (non-carcinogens)	yr	30	6	30	6
Incidental Soil Ingestion					
Daily soil ingestion rate	mg/day				
Exposure frequency for soil ingestion	days/yr				
Fraction of daily soil intake from site	unitless				
Dermal Absorption of Soil					
Exposed skin surface area for soil contact	cm2				
Soil to skin adherence factor	mg/cm2				
Exposure frequency for dermal contact with soil	days/yr				
Indoor Inhalation					
Exposure time (indoor air)	hrs/day				
Exposure frequency (indoor air)	days/yr				
Particulate emission factor (indoor air)	m3/kg				
Outdoor Inhalation					
Exposure time (outdoor air)	hrs/day				
Exposure frequency (outdoor air)	days/yr				
Particulate emission factor (outdoor air)	m3/kg				
Potable Water Ingestion					
Potable water intake rate	L/day				
Exposure frequency for potable water intake	days/yr				
Incidental Water Ingestion					
Incidental ingestion rate	L/day				
Exposure frequency for incidental water ingestion	days/yr				
Dermal Contact with Water					
Exposed skin surface for water contact	cm2				
Exposure time for dermal water contact	hr/day				
Exposure frequency for dermal water contact	days/yr				
Vapour Inhalation Shower/ Sprinkler					
Exposure frequency	days/yr				
Exposure time	min/ day				
Inhalation rate	m3/hr				
Inhalation Absorption Adjustment Factor	mg/mg				
Lung retention factor	unitless				
Ingestion of Home Grown Produce					
Proportion of homegrown produce ingested					
Exposure frequency	days/year				
Inhalation of Vapours from Flowing Water					
Exposure time	hrs/day	8	1	8	1
Exposure frequency	days/year	240	350	240	350

7. Enter Target Risk Levels for RBSL Calculation (per chemical)

	Target Hazard Index	Target Cancer Risk
Default Values:	1	1.00E-05
Site specific value (optional):		
Value Used in Calculations:	1	1.00E-05

Links to Model Setup:

[Groundwater to Air Vapour Model Setup](#)

[Soil to Air Vapour Model Setup](#)

[Soil Vapour to Air Model Setup](#)

[Calculation of source vapour concentrations from NAPL](#)

[Groundwater to Plant Model Setup](#)

[Shower/ Sprinkler Model](#)

[Water with Flow](#)

Links to RBSL and Risk Summaries:

[RBSL Summary](#)

[Risk Estimate Summary](#)

Links to Risk Calculation Detail:

SOIL:

[Soil Ingestion](#)

[Soil Dermal Contact](#)

[Soil-Derived Dust Inhalation - Indoors](#)

[Soil-Derived Dust Inhalation - Outdoors](#)

[Inhalation of Surface Soil Derived Vapours - Outdoors](#)

[Inhalation of Soil Derived Vapours - Excavation](#)

[Inhalation of Subsurface Soil Derived Vapours - Indoors](#)

[Inhalation of Subsurface Soil Derived Vapours - Outdoors](#)

GROUNDWATER:

[Potable Groundwater Ingestion](#)

[Incidental Groundwater Ingestion](#)

[Dermal Contact with Groundwater](#)

[Inhalation of GW Derived Vapours - Indoors](#)

[Inhalation of GW Derived Vapours - Outdoors](#)

[Inhalation of GW Derived Vapour- Shower/Sprinkler](#)

[Ingestion of homegrown produce](#)

[Inhalation of GW Vapours - Trench with Pooled Water](#)

[Inhalation of vapour emissions from water with flow](#)

SOIL VAPOUR:

[Inhalation of SV Derived Vapours - Indoors](#)

[Inhalation of SV Derived Vapours - Outdoors](#)

Links to RBSL Detail:

[Soil - Adult Threshold](#)

[Soil - Child Threshold](#)

[Soil - Non-Threshold](#)

[Groundwater - Adult Threshold](#)

[Groundwater - Child Threshold](#)

[Groundwater - Non-Threshold](#)

[Soil Vapour - Adult Threshold](#)

[Soil Vapour - Child Threshold](#)

[Soil Vapour - Non-Threshold](#)

Calculation of Vapour Emissions from Water with Flow
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Commercial Basement) (Risk Based Calculations)

PARAMETERS						Dimensions of Wet Section of Basement/ Impoundment											Air exchange rate (exchanges/day)				7.60E+01	
Concrete permeability		(select from drop down list)	High permeability		Length (m)		59.0		Windspeed (m/s)		if < 3.5 m/sec		3.00E-02									
Permeability Rate (m/day)			8.6.E-02		Width (m)		25.0				if = or > 3.5 m/sec											
Water Temperature (deg. C)			18.0		Depth of Water (m)		0.01															
Dimensions of Basement / Impoundment					Fetch/ Depth (m) ratio of Wet Basement Section		2500															
Height (m)			4.5		Volume of wet basement/ impoundment (m3)		14.8															
Width (m)			50.0		Area covered in water (m2)		1475															
Depth (m)			50.0		Effective diameter of impoundment/ basement) (m)		43.3															
Volume total basement/ impoundment (m3)			11250		Volume of water entering basement (m³/sec)		1.48E-05															
Parameter Definition	Volatile	Chemical	Molecular	Vapour	Vapour	Henry's Law	Henry's Law	Equilibrium	Diffusivity in	Schmidt	Gas Phase	Schmidt Number	Liquid Phase	Overall Mass	Adopted	Overall Mass	Diffusivity in Air	Equilibrium	Air Emission	Air Emission	Adjusted	
		Concentration in Water (mg/L)	weight (g/mol)	Pressure (mmHg)	Pressure (atm)	Coefficient (unitless)	Coefficient (calculated)	Coefficient (at 25 deg C)	Water (cm²/sec)	Number on Gas Side (*)	Mass Transfer Coefficient (m/sec)	on Liquid Side #	Mass Transfer Coefficient (m/s) <3.5 m/s	Transfer Coefficient (m/s) (windspeed <3.5 m/s)	Liquid Mass Transfer Coefficient (m/s)	Transfer Coefficient (m/s)	(cm2/sec)	Concentration of water in Basement/ Impoundment (g/m³)	Rate from Liquid Surface (g/sec)	Rate from Liquid Surface (mg/day)	Concentration in Basement Air (includes air exchange) (mg/m3)	
		C	MW	Vap	Vap	unitless	atm.m3/g mol	K _{eq}	D _{water}	Sc _G	k _G	Sc _L	K _L	K	K _L	K	D _{air}	C _L	E	E		
Acenaphthene	Y	4.48	154	2.15E-03	2.83E-06	7.52E-03	1.80E-04	7.345E-03	8.33E-06	3.0E+00	9.939E-05	1.08E+03	2.7E-07	2.0E-07	2.7E-07	2.0E-07	0.0506	1.6E-01	4.63E-05	4.00E+03	4.68E-03	
Acenaphthylene	Y	43.2	152	6.68E-03	8.79E-06	4.66E-03	1.11E-04	4.551E-03	6.98E-06	3.4E+00	9.188E-05	1.29E+03	2.4E-07	1.5E-07	2.4E-07	1.5E-07	0.045	1.7E+00	3.87E-04	3.34E+04	3.91E-02	
Ammonia	Y	348	17	-	-	6.58E-04	1.57E-05	6.427E-04	1.10E-05	6.6E-01	2.725E-04	8.18E+02	3.3E-07	1.1E-07	3.3E-07	1.1E-07	0.228	1.0E+01	1.73E-03	1.49E+05	1.74E-01	
Aniline	N	0.212	93.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Anthracene	Y	15.4	178	6.53E-06	8.59E-09	2.27E-03	5.42E-05	2.217E-03	7.85E-06	3.9E+00	8.348E-05	1.15E+03	2.6E-07	1.1E-07	2.6E-07	1.1E-07	0.039	5.6E-01	9.03E-05	7.80E+03	9.12E-03	
Arsenic, Inorganic	N	0.024	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Barium	N	2.23	137	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(a)anthracene	N	12.6	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(e)anthracene	N	12.6	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzene	Y	40.2	78.1	9.48E+01	1.25E-01	2.27E-01	5.42E-03	2.217E-01	1.03E-05	1.7E+00	1.456E-04	8.74E+02	3.2E-07	3.1E-07	3.2E-07	3.1E-07	0.0895	1.2E+00	5.69E-04	4.92E+04	5.75E-02	
Benzo(a)pyrene	N	9.26	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(b)fluoranthene	N	8.33	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(g,h,i)perylene	N	4.22	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Benzo(k)fluoranthene	N	2.93	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bis(2-ethylhexyl)phthalate	N	0.03	391	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cadmium (Water)	N	0.108	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chromium(III), Insoluble Salts	N	0.102	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chromium(VI)	N	0.102	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Chrysene	N	9.78	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cobalt	N	0.057	58.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cresol, m-&p-	N	436	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Cresol, o-	N	182	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dibenz(a,h)anthracene	N	0.822	278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Dibenzofuran	Y	10.2	168	2.48E-03	3.26E-06	8.71E-03	2.08E-04	8.507E-03	7.38E-06	3.7E+00	8.632E-05	1.22E+03	2.5E-07	1.9E-07	2.5E-07	1.9E-07	0.041	3.9E-01	1.08E-04	9.30E+03	1.09E-02	
Dimethylphenol, 2,4-	N	38	122	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Ethylbenzene	Y	3.02	106	9.60E+00	1.26E-02	3.22E-01	7.69E-03	3.145E-01	8.46E-06	2.2E+00	1.217E-04	1.06E+03	2.8E-07	2.8E-07	2.8E-07	2.8E-07	0.0685	1.1E-01	4.27E-05	3.69E+03	4.31E-03	
Fluoranthene	N	25.9	202	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Fluorene	Y	21.1	166	6.00E-04	7.90E-07	3.93E-03	9.38E-05	3.838E-03	7.89E-06	3.4E+00	9.050E-05	1.14E+03	2.6E-07	1.5E-07	2.6E-07	1.5E-07	0.044	7.7E-01	1.70E-04	1.47E+04	1.72E-02	
Indeno(1,2,3-cd)pyrene	N	3.05	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Iron	N	187	55.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Lead and Compounds	N	0.555	207	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Manganese	N	4.89	54.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Methylnaphthalene, 2-	Y	105	142	5.50E-02	7.24E-05	2.12E-02	5.06E-04	2.071E-02	7.78E-06	2.9E+00	1.017E-04	1.16E+03	2.6E-07	2.3E-07	2.6E-07	2.3E-07	0.0524	3.9E+00	1.33E-03	1.15E+05	1.34E-01	
Naphthalene	Y	283	128	8.50E-02	1.12E-04	1.80E-02	4.30E-04	1.758E-02	8.38E-06	2.5E+00	1.120E-04	1.07E+03	2.8E-07	2.4E-07	2.8E-07	2.4E-07	0.0605	9.9E+00	3.53E-03	3.05E+05	3.57E-01	
Nickel Soluble Salts	N	0.303	58.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Phenanthrene	Y	74.1	178	1.21E-04	1.59E-07	1.73E-03	4.13E-05	1.690E-03	6.69E-06	4.4E+00	7.689E-05	1.35E+03	2.4E-07	8.4E-08	2.4E-07	8.4E-08	0.0345	3.0E+00	3.71E-04	3.21E+04	3.75E-02	
Phenol	N	249	94.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Pyrene	Y	27.9	202	4.50E-06	5.92E-09	4.87E-04	1.16E-05	4.756E-04	7.25E-06	5.4E+00	6.654E-05	1.24E+03	2.5E-07	2.8E-08	2.5E-07	2.8E-08	0.0278	1.1E+00	4.45E-05	3.84E+03	4.49E-03	
Styrene	Y	0.194	104	6.40E+00	8.42E-03	1.12E-01	2.67E-03	1.094E-01	8.78E-06	2.1E+00	1.248E-04	1.03E+03	2.8E-07	2.8E-07	2.8E-07	2.8E-07	0.0711	6.6E-03	2.71E-06	2.34E+02	2.74E-04	
Toluene	Y	17.6	92.1	2.84E+01	3.74E-02	2.71E-01	6.47E-03	2.647E-01	9.20E-06	1.9E+00	1.326E-04	9.78E+02	2.9E-07	2.9E-07	2.9E-07	2.9E-07	0.0778	5.8E-01	2.49E-04	2.15E+04	2.52E-02	
TPH C06-C09 aliphatic	Y	6.08	103	9.16E+01	1.21E-01	5.05E+01	1.21E+00	4.932E+01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.1E-07	3.1E-07	3.1E-07	3.1E-07	0.1	1.9E-01	8.69E-05	7.51E+03	8.78E-03	
TPH C10-C14 aliphatic	Y	1730	170	1.16E+00	1.53E-03	6.26E+01	1.49E+00	6.114E+01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.1E-07	3.1E-07	3.1E-07	3.1E-07	0.1	5.4E+01	2.47E-02	2.14E+06	2.50E+00	
TPH C10-C14 aromatic	Y	1730	136	1.16E+00	1.53E-03	1.41E-01	3.37E-03	1.377E-01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.1E-07	3.1E-07	3.1E-07	3.1E-07	0.1	5.4E+01	2.44E-02	2.11E+06	2.46E+00	
TPH C15-C28 aliphatic	n	1520	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
TPH C15-C28 aromatic	n	1520	209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
TPH C29-C36 aliphatic	n	332	270	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
TPH C29-C36 aromatic	N	332	240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Trimethylbenzene, 1,2,4-	Y	0.92	120	2.10E+00	2.76E-03	2.52E-01	6.02E-03	2.461E-01	7.92E-06	2.5E+00	1.123E-04	1.14E+03	2.7E-07	2.6E-07	2.7E-07	2.6E-07	0.0607	3.3E-02	1.30E-05	1.12E+03	1.31E-03	
Vanadium and compounds	N	0.0228	50.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Xylenes (total)	Y	6.7	106	7.99E+00	1.05E-02	2.12E-01	5.06E-03	2.071E-01	9.90E-06	1.8E+00	1.404E-04	9.09E+02	3.1E-07	3.0E-07	3.1E-07	3.0E-07	0.0847	2.1E-01	9.47E-05	8.18E+03	9.57E-03	

Summary of Derived RBSLs

Barangaroo

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

Chemical	Soil RBSLs (mg/kg)						Groundwater RBSLs (mg/L)					
	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Saturation Limited?	Site Concentration	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Solubility Limited?	Site Concentration
Acenaphthene	-	-	-	-	-	-	1.60E+02	8.75E+02	-	1.60E+02	>Sol	4.48E+00
Acenaphthylene	-	-	-	-	-	-	7.90E+01	4.33E+02	-	7.90E+01	>Sol	4.32E+01
Ammonia	-	-	-	-	-	-	6.32E+02	3.47E+03	-	6.32E+02	-	3.48E+02
Aniline	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	-	-	-	-	-	-	4.56E+00	2.50E+01	-	4.56E+00	>Sol	1.54E+01
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	-	-	-	-	-	7.65E+00	4.20E+01	1.20E+01	7.65E+00	-	4.02E+01
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	-	-	-	-	-	-	2.73E+02	1.50E+03	-	2.73E+02	>Sol	1.02E+01
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	1.04E+03	5.70E+03	-	1.04E+03	>Sol	3.02E+00
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	-	-	-	-	-	1.25E+01	6.88E+01	-	1.25E+01	>Sol	2.11E+01
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	-	-	-	-	-	-	2.34E+01	1.29E+02	-	2.34E+01	-	1.05E+02
Naphthalene	-	-	-	-	-	-	2.38E-01	1.30E+00	-	2.38E-01	-	2.83E+02
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	5.87E+00	3.22E+01	-	5.87E+00	>Sol	7.41E+01
Phenol	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	-	-	-	-	-	-	2.88E+00	1.58E+01	-	2.88E+00	>Sol	2.79E+01
Styrene	-	-	-	-	-	-	8.41E+02	4.61E+03	-	8.41E+02	>Sol	1.94E-01
Toluene	-	-	-	-	-	-	3.99E+03	2.19E+04	-	3.99E+03	>Sol	1.76E+01
TPH C06-C09 aliphatic	-	-	-	-	-	-	7.27E+03	3.99E+04	-	7.27E+03	>Sol	6.08E+00
TPH C10-C14 aliphatic	-	-	-	-	-	-	5.70E-01	3.13E+00	-	5.70E-01	>Sol	1.73E+03
TPH C10-C14 aromatic	-	-	-	-	-	-	1.17E+00	6.43E+00	-	1.17E+00	-	1.73E+03
TPH C15-C28 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	-	-	-	-	-	-	2.24E+01	1.23E+02	-	2.24E+01	-	9.20E-01
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	-	-	-	-	-	-	1.76E+02	9.64E+02	-	1.76E+02	>Sol	6.70E+00

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Pathways included in derivation of Soil RBSL:

Pathways included in derivation of Soil Vapour RBSL:

Pathways included in derivation of Groundwater RBSL:

Barangaroo

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

TOTAL

3.11E+01

5.66E+00

3.36E-05

[illegible]

Groundwater RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW vapours from flowing water	TOTAL (All Pathways)	GW vapours from flowing water	Total Vapour Pathways	TOTAL (All Pathways)					GW vapours from flowing water	TOTAL
	mg/L	mg/L	unitless	unitless	unitless	L/mg	L/mg	mg/L			mg/L	%	%
Acenaphthene	4.48	3.90E+00	4.89E-03	4.89E-03	1.25E-03	1.25E-03	1.25E-03	1.60E+02	4.89E-03	4.89E-03	1.60E+02	2.4%	2.44%
Acenaphthylene	43.2	1.61E+01	4.08E-02	4.08E-02	2.53E-03	2.53E-03	2.53E-03	7.90E+01	4.08E-02	4.08E-02	7.90E+01	20.4%	20.39%
Ammonia	348	4.82E+05	5.50E-01	5.50E-01	1.58E-03	1.58E-03	1.58E-03	6.32E+02	1.00E+00	-	6.32E+02	100.0%	100.00%
Aniline	0.212	3.60E+04	-	-	-	-	-	-	-	-	-	-	-
Anthracene	15.4	4.34E-02	1.90E-03	1.90E-03	4.39E-02	4.39E-02	4.39E-02	4.56E+00	1.90E-03	1.90E-03	4.56E+00	1.0%	0.95%
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	-	-	-
Barium	2.23		-	-	-		-	-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	-	-	-
Benzene	40.2	1.79E+03	1.31E+00	1.31E+00	3.27E-02	3.27E-02	3.27E-02	7.65E+00	2.50E-01	-	7.65E+00	100.0%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	-	-	-
Cobalt	0.057		-	-	-		-	-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-		-	-	-	-	-	-	-
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	1.14E-02	1.14E-02	3.66E-03	3.66E-03	3.66E-03	2.73E+02	1.14E-02	1.14E-02	2.73E+02	1.1%	1.14%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	7.27E-04	7.27E-04	2.41E-04	2.41E-04	2.41E-04	1.04E+03	4.07E-02	4.07E-02	1.04E+03	16.3%	16.28%
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	-	-	-
Fluorene	21.1	1.69E+00	2.69E-02	2.69E-02	1.59E-02	1.59E-02	1.59E-02	1.25E+01	2.69E-02	2.69E-02	1.25E+01	13.5%	13.47%
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	-	-	-
Iron	187		-	-	-		-	-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	-	-	-
Manganese	4.89		-	-	-		-	-	-	-	-	-	-
Methylnaphthalene, 2-Naphthalene	105	2.46E+01	2.10E-01	2.10E-01	8.53E-03	8.53E-03	8.53E-03	2.34E+01	2.00E-01	-	2.34E+01	100.0%	100.00%
	283	3.10E+01	2.61E+01	2.61E+01	8.42E-01	8.42E-01	8.42E-01	2.38E-01	2.00E-01	-	2.38E-01	100.0%	100.00%
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	3.92E-02	3.92E-02	3.41E-02	3.41E-02	3.41E-02	5.87E+00	3.92E-02	3.92E-02	5.87E+00	19.6%	19.58%
Phenol	249	8.28E+04	-	-	-		-	-	-	-	-	-	-
Pyrene	27.9	1.35E-01	9.38E-03	9.38E-03	6.95E-02	6.95E-02	6.95E-02	2.88E+00	9.38E-03	9.38E-03	2.88E+00	4.7%	4.69%
Styrene	0.194	3.10E+02	2.31E-04	2.31E-04	1.19E-03	1.19E-03	1.19E-03	8.41E+02	3.69E-01	3.69E-01	8.41E+02	36.9%	36.86%
Toluene	17.6	5.26E+02	1.10E-03	1.10E-03	6.27E-05	6.27E-05	6.27E-05	3.99E+03	3.30E-02	3.30E-02	3.99E+03	13.2%	13.18%
TPH C06-C09 aliphatic	6.08	1.18E+01	1.05E-04	1.05E-04	1.72E-05	1.72E-05	1.72E-05	7.27E+03	2.03E-04	2.03E-04	7.27E+03	0.2%	0.16%
TPH C10-C14 aliphatic	1730	9.99E-02	2.19E-02	2.19E-02	2.19E-01	2.19E-01	2.19E-01	5.70E-01	2.19E-02	2.19E-02	5.70E-01	17.5%	17.52%
TPH C10-C14 aromatic	1730	2.53E+01	2.70E+00	2.70E+00	1.07E-01	1.07E-01	1.07E-01	1.17E+00	1.25E-01	-	1.17E+00	100.0%	100.00%
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-Vanadium and compounds	0.92	5.70E+01	4.10E-02	4.10E-02	4.45E-02	4.45E-02	4.45E-02	2.24E+01	1.00E+00	-	2.24E+01	100.0%	100.00%
	0.0228	-	-	-	-		-	-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	9.54E-03	9.54E-03	1.42E-03	1.42E-03	1.42E-03	1.76E+02	1.51E-01	1.51E-01	1.76E+02	60.3%	60.34%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Child Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Residential Receptor) (Risk Based Calculations)

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW Vapurs from Flowing Water	TOTAL (All Pathways)	GW Vapour from Flowing Water	Total Vapour Pathways	TOTAL (All Pathways)					GW Vapours from Flowing Water	TOTAL
			unitless	unitless	unitless	L/mg	L/mg				mg/L	%	%
Acenaphthene	4.48	3.90E+00	8.91E-04	8.91E-04	2.28E-04	2.28E-04	2.28E-04	8.75E+02	8.91E-04	8.91E-04	8.75E+02	0.4%	0.45%
Acenaphthylene	43.2	1.61E+01	7.43E-03	7.43E-03	4.62E-04	4.62E-04	4.62E-04	4.33E+02	7.43E-03	7.43E-03	4.33E+02	3.7%	3.72%
Ammonia	348	4.82E+05	1.00E-01	1.00E-01	2.88E-04	2.88E-04	2.88E-04	3.47E+03	1.00E+00	-	3.47E+03	100.0%	100.00%
Aniline	0.212	3.60E+04	-	-	-	-	-	-	-	-	-	-	-
Anthracene	15.4	4.34E-02	3.47E-04	3.47E-04	8.00E-03	8.00E-03	8.00E-03	2.50E+01	3.47E-04	3.47E-04	2.50E+01	0.2%	0.17%
Arsenic, Inorganic	0.024		-	-	-	-	-	-	-	-	-	-	-
Barium	2.23		-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-	-	-	-	-	-	-	-	-
Benzene	40.2	1.79E+03	2.39E-01	2.39E-01	5.95E-03	5.95E-03	5.95E-03	4.20E+01	2.50E-01	-	4.20E+01	100.0%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-	-	-	-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-	-	-	-	-	-	-	-	-
Cobalt	0.057		-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	182	2.59E+04	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	2.07E-03	2.07E-03	6.68E-04	6.68E-04	6.68E-04	1.50E+03	2.07E-03	2.07E-03	1.50E+03	0.2%	0.21%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	1.33E-04	1.33E-04	4.39E-05	4.39E-05	4.39E-05	5.70E+03	7.42E-03	7.42E-03	5.70E+03	3.0%	2.97%
Fluoranthene	25.9	2.60E-01	-	-	-	-	-	-	-	-	-	-	-
Fluorene	21.1	1.69E+00	4.91E-03	4.91E-03	2.91E-03	2.91E-03	2.91E-03	6.88E+01	4.91E-03	4.91E-03	6.88E+01	2.5%	2.45%
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-	-	-	-	-	-	-	-	-
Iron	187		-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-	-	-	-	-	-	-	-	-
Manganese	4.89		-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-Naphthalene	105	2.46E+01	3.83E-02	3.83E-02	1.56E-03	1.56E-03	1.56E-03	1.29E+02	3.83E-02	3.83E-02	1.29E+02	19.1%	19.13%
	283	3.10E+01	4.76E+00	4.76E+00	1.53E-01	1.53E-01	1.53E-01	1.30E+00	2.00E-01	-	1.30E+00	100.0%	100.00%
Nickel Soluble Salts	0.303		-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	7.14E-03	7.14E-03	6.21E-03	6.21E-03	6.21E-03	3.22E+01	7.14E-03	7.14E-03	3.22E+01	3.6%	3.57%
Phenol	249	8.28E+04	-	-	-	-	-	-	-	-	-	-	-
Pyrene	27.9	1.35E-01	1.71E-03	1.71E-03	1.27E-02	1.27E-02	1.27E-02	1.58E+01	1.71E-03	1.71E-03	1.58E+01	0.9%	0.85%
Styrene	0.194	3.10E+02	4.20E-05	4.20E-05	2.17E-04	2.17E-04	2.17E-04	4.61E+03	6.72E-02	6.72E-02	4.61E+03	6.7%	6.72%
Toluene	17.6	5.26E+02	2.01E-04	2.01E-04	1.14E-05	1.14E-05	1.14E-05	2.19E+04	6.01E-03	6.01E-03	2.19E+04	2.4%	2.40%
TPH C06-C09 aliphatic	6.08	1.18E+01	1.91E-05	1.91E-05	3.14E-06	3.14E-06	3.14E-06	3.99E+04	3.70E-05	3.70E-05	3.99E+04	0.0%	0.03%
TPH C10-C14 aliphatic	1730	9.99E-02	3.99E-03	3.99E-03	4.00E-02	4.00E-02	4.00E-02	3.13E+00	3.99E-03	3.99E-03	3.13E+00	3.2%	3.19%
TPH C10-C14 aromatic	1730	2.53E+01	4.92E-01	4.92E-01	1.94E-02	1.94E-02	1.94E-02	6.43E+00	1.25E-01	-	6.43E+00	100.0%	100.00%
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	7.47E-03	7.47E-03	8.12E-03	8.12E-03	8.12E-03	1.23E+02	4.63E-01	4.63E-01	1.23E+02	46.3%	46.29%
Vanadium and compounds	0.0228	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	1.74E-03	1.74E-03	2.59E-04	2.59E-04	2.59E-04	9.64E+02	2.75E-02	2.75E-02	9.64E+02	11.0%	11.00%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Non-Threshold Health Effects
Barangaroo Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Commercial Receptor) (Risk Based Calculations)

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (ILCR)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW Vapours from Flowing Water	TOTAL (All Pathways)	GW Vapours from Flowing Water	Total Vapour Pathways	TOTAL (All Pathways)				GW Vapours from Flowing Water	TOTAL
	mg/L	mg/L	unitless	unitless	L/mg	L/mg	L/mg	mg/L		mg/L	%	%
Acenaphthene	4.48	3.90E+00	-	-	-		-	-	-	-	-	-
Acenaphthylene	43.2	1.61E+01	-	-	-		-	-	-	-	-	-
Ammonia	348	4.82E+05	-	-	-		-	-	-	-	-	-
Aniline	0.212	3.60E+04	-	-	-		-	-	-	-	-	-
Anthracene	15.4	4.34E-02	-	-	-		-	-	-	-	-	-
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	-	-
Barium	2.23		-	-	-		-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	-	-
Benzene	40.2	1.79E+03	3.36E-05	3.36E-05	8.36E-07	8.36E-07	8.36E-07	1.20E+01	1.00E-05	1.20E+01	100.00%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	-	-
Cobalt	0.057		-	-	-		-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-		-	-	-	-	-	-
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	-	-	-		-	-	-	-	-	-
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	-	-	-		-	-	-	-	-	-
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	-	-
Fluorene	21.1	1.69E+00	-	-	-		-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	-	-
Iron	187		-	-	-		-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	-	-
Manganese	4.89		-	-	-		-	-	-	-	-	-
Methylnaphthalene, 2-	105	2.46E+01	-	-	-		-	-	-	-	-	-
Naphthalene	283	3.10E+01	-	-	-		-	-	-	-	-	-
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	-	-	-		-	-	-	-	-	-
Phenol	249	8.28E+04	-	-	-		-	-	-	-	-	-
Pyrene	27.9	1.35E-01	-	-	-		-	-	-	-	-	-
Styrene	0.194	3.10E+02	-	-	-		-	-	-	-	-	-
Toluene	17.6	5.26E+02	-	-	-		-	-	-	-	-	-
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-		-	-	-	-	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-		-	-	-	-	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-		-	-	-	-	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	-	-	-		-	-	-	-	-	-
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	-	-	-		-	-	-	-	-	-

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

1. General Information:

Site:	Barangaroo
Address:	Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Client:	Lend Lease
Scenario:	Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations)

Header Colour (Defaults = Blue):

Blue

2. Select Receptor:

Commercial/Industrial

3. Select Exposure Pathways to Include:

Enter "x" in box, or select from dropdown box.

Soil Pathways

☐	Incidental Ingestion of Soil
☐	Dermal Contact with Soil
☐	Inhalation of Surface Soil-Derived Dust in Indoor Air
☐	Inhalation of Surface Soil-Derived Dust in Outdoor Air
☐	Inhalation of Surface Soil-Derived Vapours in Outdoor Air
☐	Inhalation of Soil-Derived Vapours From Excavation (USEPA 2002 method)
☒	Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
☐	Inhalation of Subsurface Soil-Derived Vapours in Outdoor Air

Groundwater Pathways

☐	Inhalation of Groundwater-Derived Vapours in Indoor Air
☐	Inhalation of Groundwater-Derived Vapours in Outdoor Air
☐	Ingestion of Potable Groundwater
☐	Incidental Ingestion of Groundwater (Bathing or Excavation)
☐	Dermal Contact with Groundwater (Bathing or Excavation)
☐	Inhalation of Groundwater Vapours during Irrigation/ Showering
☐	Ingestion of Vegetables Irrigated with Groundwater
☐	Inhalation of Groundwater Vapours (Where GW Enters Trench)
☒	Inhalation of vapour emissions from flowing water (groundwater in basement)

☐	Inhalation of Soil Vapour-Derived Vapours in Indoor Air
☐	Inhalation of Soil Vapour-Derived Vapours in Outdoor Air

☐	Y	Soil RBSLs saturation limited?
☐	Y	Groundwater RBSLs solubility limited?

4. Select Chemicals for Quantitative Assessment:

	Target Hazard Index	Target Cancer Risk	5. Enter Chemical Concentrations (if only calculating RBSLs, enter 1 for media for which you want RBSLs):	
	default = 1 (or manually overwrite)	default = 1x10 ⁻⁵ (or manually overwrite)	Soil (mg/kg)	Groundwater (mg/L)
Acenaphthene	0.2	1.00E-05	511	4.48
Acenaphthylene	0.2	1.00E-05	1700	43.2
Ammonia	1	1.00E-05		348
Aniline	1	1.00E-05		0.212
Anthracene	0.2	1.00E-05	2150	15.4
Arsenic, Inorganic	1	1.00E-05		0.024
Barium	1	1.00E-05		2.23
Benz(a)anthracene			1470	12.6
Benzene	0.25	1.00E-05	1510	40.2
Benzo(a)pyrene			652	9.26
Benzo(b)fluoranthene			587	8.33
Benzo(g,h,i)perylene			305	4.22
Benzo(k)fluoranthene			231	2.93
Bis(2-ethylhexyl)phalate	1	1.00E-05		0.03
Cadmium (Water)	1	1.00E-05		0.108
Chromium(III), Insoluble Salts	1	1.00E-05	210	0.102
Chromium(VI)	1	1.00E-05	2.3	0.102
Chrysene			771	9.78
Cobalt	1	1.00E-05		0.057
Cresol, m-&p-	1	1.00E-05	2290	436
Cresol, o-	1	1.00E-05		182
Blank				
Dibenz(a,h)anthracene			71.4	0.822
Dibenzofuran	1	1.00E-05	277	10.2
Dimethylphenol, 2,4-	1	1.00E-05		38
Ethylbenzene	0.25	1.00E-05	261	3.02
Fluoranthene			2440	25.9
Fluorene	0.2	1.00E-05	2100	21.1
Indeno(1,2,3-cd)pyrene			247	3.05
Iron	1	1.00E-05	60600	187
Lead and Compounds	1	1.00E-05	13600	0.555
Manganese	1	1.00E-05		4.89
Methylnaphthalene, 2-	0.2	1.00E-05	7650	105
Naphthalene	0.2	1.00E-05	10200	283
Nickel Soluble Salts	1	1.00E-05		0.303
Phenanthrene	0.2	1.00E-05	5180	74.1
Phenol	1	1.00E-05		249
Pyrene	0.2	1.00E-05	2640	27.9
Styrene	1	1.00E-05		0.194
Toluene	0.25	1.00E-05	2650	17.6
TPH C06-C09 aliphatic	0.125	1.00E-05	593	6.08
TPH C10-C14 aliphatic	0.125	1.00E-05	69400	1730
TPH C10-C14 aromatic	0.125	1.00E-05	69400	1730
TPH C15-C28 aliphatic	0.125	1.00E-05	93200	1520
TPH C15-C28 aromatic	0.125	1.00E-05	93200	1520
TPH C29-C36 aliphatic	0.125	1.00E-05	20600	332
TPH C29-C36 aromatic	0.125	1.00E-05	20600	332
Trimethylbenzene, 1,2,4-	1	1.00E-05	220	0.92
Vanadium and compounds	1	1.00E-05	248	0.0228
Xylenes (total)	0.25	1.00E-05	2567	6.7

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

6. Confirm/Modify Exposure Parameters:

	Units	Site-Specific Value (leave blank to use default value)		Value Used in Calculations	
		Adult	Child	Adult	Child

General receptor parameters:

Body weight	kg	70	na	70	
Exposure duration	yr	30	na	30	
Averaging time (carcinogens)	yr	70	na	70	
Averaging time (non-carcinogens)	yr	30	na	30	

Incidental Soil Ingestion

Daily soil ingestion rate	mg/day				
Exposure frequency for soil ingestion	days/yr				
Fraction of daily soil intake from site	unitless				

Dermal Absorption of Soil

Exposed skin surface area for soil contact	cm2				
Soil to skin adherence factor	mg/cm2				
Exposure frequency for dermal contact with soil	days/yr				

Indoor Inhalation

Exposure time (indoor air)	hrs/day	8	8	8	8
Exposure frequency (indoor air)	days/yr	240	240	240	240
Particulate emission factor (indoor air)	m3/kg				

Outdoor Inhalation

Exposure time (outdoor air)	hrs/day				
Exposure frequency (outdoor air)	days/yr				
Particulate emission factor (outdoor air)	m3/kg				

Potable Water Ingestion

Potable water intake rate	L/day				
Exposure frequency for potable water intake	days/yr				

Incidental Water Ingestion

Incidental ingestion rate	L/day				
Exposure frequency for incidental water ingestion	days/yr				

Dermal Contact with Water

Exposed skin surface for water contact	cm2				
Exposure time for dermal water contact	hr/day				
Exposure frequency for dermal water contact	days/yr				

Vapour Inhalation Shower/ Sprinkler

Exposure frequency	days/yr				
Exposure time	min/ day				
Inhalation rate	m3/hr				
Inhalation Absorption Adjustment Factor	mg/mg				
Lung retention factor	unitless				

Ingestion of Home Grown Produce

Proportion of homegrown produce ingested					
Exposure frequency	days/year				

Inhalation of Vapours from Flowing Water

Exposure time	hrs/day	8	na	8	
Exposure frequency	days/year	240	na	240	

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo

[Back to User Input Sheet](#)

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

A. Model Input Parameters

Parameter Definition	Units	Default Value (Shell 2007 unless otherwise noted)	Notes	Site-Specific Value (leave blank if adopting Shell default)	Label	Adopted Value for Model	Justification for Site-specific value, if applicable
Lower depth of surficial soil zone	cm	100			LDSSZ	100	
Depth to subsurface soil sources (below building, ground surface or trench)	cm	100			LS	0.001	Autocalculates from layer thicknesses
<u>Vadose Zone Layer 1 (soil type where source is)</u>							
Thickness	cm	100		0.001	HV	0.001	Negligible distance - assumes soil is adjacent building foundataion
SCS Soil Type:				Sand and gravel (<12% fines)			Conservative assumption for mixed fill.
Fraction of organic carbon	unitless	0.01		0.002	OC	0.002	
Soil bulk density	g/cm3	1.7		1.66	sbd	1.66	
Air-filled porosity (volumetric)	cm3/cm3	0.26		0.321	VACS	0.321	
Water-filled porosity (volumetric)	cm3/cm3	0.12		0.054	wvcvz	0.054	
Total soil porosity	cm3/cm3	0.38		0.375	TPOR	0.375	
Vapour phase source partitioning adjustment	unitless	1		10	VPPA	10	Adjustment for vapour partitioning; see text.
Vadose zone biodegradation adjustment	unitless	1		1	BioA	1	Conservatively assumes no soil vapour biodegradation
<u>Vadose Zone Layer 2 (lens)</u>							
Thickness	cm				Hvtwo		
SCS Soil Type:							
Air-filled porosity (volumetric)	cm3/cm3	NA			VACS2	NA	
Water-filled porosity (volumetric)	cm3/cm3	NA			wvcvz2	NA	
Total soil porosity	cm3/cm3	NA			TPOR2	NA	
<u>Vadose Zone Layer 3 (lens)</u>							
Thickness	cm				Hvthree		
SCS Soil Type:							
Air-filled porosity (volumetric)	cm3/cm3	NA			VACS3	NA	
Water-filled porosity (volumetric)	cm3/cm3	NA			Vwcvz3	NA	
Total soil porosity	cm3/cm3	NA			TPOR3	NA	
<u>Building Characteristics</u>							
Enclosed-space volume/infiltration area (ratio)	cm	300	(a)	5625	LB	5625	Assumes 50 m by 50 m by 4.5 m high basement section, with soil vapour infiltration through upper 2m of 2 of 4 walls only (no floor), ie volume = 11250 m3 and infiltration area = 200 m2. See text.
Enclosed-space foundation or wall thickness	cm	15		15	Lcrack	15	Conservative default
Enclosed-space air exchange rate	1/s	0.000555556		0.00088	ENCAER	8.80E-04	assumed to be 3.17 air exchanges per hour- as per information provided by Lend Lease
Areal fraction of cracks in foundations/walls	cm ² -cracks/cm ² -total area	0.0019	(b)	0.0002	NU	0.0002	USEPA (2004) default for basement foundation.
Volumetric air content in found./wall cracks	cc/cc	0.26		0.321	VACF	0.321	Assumes cracks in concrete are filled with sand
Volumetric water content in found./wall cracks	cc/cc	0.12		0.054	wvcfnd	0.054	Assumes cracks in concrete are filled with sand
<u>Convective vapour flow term</u>							
Calculate convective flow term?		Y		Y	Conv	Y	
Convective flow rate (if specified directly)	cm3/sec						
Convective flow through slab (calculated)	cm3/sec	10.88		380.3828744	Qs	380.38	
Slab Area	cm2	700000		2.70E+07	Ab	27000000	Area through which vapours may enter (conservatively includes floor and two walls)
Areal fraction of cracks in foundations/walls	cm ² -cracks/cm ² -total area	0.0019		0.0002	Nuc		
Soil vapour permeability	cm ²	1.00E-08		1.00E-07	kv	1.00E-07	Conservative default for coarse sand/gravel
Indoor-outdoor pressure differential	g/cm-s ²	40		40	dP	40	USEPA (2004b) default
Slab perimeter	cm	3400		20000	Xcrack	20000	Perimeter of basement footprint.
Depth below ground to bottom of slab	cm	15		200	Zcrack	200	Advection occurring to max depth of 2 m.
Viscosity of air	g/cm-s	1.81E-04		1.81E-04	uair	1.81E-04	Viscosity of air at 20 C

(a) Building Code of Australia minimum ceiling height for habitable dwelling.
(b) USEPA (2004) upper limit of range for slab on grade foundation.
(c) If receptor is construction/excavation worker, wind speed is default wind speed of 225 cm/s reduced by factor of 10 to account for reduced wind circulation within excavation. For other receptors, wind speed is default of 225 cm/s.
(d) For construction/excavation worker, default is 400 cm (assumes trench is 2 m long and 2 m deep, and vapours enter through both walls and floor). For other receptors, Shell (2007) default of 4500 cm is assumed.
(e) Equals exposure duration for selected receptor. For residential scenario, shortest (child) exposure duration is selected for conservative purposes.
(f) USEPA (2002) default (0.5 acre).

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo

[Back to User Input Sheet](#)

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

B. Chemical-Specific Fate and Transport Parameters

CHEMICAL	Koc	Kd	H'	S	D ^{air}	D ^{wat}	MW	VP	Volatile?
	(cm ³ /g)	(cm ³ /g)	(cc-H ₂ O / cc-air)	(mg/l-water)	(cm ² /s)	(cm ² /s)	(g/mol)	(mmHg)	
Acenaphthene	5.03E+03	1.01E+01	7.52E-03	3.90E+00	5.06E-02	8.33E-06	1.54E+02	2.15E-03	Y
Acenaphthylene	5.03E+03	1.01E+01	4.66E-03	1.61E+01	4.50E-02	6.98E-06	1.52E+02	6.68E-03	Y
Ammonia	3.10E+00	6.20E-03	6.58E-04	4.82E+05	2.28E-01	1.10E-05	1.70E+01	-	Y
Aniline	7.02E+01	1.40E-01	8.26E-05	3.60E+04	8.30E-02	1.01E-05	9.31E+01	4.90E-01	N
Anthracene	1.64E+04	3.28E+01	2.27E-03	4.34E-02	3.90E-02	7.85E-06	1.78E+02	6.53E-06	Y
Arsenic, Inorganic	-	#VALUE!	-		-	-	7.80E+01	-	N
Barium	-	#VALUE!	-		-	-	1.37E+02	-	N
Benz(a)anthracene	1.77E+05	3.54E+02	1.37E-04	9.40E-03	5.10E-02	9.00E-06	2.28E+02	2.10E-07	N
Benzene	1.46E+02	2.92E-01	2.27E-01	1.79E+03	8.95E-02	1.03E-05	7.81E+01	9.48E+01	Y
Benzo(a)pyrene	5.87E+05	1.17E+03	1.87E-05	1.62E-03	4.30E-02	9.00E-06	2.52E+02	5.49E-09	N
Benzo(b)fluoranthene	5.99E+05	1.20E+03	2.69E-05	1.50E-03	2.26E-02	5.56E-06	2.52E+02	5.00E-07	N
Benzo(g,h,i)perylene	1.95E+06	3.90E+03	1.35E-05	2.60E-04	4.90E-02	5.56E-06	2.76E+02	1.00E-10	N
Benzo(k)fluoranthene	5.87E+05	1.17E+03	2.39E-05	8.00E-04	2.26E-02	5.56E-06	2.52E+02	9.65E-10	N
Bis(2-ethylhexyl)phalate	1.20E+05	2.40E+02	1.10E-05	2.70E-01	3.51E-02	3.66E-06	3.91E+02	1.42E-07	N
Cadmium (Water)	-	#VALUE!	-		-	-	1.12E+02		N
Chromium(III), Insoluble Salts	-	#VALUE!	-		-	-	5.20E+01	-	N
Chromium(VI)	-	#VALUE!	-	1.69E+06	-	-	5.20E+01	-	N
Chrysene	1.81E+05	3.62E+02	2.14E-04	2.00E-03	2.48E-02	6.21E-06	2.28E+02	6.23E-09	N
Cobalt	-	#VALUE!	-		-	-	5.89E+01		N
Cresol, m-&p-	3.00E+02	6.00E-01	3.50E-05	2.27E+04	7.29E-02	9.32E-06	1.08E+02	1.10E-01	N
Cresol, o-	3.07E+02	6.14E-01	4.91E-05	2.59E+04	7.28E-02	9.32E-06	1.08E+02	1.70E-01	N
Dibenz(a,h)anthracene	1.91E+06	3.82E+03	5.76E-06	2.49E-03	2.00E-02	5.24E-06	2.78E+02	9.55E-10	N
Dibenzofuran	9.16E+03	1.83E+01	8.71E-03	3.10E+00	4.10E-02	7.38E-06	1.68E+02	2.48E-03	Y
Dimethylphenol, 2,4-	4.92E+02	9.84E-01	3.89E-05	7.87E+03	6.22E-02	8.31E-06	1.22E+02	1.02E-01	N
Ethylbenzene	4.46E+02	8.92E-01	3.22E-01	1.69E+02	6.85E-02	8.46E-06	1.06E+02	9.60E+00	Y
Fluoranthene	5.55E+04	1.11E+02	3.62E-04	2.60E-01	3.02E-02	6.35E-06	2.02E+02	9.22E-06	N
Fluorene	9.16E+03	1.83E+01	3.93E-03	1.69E+00	4.40E-02	7.89E-06	1.66E+02	6.00E-04	Y
Indeno(1,2,3-cd)pyrene	1.95E+06	3.90E+03	1.42E-05	1.90E-04	2.30E-02	4.41E-06	2.76E+02	1.25E-10	N
Iron	-	#VALUE!	-		-	-	5.59E+01		N
Lead and Compounds	-	#VALUE!	-		-	-	2.07E+02		N
Manganese	-	#VALUE!	-		-	-	5.49E+01	-	N
Methylnaphthalene, 2-	2.48E+03	4.96E+00	2.12E-02	2.46E+01	5.24E-02	7.78E-06	1.42E+02	5.50E-02	Y
Naphthalene	1.54E+03	3.08E+00	1.80E-02	3.10E+01	6.05E-02	8.38E-06	1.28E+02	8.50E-02	Y
Nickel Soluble Salts	-	#VALUE!	-		-	-	5.87E+01		N
Phenanthrene	1.67E+04	3.34E+01	1.73E-03	1.15E+00	3.45E-02	6.69E-06	1.78E+02	1.21E-04	Y
Phenol	1.87E+02	3.74E-01	1.36E-05	8.28E+04	8.34E-02	1.03E-05	9.41E+01	3.50E-01	N
Pyrene	5.43E+04	1.09E+02	4.87E-04	1.35E-01	2.78E-02	7.25E-06	2.02E+02	4.50E-06	Y
Styrene	4.46E+02	8.92E-01	1.12E-01	3.10E+02	7.11E-02	8.78E-06	1.04E+02	6.40E+00	Y
Toluene	2.34E+02	4.68E-01	2.71E-01	5.26E+02	7.78E-02	9.20E-06	9.21E+01	2.84E+01	Y
TPH C06-C09 aliphatic	4.47E+03	8.94E+00	5.05E+01	1.18E+01	1.00E-01	1.00E-05	1.03E+02	9.16E+01	Y
TPH C10-C14 aliphatic	5.50E+05	1.10E+03	6.26E+01	9.99E-02	1.00E-01	1.00E-05	1.70E+02	1.16E+00	Y
TPH C10-C14 aromatic	3.02E+03	6.04E+00	1.41E-01	2.53E+01	1.00E-01	1.00E-05	1.36E+02	1.16E+00	Y
TPH C15-C28 aliphatic	3.16E+08	6.32E+05	8.27E+01	1.11E-04	1.00E-01	1.00E-05	2.60E+02	5.93E-03	N
TPH C15-C28 aromatic	3.79E+04	7.58E+01	4.90E-03	1.06E+00	1.00E-01	1.00E-05	2.09E+02	5.51E-03	N
TPH C29-C36 aliphatic	6.31E+08	1.26E+06	8.50E+01	2.50E-06	1.00E-01	1.00E-05	2.70E+02	8.36E-04	N
TPH C29-C36 aromatic	1.26E+05	2.52E+02	1.70E-05	6.60E-03	1.00E-01	1.00E-05	2.40E+02	3.34E-07	N
Trimethylbenzene, 1,2,4-	6.14E+02	1.23E+00	2.52E-01	5.70E+01	6.07E-02	7.92E-06	1.20E+02	2.10E+00	Y
Vanadium and compounds	-	#VALUE!	-	-	-	-	5.09E+01	-	N
Xylenes (total)	3.83E+02	7.66E-01	2.12E-01	1.06E+01	8.47E-02	9.90E-06	1.06E+02	7.99E+00	Y
	-	-	-	-	-	-	-	-	-

Definition of Parameters

Koc	Organic carbon partition coefficient	D ^{air}	Diffusion coefficient in air
Kd	Soil-water partition coefficient	D ^{wat}	Diffusion coefficient in water
H'	Dimensionless Henry's Law Constant	MW	Molecular weight
S	Solubility	VP	Vapopur pressure

Vapour Modelling - Soil to Outdoor and Indoor Air

[Back to User Input Sheet](#)

Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

C. Chemical-Specific Diffusion Coefficients

CHEMICAL	D _{s1} (cm ² /s)	D _{s2} (cm ² /s)	D _{s3} (cm ² /s)	D _{stot} (cm ² /s)	D _{crack} (cm ² /s)	C _{sat} (mg/kg)	Convective Factor (unitless)	D _a (cm ² /s)	M _{excav} (g)
Acenaphthene	8.18E-03	-	-	8.18E-03	8.18E-03	3.94E+01	1.29E+02	3.66E-06	7.25E+04
Acenaphthylene	7.28E-03	-	-	7.28E-03	7.28E-03	1.63E+02	1.45E+02	2.02E-06	5.38E+04
Ammonia	3.69E-02	-	-	3.69E-02	3.69E-02	1.87E+04	2.87E+01	3.75E-04	7.34E+05
Aniline	NV	NV	NV	NV	NV	6.23E+03	NV	NV	NV
Anthracene	6.31E-03	-	-	6.31E-03	6.31E-03	1.42E+00	1.68E+02	2.62E-07	1.94E+04
Arsenic, Inorganic	NV	NV	NV	NV	NV		NV	NV	NV
Barium	NV	NV	NV	NV	NV		NV	NV	NV
Benz(a)anthracene	NV	NV	NV	NV	NV	3.33E+00	NV	NV	NV
Benzene	1.45E-02	-	-	1.45E-02	1.45E-02	6.59E+02	7.30E+01	5.35E-03	2.77E+06
Benzo(a)pyrene	NV	NV	NV	NV	NV	1.90E+00	NV	NV	NV
Benzo(b)fluoranthene	NV	NV	NV	NV	NV	1.80E+00	NV	NV	NV
Benzo(g,h,i)perylene	NV	NV	NV	NV	NV	1.01E+00	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	NV	NV	NV	9.39E-01	NV	NV	NV
Bis(2-ethylhexyl)phalate	NV	NV	NV	NV	NV	6.48E+01	NV	NV	NV
Cadmium (Water)	NV	NV	NV	NV	NV		NV	NV	NV
Chromium(III), Insoluble Salts	NV	NV	NV	NV	NV		NV	NV	NV
Chromium(VI)	NV	NV	NV	NV	NV		NV	NV	NV
Chrysene	NV	NV	NV	NV	NV	7.24E-01	NV	NV	NV
Cobalt	NV	NV	NV	NV	NV		NV	NV	NV
Cresol, m-&p-	NV	NV	NV	NV	NV	1.44E+04	NV	NV	NV
Cresol, o-	NV	NV	NV	NV	NV	1.67E+04	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	NV	NV	NV	9.51E+00	NV	NV	NV
Dibenzofuran	6.63E-03	-	-	6.63E-03	6.63E-03	5.69E+01	1.59E+02	1.89E-06	5.21E+04
Dimethylphenol, 2,4-	NV	NV	NV	NV	NV	8.00E+03	NV	NV	NV
Ethylbenzene	1.11E-02	-	-	1.11E-02	1.11E-02	1.67E+02	9.54E+01	2.17E-03	1.77E+06
Fluoranthene	NV	NV	NV	NV	NV	2.89E+01	NV	NV	NV
Fluorene	7.11E-03	-	-	7.11E-03	7.11E-03	3.10E+01	1.49E+02	9.14E-07	3.62E+04
Indeno(1,2,3-cd)pyrene	NV	NV	NV	NV	NV	7.41E-01	NV	NV	NV
Iron	NV	NV	NV	NV	NV		NV	NV	NV
Lead and Compounds	NV	NV	NV	NV	NV		NV	NV	NV
Manganese	NV	NV	NV	NV	NV		NV	NV	NV
Methylnaphthalene, 2-	8.47E-03	-	-	8.47E-03	8.47E-03	1.23E+02	1.25E+02	2.16E-05	1.76E+05
Naphthalene	9.78E-03	-	-	9.78E-03	9.78E-03	9.66E+01	1.08E+02	3.39E-05	2.21E+05
Nickel Soluble Salts	NV	NV	NV	NV	NV		NV	NV	NV
Phenanthrene	5.58E-03	-	-	5.58E-03	5.58E-03	3.84E+01	1.89E+02	1.73E-07	1.58E+04
Phenol	NV	NV	NV	NV	NV	3.37E+04	NV	NV	NV
Pyrene	4.50E-03	-	-	4.50E-03	4.50E-03	1.47E+01	2.35E+02	1.21E-08	4.17E+03
Styrene	1.15E-02	-	-	1.15E-02	1.15E-02	2.93E+02	9.19E+01	8.17E-04	1.08E+06
Toluene	1.26E-02	-	-	1.26E-02	1.26E-02	2.91E+02	8.40E+01	3.70E-03	2.31E+06
TPH C06-C09 aliphatic	1.62E-02	-	-	1.62E-02	1.62E-02	2.21E+02	6.54E+01	2.61E-02	6.13E+06
TPH C10-C14 aliphatic	1.62E-02	-	-	1.62E-02	1.62E-02	1.11E+02	6.54E+01	5.46E-04	8.86E+05
TPH C10-C14 aromatic	1.62E-02	-	-	1.62E-02	1.62E-02	1.54E+02	6.54E+01	2.24E-04	5.68E+05
TPH C15-C28 aliphatic	NV	NV	NV	NV	NV	7.02E+01	NV	NV	NV
TPH C15-C28 aromatic	NV	NV	NV	NV	NV	8.04E+01	NV	NV	NV
TPH C29-C36 aliphatic	NV	NV	NV	NV	NV	3.16E+00	NV	NV	NV
TPH C29-C36 aromatic	NV	NV	NV	NV	NV	1.66E+00	NV	NV	NV
Trimethylbenzene, 1,2,4-	9.81E-03	-	-	9.81E-03	9.81E-03	7.46E+01	1.08E+02	1.13E-03	1.28E+06
Vanadium and compounds	NV	NV	NV	NV	NV		NV	NV	NV
Xylenes (total)	1.37E-02	-	-	1.37E-02	1.37E-02	8.90E+00	7.72E+01	2.08E-03	1.73E+06

Definition of Parameters

D _s	Effective diffusion coefficient in soil based on vapor-phase concentration	D _a = Apparent diffusivity (for construction scenario Volatilisation Factor)
D _{crack}	Effective diffusion coefficient through foundation cracks	M _{excav} = Cumulative unit mass emitted from excavation (Eq E-13 in USEPA, 2002).
C _{sat}	Soil concentration at which dissolved pore-water and vapor phases become saturated	

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

[Back to User Input Sheet](#)

D. Chemical-Specific Volatilisation Factors

CHEMICAL	VF _{as1}	VF _{as2}	VF _p (indoor)	VF _p (outdoor)	VF _{samb}	VF _{sevp}	VF _{excav}
	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)
Acenaphthene	1.17E-05	1.75E-05	-	-	3.35E-01	2.12E-06	-3.12E+08
Acenaphthylene	8.66E-06	1.75E-05	-	-	1.94E-01	1.31E-06	-2.32E+08
Ammonia	1.18E-04	1.75E-05	-	-	1.33E+01	4.82E-05	-3.16E+09
Aniline	NV	NV	-	-	NV	NV	NV
Anthracene	3.12E-06	1.75E-05	-	-	2.67E-02	1.97E-07	-8.35E+07
Arsenic, Inorganic	NV	NV	-	-	NV	NV	NV
Barium	NV	NV	-	-	NV	NV	NV
Benz(a)anthracene	NV	NV	-	-	NV	NV	NV
Benzene	4.46E-05	1.75E-05	-	-	3.64E+01	1.75E-04	-1.19E+10
Benzo(a)pyrene	NV	NV	-	-	NV	NV	NV
Benzo(b)fluoranthene	NV	NV	-	-	NV	NV	NV
Benzo(g,h,i)perylene	NV	NV	-	-	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	-	-	NV	NV	NV
Bis(2-ethylhexyl)phalate	NV	NV	-	-	NV	NV	NV
Cadmium (Water)	NV	NV	-	-	NV	NV	NV
Chromium(III), Insoluble Salts	NV	NV	-	-	NV	NV	NV
Chromium(VI)	NV	NV	-	-	NV	NV	NV
Chrysene	NV	NV	-	-	NV	NV	NV
Cobalt	NV	NV	-	-	NV	NV	NV
Cresol, m-&p-	NV	NV	-	-	NV	NV	NV
Cresol, o-	NV	NV	-	-	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	-	-	NV	NV	NV
Dibenzofuran	8.38E-06	1.75E-05	-	-	1.89E-01	1.35E-06	-2.24E+08
Dimethylphenol, 2,4-	NV	NV	-	-	NV	NV	NV
Ethylbenzene	2.84E-05	1.75E-05	-	-	1.71E+01	9.29E-05	-7.61E+09
Fluoranthene	NV	NV	-	-	NV	NV	NV
Fluorene	5.84E-06	1.75E-05	-	-	8.90E-02	6.09E-07	-1.56E+08
Indeno(1,2,3-cd)pyrene	NV	NV	-	-	NV	NV	NV
Iron	NV	NV	-	-	NV	NV	NV
Lead and Compounds	NV	NV	-	-	NV	NV	NV
Manganese	NV	NV	-	-	NV	NV	NV
Methylnaphthalene, 2-	2.83E-05	1.75E-05	-	-	1.95E+00	1.21E-05	-7.59E+08
Naphthalene	3.55E-05	1.75E-05	-	-	3.14E+01	1.64E-05	-9.51E+08
Nickel Soluble Salts	NV	NV	-	-	NV	NV	NV
Phenanthrene	2.54E-06	1.75E-05	-	-	1.85E-02	1.47E-07	-6.80E+07
Phenol	NV	NV	-	-	NV	NV	NV
Pyrene	6.72E-07	1.75E-05	-	-	1.39E-03	1.28E-08	-1.80E+07
Styrene	1.74E-04	1.75E-05	-	-	6.33E+01	3.37E-04	-4.67E+09
Toluene	3.71E-05	1.75E-05	-	-	2.73E+01	1.39E-04	-9.93E+09
TPH C06-C09 aliphatic	9.87E-05	1.75E-05	-	-	1.67E+02	7.67E-04	-2.64E+10
TPH C10-C14 aliphatic	1.43E-05	1.75E-05	-	-	3.48E+00	1.60E-05	-3.82E+09
TPH C10-C14 aromatic	9.14E-06	1.75E-05	-	-	1.43E+00	6.58E-06	-2.45E+09
TPH C15-C28 aliphatic	NV	NV	-	-	NV	NV	NV
TPH C15-C28 aromatic	NV	NV	-	-	NV	NV	NV
TPH C29-C36 aliphatic	NV	NV	-	-	NV	NV	NV
TPH C29-C36 aromatic	NV	NV	-	-	NV	NV	NV
Trimethylbenzene, 1,2,4-	2.05E-04	1.75E-05	-	-	1.05E+03	5.48E-04	-5.50E+09
Vanadium and compounds	NV	NV	-	-	NV	NV	NV
Xylenes (total)	2.78E-05	1.75E-05	-	-	1.46E+01	7.19E-05	-7.44E+09

Definition of Parameters

VF _{as}	Volatilization factor from surficial soils to ambient air (vapors) - use lower of two values
VF _p	Volatilization factor from surficial soils to ambient air (particulates)
VF _{samb}	Volatilization factor from subsurface soils to ambient air
VF _{sevp}	Volatilization factor from soil to enclosed-space vapors
VF _{excav}	Volatilisation factor from subsurface soil to trench air (where soil contamination is below base of trench)

Calculation of Vapour Emissions from Water with Flow

Barangaroo

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Scenario 2 Upper Basement Commercial Workers, New York (Risk Based Calculations) Scenario

Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Notes:
Assumes viscosity of air at 25 deg C
(*) Adopted density and viscosity of air values are those published in USEPA Air Emissions for Wast and Waste Water Nov 1994. (viscosity = 1.81×10^{-4} , density = 1.2×10^{-3})
** where windspeeds are greater than 3.25 m/s, F/D ratios greater than 51.2 and diffusivity of ether is 8.5×10^{-5}
where viscosity of water is assumed to be 9×10^{-3} g/cm per sec and density of water 1g/cm³.
Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Summary of Derived RBSLs

Barangaroo

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical	Soil RBSLs (mg/kg)						Groundwater RBSLs (mg/L)					
	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Saturation Limited?	Site Concentration	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Solubility Limited?	Site Concentration
Acenaphthene	9.04E+04	-	-	9.04E+04	>Sat	5.11E+02	1.82E+03	-	-	1.82E+03	>Sol	4.48E+00
Acenaphthylene	1.46E+05	-	-	1.46E+05	>Sat	1.70E+03	8.88E+02	-	-	8.88E+02	>Sol	4.32E+01
Ammonia	-	-	-	-	-	-	6.84E+03	-	-	6.84E+03	-	3.48E+02
Aniline	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	4.87E+06	-	-	4.87E+06	>Sat	2.15E+03	4.98E+01	-	-	4.98E+01	>Sol	1.54E+01
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	6.24E+01	-	1.01E+02	6.24E+01	-	1.51E+03	9.02E+01	-	1.46E+02	9.02E+01	-	4.02E+01
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	7.09E+05	-	-	7.09E+05	>Sat	2.77E+02	3.12E+03	-	-	3.12E+03	>Sol	1.02E+01
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	1.60E+04	-	-	1.60E+04	>Sat	2.61E+02	1.22E+04	-	-	1.22E+04	>Sol	3.02E+00
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	2.10E+05	-	-	2.10E+05	>Sat	2.10E+03	1.40E+02	-	-	1.40E+02	>Sol	2.11E+01
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	1.06E+04	-	-	1.06E+04	>Sat	7.65E+03	2.73E+02	-	-	2.73E+02	>Sol	1.05E+02
Naphthalene	1.67E+02	-	-	1.67E+02	>Sat	1.02E+04	2.76E+00	-	-	2.76E+00	-	2.83E+02
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	1.30E+06	-	-	1.30E+06	>Sat	5.18E+03	6.36E+01	-	-	6.36E+01	>Sol	7.41E+01
Phenol	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	7.51E+06	-	-	7.51E+06	>Sat	2.64E+03	3.01E+01	-	-	3.01E+01	>Sol	2.79E+01
Styrene	-	-	-	-	-	-	9.90E+03	-	-	9.90E+03	>Sol	1.94E-01
Toluene	4.09E+04	-	-	4.09E+04	>Sat	2.65E+03	4.70E+04	-	-	4.70E+04	>Sol	1.76E+01
TPH C06-C09 aliphatic	1.37E+04	-	-	1.37E+04	>Sat	5.93E+02	8.58E+04	-	-	8.58E+04	>Sol	6.08E+00
TPH C10-C14 aliphatic	3.56E+04	-	-	3.56E+04	>Sat	6.94E+04	5.70E-01	-	-	5.70E-01	>Sol	1.73E+03
TPH C10-C14 aromatic	1.73E+04	-	-	1.73E+04	>Sat	6.94E+04	1.38E+01	-	-	1.38E+01	-	1.73E+03
TPH C15-C28 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	5.83E+01	-	-	5.83E+01	-	2.20E+02	2.65E+02	-	-	2.65E+02	>Sol	9.20E-01
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	3.49E+03	-	-	3.49E+03	>Sat	2.57E+03	2.07E+03	-	-	2.07E+03	>Sol	6.70E+00
	-	-	-	-	-	-	-	-	-	-	-	-

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Health Risk Calculations - Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical			Volatilisation Factor from Subsurface Soil to Indoor Air (mg/m3)/(mg/kg)	Vapour Concentration in Indoor Air (From Subsurface Soil) (mg/m3)	Threshold Intake and Risk Calculations			
	Soil Conc.	Csat			Inhalation RfC	Adult Exposure Factor (threshold)	Adult Exposure Adjusted Air Concentration (threshold)	Hazard Index (Adult)
	(mg/kg)	(mg/kg)			(mg/m3)	(kg/m3)	(mg/m3)	(unitless)
Acenaphthene	511	3.94E+01	2.12E-06	8.35E-05	2.10E-01	4.65E-07	1.83E-05	8.71E-05
Acenaphthylene	1700	1.63E+02	1.31E-06	2.14E-04	2.10E-01	2.88E-07	4.68E-05	2.23E-04
Ammonia	-	-	-	-	-	-	-	-
Aniline	-	-	NV	-	-	-	-	-
Anthracene	2150	1.42E+00	1.97E-07	2.80E-07	1.05E+00	4.31E-08	6.15E-08	5.85E-08
Arsenic, Inorganic	-	-	NV	-	-	-	-	-
Barium	-	-	NV	-	-	-	-	-
Benz(a)anthracene	1470	3.33E+00	NV	-	-	-	-	-
Benzene	1510	6.59E+02	1.75E-04	1.16E-01	9.60E-03	3.84E-05	2.53E-02	2.64E+00
Benzo(a)pyrene	652	1.90E+00	NV	-	-	-	-	-
Benzo(b)fluoranthene	587	1.80E+00	NV	-	-	-	-	-
Benzo(g,h,i)perylene	305	1.01E+00	NV	-	-	-	-	-
Benzo(k)fluoranthene	231	9.39E-01	NV	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	NV	-	-	-	-	-
Cadmium (Water)	-	-	NV	-	-	-	-	-
Chromium(III), Insoluble Salts	210		NV	-	1.00E-04	-	-	-
Chromium(VI)	2.3		NV	-	1.00E-04	-	-	-
Chrysene	771	7.24E-01	NV	-	--	-	-	-
Cobalt	-	-	NV	-	-	-	-	-
Cresol, m-&p-	2290	1.44E+04	NV	-	5.95E-01	-	-	-
Cresol, o-	-	-	NV	-	-	-	-	-
Dibenz(a,h)anthracene	71.4	9.51E+00	NV	-	--	-	-	-
Dibenzofuran	277	5.69E+01	1.35E-06	7.68E-05	2.10E-01	2.96E-07	1.68E-05	8.02E-05
Dimethylphenol, 2,4-	-	-	NV	-	-	-	-	-
Ethylbenzene	261	1.67E+02	9.29E-05	1.55E-02	1.30E+00	2.04E-05	3.39E-03	2.61E-03
Fluoranthene	2440	2.89E+01	NV	-	1.40E-01	-	-	-
Fluorene	2100	3.10E+01	6.09E-07	1.89E-05	1.40E-01	1.34E-07	4.14E-06	2.96E-05
Indeno(1,2,3-cd)pyrene	247	7.41E-01	NV	-	--	-	-	-
Iron	60600		NV	-	2.80E+00	-	-	-
Lead and Compounds	13600		NV	-	5.00E-04	-	-	-
Manganese	-	-	NV	-	-	-	-	-
Methylnaphthalene, 2-	7650	1.23E+02	1.21E-05	1.48E-03	1.40E-01	2.65E-06	3.25E-04	2.32E-03
Naphthalene	10200	9.66E+01	1.64E-05	1.59E-03	3.00E-03	3.60E-06	3.48E-04	1.16E-01
Nickel Soluble Salts	-	-	NV	-	-	-	-	-
Phenanthrene	5180	3.84E+01	1.47E-07	5.66E-06	2.10E-01	3.23E-08	1.24E-06	5.91E-06
Phenol	-	-	NV	-	-	-	-	-
Pyrene	2640	1.47E+01	1.28E-08	1.87E-07	1.05E-01	2.80E-09	4.10E-08	3.91E-07
Styrene	-	-	-	-	-	-	-	-
Toluene	2650	2.91E+02	1.39E-04	4.06E-02	5.00E+00	3.06E-05	8.89E-03	1.78E-03
TPH C06-C09 aliphatic	593	2.21E+02	7.67E-04	1.70E-01	1.84E+01	1.68E-04	3.72E-02	2.02E-03
TPH C10-C14 aliphatic	69400	1.11E+02	1.60E-05	1.78E-03	1.00E+00	3.51E-06	3.90E-04	3.90E-04
TPH C10-C14 aromatic	69400	1.54E+02	6.58E-06	1.02E-03	2.00E-01	1.44E-06	2.23E-04	1.11E-03
TPH C15-C28 aliphatic	93200	7.02E+01	NV	-	7.00E+00	-	-	-
TPH C15-C28 aromatic	93200	8.04E+01	NV	-	1.05E-01	-	-	-
TPH C29-C36 aliphatic	20600	3.16E+00	NV	-	7.00E+00	-	-	-
TPH C29-C36 aromatic	20600	1.66E+00	NV	-	1.05E-01	-	-	-
Trimethylbenzene, 1,2,4-	220	7.46E+01	5.48E-04	4.09E-02	7.00E-03	1.20E-04	8.96E-03	1.28E+00
Vanadium and compounds	248		NV	-	1.00E-03	-	-	-
Xylenes (total)	2567	8.90E+00	7.19E-05	6.40E-04	2.20E-01	1.58E-05	1.40E-04	6.37E-04

TOTAL	4.05E+00
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Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

[illegible]

6.52E-05

Barangaroo

Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

TOTAL	2.69E+00
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2.75E-06

Soil RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical	Csoil	Csat	Risk at Input Soil Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity) (kg/mg)			RBSL (assumes no sat limit)	Risk at RBSL (with sat)	Vapour Only Risk at Csat (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			Vapours from Subsurface Soil Indoors	TOTAL (All Pathways)	Vapours from Subsurface Soil Indoors	Total Vapour Pathways	TOTAL (All Pathways)					Vapours from Subsurface Soil Indoors	TOTAL
	mg/kg	mg/kg	unitless	unitless	kg/mg	kg/mg	kg/mg	mg/kg			mg/kg	%	%
Acenaphthene	511	3.94E+01	8.71E-05	8.71E-05	2.21E-06	2.21E-06	2.21E-06	9.04E+04	8.71E-05	8.71E-05	9.04E+04	0.04%	0.04%
Acenaphthylene	1700	1.63E+02	2.23E-04	2.23E-04	1.37E-06	1.37E-06	1.37E-06	1.46E+05	2.23E-04	2.23E-04	1.46E+05	0.11%	0.11%
Ammonia	-	-	-	-	-		-	-	-	-	-	-	
Aniline	-	-	-	-	-		-	-	-	-	-	-	
Anthracene	2150	1.42E+00	5.85E-08	5.85E-08	4.11E-08	4.11E-08	4.11E-08	4.87E+06	5.85E-08	5.85E-08	4.87E+06	0.00%	0.00%
Arsenic, Inorganic	-	-	-	-	-		-	-	-	-	-	-	
Barium	-	-	-	-	-		-	-	-	-	-	-	
Benz(a)anthracene	1470	3.33E+00	-	-	-		-	-	-	-	-	-	
Benzene	1510	6.59E+02	2.64E+00	2.64E+00	4.00E-03	4.00E-03	4.00E-03	6.24E+01	2.50E-01	-	6.24E+01	100.00%	100.00%
Benzo(a)pyrene	652	1.90E+00	-	-	-		-	-	-	-	-	-	
Benzo(b)fluoranthene	587	1.80E+00	-	-	-		-	-	-	-	-	-	
Benzo(g,h,i)perylene	305	1.01E+00	-	-	-		-	-	-	-	-	-	
Benzo(k)fluoranthene	231	9.39E-01	-	-	-		-	-	-	-	-	-	
Bis(2-ethylhexyl)phalate	-	-	-	-	-		-	-	-	-	-	-	
Cadmium (Water)	-	-	-	-	-		-	-	-	-	-	-	
Chromium(III), Insoluble Salts	210		-	-	-		-	-	-	-	-	-	
Chromium(VI)	2.3		-	-	-		-	-	-	-	-	-	
Chrysene	771	7.24E-01	-	-	-		-	-	-	-	-	-	
Cobalt	-	-	-	-	-		-	-	-	-	-	-	
Cresol, m-&p-	2290	1.44E+04	-	-	-		-	-	-	-	-	-	
Cresol, o-	-	-	-	-	-		-	-	-	-	-	-	
Dibenz(a,h)anthracene	71.4	9.51E+00	-	-	-		-	-	-	-	-	-	
Dibenzofuran	277	5.69E+01	8.02E-05	8.02E-05	1.41E-06	1.41E-06	1.41E-06	7.09E+05	8.02E-05	8.02E-05	7.09E+05	0.01%	0.01%
Dimethylphenol, 2,4-	-	-	-	-	-		-	-	-	-	-	-	
Ethylbenzene	261	1.67E+02	2.61E-03	2.61E-03	1.57E-05	1.57E-05	1.57E-05	1.60E+04	2.61E-03	2.61E-03	1.60E+04	1.04%	1.04%
Fluoranthene	2440	2.89E+01	-	-	-		-	-	-	-	-	-	
Fluorene	2100	3.10E+01	2.96E-05	2.96E-05	9.54E-07	9.54E-07	9.54E-07	2.10E+05	2.96E-05	2.96E-05	2.10E+05	0.01%	0.01%
Indeno(1,2,3-cd)pyrene	247	7.41E-01	-	-	-		-	-	-	-	-	-	
Iron	60600		-	-	-		-	-	-	-	-	-	
Lead and Compounds	13600		-	-	-		-	-	-	-	-	-	
Manganese	-	-	-	-	-		-	-	-	-	-	-	
Methylnaphthalene, 2-Naphthalene	7650	1.23E+02	2.32E-03	2.32E-03	1.89E-05	1.89E-05	1.89E-05	1.06E+04	2.32E-03	2.32E-03	1.06E+04	1.16%	1.16%
	10200	9.66E+01	1.16E-01	1.16E-01	1.20E-03	1.20E-03	1.20E-03	1.67E+02	1.16E-01	1.16E-01	1.67E+02	58.01%	58.01%
Nickel Soluble Salts	-	-	-	-	-		-	-	-	-	-	-	
Phenanthrene	5180	3.84E+01	5.91E-06	5.91E-06	1.54E-07	1.54E-07	1.54E-07	1.30E+06	5.91E-06	5.91E-06	1.30E+06	0.00%	0.00%
Phenol	-	-	-	-	-		-	-	-	-	-	-	
Pyrene	2640	1.47E+01	3.91E-07	3.91E-07	2.66E-08	2.66E-08	2.66E-08	7.51E+06	3.91E-07	3.91E-07	7.51E+06	0.00%	0.00%
Styrene	-	-	-	-	-		-	-	-	-	-	-	
Toluene	2650	2.91E+02	1.78E-03	1.78E-03	6.11E-06	6.11E-06	6.11E-06	4.09E+04	1.78E-03	1.78E-03	4.09E+04	0.71%	0.71%
TPH C06-C09 aliphatic	593	2.21E+02	2.02E-03	2.02E-03	9.14E-06	9.14E-06	9.14E-06	1.37E+04	2.02E-03	2.02E-03	1.37E+04	1.62%	1.62%
TPH C10-C14 aliphatic	69400	1.11E+02	3.90E-04	3.90E-04	3.51E-06	3.51E-06	3.51E-06	3.56E+04	3.90E-04	3.90E-04	3.56E+04	0.31%	0.31%
TPH C10-C14 aromatic	69400	1.54E+02	1.11E-03	1.11E-03	7.21E-06	7.21E-06	7.21E-06	1.73E+04	1.11E-03	1.11E-03	1.73E+04	0.89%	0.89%
TPH C15-C28 aliphatic	93200	7.02E+01	-	-	-		-	-	-	-	-	-	
TPH C15-C28 aromatic	93200	8.04E+01	-	-	-		-	-	-	-	-	-	
TPH C29-C36 aliphatic	20600	3.16E+00	-	-	-		-	-	-	-	-	-	
TPH C29-C36 aromatic	20600	1.66E+00	-	-	-		-	-	-	-	-	-	
Trimethylbenzene, 1,2,4-	220	7.46E+01	1.28E+00	1.28E+00	1.72E-02	1.72E-02	1.72E-02	5.83E+01	1.00E+00	-	5.83E+01	100.00%	100.00%
Vanadium and compounds	248		-	-	-		-	-	-	-	-	-	
Xylenes (total)	2567	8.90E+00	6.37E-04	6.37E-04	7.16E-05	7.16E-05	7.16E-05	3.49E+03	6.37E-04	6.37E-04	3.49E+03	0.25%	0.25%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Soil RBSL Derivation - Non-Threshold Lifetime Health Effects (Adult and Child)
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical	Csoil	Csat	Risk at Input Soil Concentration (ILCR)		Risk/Soil Concentration (i.e., exposure and toxicity factor)			RBSL (assumes no sat limit)	Risk at RBSL (with sat)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			Vapours from Subsurface Soil Indoors	TOTAL	Vapours from Subsurface Soil Indoors	Total Vapour Pathways	TOTAL				Vapours from Subsurface Soil Indoors	TOTAL
	mg/kg	mg/kg	unitless	unitless	kg/mg	kg/mg	kg/mg	mg/kg		mg/kg	%	%
Acenaphthene	511	3.94E+01	-	-	-		-	-	-	-	-	-
Acenaphthylene	1700	1.63E+02	-	-	-		-	-	-	-	-	-
Ammonia	-	-	-	-	-		-	-	-	-	-	-
Aniline	-	-	-	-	-		-	-	-	-	-	-
Anthracene	2150	1.42E+00	-	-	-		-	-	-	-	-	-
Arsenic, Inorganic	-	-	-	-	-		-	-	-	-	-	-
Barium	-	-	-	-	-		-	-	-	-	-	-
Benz(a)anthracene	1470	3.33E+00	-	-	-		-	-	-	-	-	-
Benzene	1510	6.59E+02	6.52E-05	6.52E-05	9.88E-08	9.88E-08	9.88E-08	1.01E+02	1.00E-05	1.01E+02	100.00%	100.00%
Benzo(a)pyrene	652	1.90E+00	-	-	-		-	-	-	-	-	-
Benzo(b)fluoranthene	587	1.80E+00	-	-	-		-	-	-	-	-	-
Benzo(g,h,i)perylene	305	1.01E+00	-	-	-		-	-	-	-	-	-
Benzo(k)fluoranthene	231	9.39E-01	-	-	-		-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-		-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-		-	-	-	-	-	-
Chromium(III), Insoluble Salts	210		-	-	-		-	-	-	-	-	-
Chromium(VI)	2.3		-	-	-		-	-	-	-	-	-
Chrysene	771	7.24E-01	-	-	-		-	-	-	-	-	-
Cobalt	-	-	-	-	-		-	-	-	-	-	-
Cresol, m-&p-	2290	1.44E+04	-	-	-		-	-	-	-	-	-
Cresol, o-	-	-	-	-	-		-	-	-	-	-	-
Dibenz(a,h)anthracene	71.4	9.51E+00	-	-	-		-	-	-	-	-	-
Dibenzofuran	277	5.69E+01	-	-	-		-	-	-	-	-	-
Dimethylphenol, 2,4-	-	-	-	-	-		-	-	-	-	-	-
Ethylbenzene	261	1.67E+02	-	-	-		-	-	-	-	-	-
Fluoranthene	2440	2.89E+01	-	-	-		-	-	-	-	-	-
Fluorene	2100	3.10E+01	-	-	-		-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	247	7.41E-01	-	-	-		-	-	-	-	-	-
Iron	60600		-	-	-		-	-	-	-	-	-
Lead and Compounds	13600		-	-	-		-	-	-	-	-	-
Manganese	-	-	-	-	-		-	-	-	-	-	-
Methylnaphthalene, 2-	7650	1.23E+02	-	-	-		-	-	-	-	-	-
Naphthalene	10200	9.66E+01	-	-	-		-	-	-	-	-	-
Phenol	-	-	-	-	-		-	-	-	-	-	-
Pyrene	2640	3.84E+01	-	-	-		-	-	-	-	-	-
Styrene	-	-	-	-	-		-	-	-	-	-	-
Toluene	2650	1.47E+01	-	-	-		-	-	-	-	-	-
TPH C06-C09 aliphatic	593	2.93E+02	-	-	-		-	-	-	-	-	-
TPH C10-C14 aliphatic	69400	2.91E+02	-	-	-		-	-	-	-	-	-
TPH C10-C14 aromatic	69400	2.21E+02	-	-	-		-	-	-	-	-	-
TPH C15-C28 aliphatic	93200	1.11E+02	-	-	-		-	-	-	-	-	-
TPH C15-C28 aromatic	93200	1.54E+02	-	-	-		-	-	-	-	-	-
TPH C29-C36 aliphatic	20600	7.02E+01	-	-	-		-	-	-	-	-	-
TPH C29-C36 aromatic	20600	8.04E+01	-	-	-		-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	220	3.16E+00	-	-	-		-	-	-	-	-	-
Vanadium and compounds	248	1.66E+00	-	-	-		-	-	-	-	-	-
Xylenes (total)	2567	7.46E+01	-	-	-		-	-	-	-	-	-
	-	-	-	-	-		-	-	-	-	-	-
	-	-	-	-	-		-	-	-	-	-	-

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - Commercial Workers Present (Risk Based Calculations) Scenario

Chemical	Cgw mg/L	Solubility mg/L	Risk at Input Groundwater Concentration (ILCR)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL mg/L	Pathway Contributions to Total Estimated Risk at RBSL	
			GW vapours from flowing water	TOTAL (All Pathways)	GW vapours from flowing water	Total Vapour Pathways	TOTAL (All Pathways)					GW vapours from flowing water	
			unitless	unitless	unitless	L/mg	L/mg					%	%
Acenaphthene	4.48	3.90E+00	4.29E-04	4.29E-04	1.10E-04	1.10E-04	1.10E-04	1.82E+03	4.29E-04	4.29E-04	1.82E+03	0.2%	0.21%
Acenaphthylene	43.2	1.61E+01	3.63E-03	3.63E-03	2.25E-04	2.25E-04	2.25E-04	8.88E+02	3.63E-03	3.63E-03	8.88E+02	1.8%	1.81%
Ammonia	348	4.82E+05	5.09E-02	5.09E-02	1.46E-04	1.46E-04	1.46E-04	6.84E+03	1.00E+00	-	6.84E+03	100.0%	100.00%
Aniline	0.212	3.60E+04	-	-	-	-	-	-	-	-	-	-	-
Anthracene	15.4	4.34E-02	1.74E-04	1.74E-04	4.02E-03	4.02E-03	4.02E-03	4.98E+01	1.74E-04	1.74E-04	4.98E+01	0.1%	0.09%
Arsenic, Inorganic	0.024		-	-	-	-	-	-	-	-	-	-	-
Barium	2.23		-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-	-	-	-	-	-	-	-	-
Benzene	40.2	1.79E+03	1.11E-01	1.11E-01	2.77E-03	2.77E-03	2.77E-03	9.02E+01	2.50E-01	-	9.02E+01	100.0%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-	-	-	-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-	-	-	-	-	-	-	-	-
Cobalt	0.057		-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-	-	-	-	-	-	-	-	-
Cresol, o-	182	2.59E+04	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	9.94E-04	9.94E-04	3.21E-04	3.21E-04	3.21E-04	3.12E+03	9.94E-04	9.94E-04	3.12E+03	0.1%	0.10%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	6.17E-05	6.17E-05	2.04E-05	2.04E-05	2.04E-05	1.22E+04	3.45E-03	3.45E-03	1.22E+04	1.4%	1.38%
Fluoranthene	25.9	2.60E-01	-	-	-	-	-	-	-	-	-	-	-
Fluorene	21.1	1.69E+00	2.42E-03	2.42E-03	1.43E-03	1.43E-03	1.43E-03	1.40E+02	2.42E-03	2.42E-03	1.40E+02	1.2%	1.21%
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-	-	-	-	-	-	-	-	-
Iron	187		-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-	-	-	-	-	-	-	-	-
Manganese	4.89		-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	105	2.46E+01	1.80E-02	1.80E-02	7.33E-04	7.33E-04	7.33E-04	2.73E+02	1.80E-02	1.80E-02	2.73E+02	9.0%	9.02%
Naphthalene	283	3.10E+01	2.25E+00	2.25E+00	7.25E-02	7.25E-02	7.25E-02	2.76E+00	2.00E-01	-	2.76E+00	100.0%	100.00%
Nickel Soluble Salts	0.303		-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	3.62E-03	3.62E-03	3.14E-03	3.14E-03	3.14E-03	6.36E+01	3.62E-03	3.62E-03	6.36E+01	1.8%	1.81%
Phenol	249	8.28E+04	-	-	-	-	-	-	-	-	-	-	-
Pyrene	27.9	1.35E-01	8.96E-04	8.96E-04	6.63E-03	6.63E-03	6.63E-03	3.01E+01	8.96E-04	8.96E-04	3.01E+01	0.4%	0.45%
Styrene	0.194	3.10E+02	1.96E-05	1.96E-05	1.01E-04	1.01E-04	1.01E-04	9.90E+03	3.13E-02	3.13E-02	9.90E+03	3.1%	3.13%
Toluene	17.6	5.26E+02	9.36E-05	9.36E-05	5.32E-06	5.32E-06	5.32E-06	4.70E+04	2.80E-03	2.80E-03	4.70E+04	1.1%	1.12%
TPH C06-C09 aliphatic	6.08	1.18E+01	8.86E-06	8.86E-06	1.46E-06	1.46E-06	1.46E-06	8.58E+04	1.72E-05	1.72E-05	8.58E+04	0.0%	0.01%
TPH C10-C14 aliphatic	1730	9.99E-02	2.19E-02	2.19E-02	2.19E-01	2.19E-01	2.19E-01	5.70E-01	2.19E-02	2.19E-02	5.70E-01	17.5%	17.52%
TPH C10-C14 aromatic	1730	2.53E+01	2.29E-01	2.29E-01	9.06E-03	9.06E-03	9.06E-03	1.38E+01	1.25E-01	-	1.38E+01	100.0%	100.00%
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	3.48E-03	3.48E-03	3.78E-03	3.78E-03	3.78E-03	2.65E+02	2.15E-01	2.15E-01	2.65E+02	21.5%	21.54%
Vanadium and compounds	0.0228	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+01	8.09E-04	8.09E-04	1.21E-04	1.21E-04	1.21E-04	2.07E+03	1.28E-03	1.28E-03	2.07E+03	0.5%	0.51%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Non-Threshold Health Effects
Barangaroo Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement - (Risk Based Calculations) Scenario

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (ILCR)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW Vapours from Flowing Water	TOTAL (All Pathways)	GW Vapours from Flowing Water	Total Vapour Pathways	TOTAL (All Pathways)				GW Vapours from Flowing Water	TOTAL
	mg/L	mg/L	unitless	unitless	L/mg	L/mg	L/mg	mg/L		mg/L	%	%
Acenaphthene	4.48	3.90E+00	-	-	-		-	-	-	-	-	-
Acenaphthylene	43.2	1.61E+01	-	-	-		-	-	-	-	-	-
Ammonia	348	4.82E+05	-	-	-		-	-	-	-	-	-
Aniline	0.212	3.60E+04	-	-	-		-	-	-	-	-	-
Anthracene	15.4	4.34E-02	-	-	-		-	-	-	-	-	-
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	-	-
Barium	2.23		-	-	-		-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	-	-
Benzene	40.2	1.79E+03	2.75E-06	2.75E-06	6.84E-08	6.84E-08	6.84E-08	1.46E+02	1.00E-05	1.46E+02	100.00%	100.00%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	-	-
Cobalt	0.057		-	-	-		-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	-	-	-		-	-	-	-	-	-
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	-	-	-		-	-	-	-	-	-
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	-	-	-		-	-	-	-	-	-
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	-	-
Fluorene	21.1	1.69E+00	-	-	-		-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	-	-
Iron	187		-	-	-		-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	-	-
Manganese	4.89		-	-	-		-	-	-	-	-	-
Methylnaphthalene, 2-	105	2.46E+01	-	-	-		-	-	-	-	-	-
Naphthalene	283	3.10E+01	-	-	-		-	-	-	-	-	-
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	-	-	-		-	-	-	-	-	-
Phenol	249	8.28E+04	-	-	-		-	-	-	-	-	-
Pyrene	27.9	1.35E-01	-	-	-		-	-	-	-	-	-
Styrene	0.194	3.10E+02	-	-	-		-	-	-	-	-	-
Toluene	17.6	5.26E+02	-	-	-		-	-	-	-	-	-
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-		-	-	-	-	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-		-	-	-	-	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-		-	-	-	-	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	-	-	-		-	-	-	-	-	-
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+01	-	-	-		-	-	-	-	-	-

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

1. General Information:

Site:	Barangaroo
Address:	Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Client:	Lend Lease
Scenario:	Scenario 1 - Lower Basement (Odour Based Calculations)

Header Colour (Defaults = Blue):

Blue

2. Select Receptor:

Commercial/Industrial

3. Select Exposure Pathways to Include:

Enter "x" in box, or select from dropdown box.

Soil Pathways

	Incidental Ingestion of Soil
	Dermal Contact with Soil
	Inhalation of Surface Soil-Derived Dust in Indoor Air
	Inhalation of Surface Soil-Derived Dust in Outdoor Air
	Inhalation of Surface Soil-Derived Vapours in Outdoor Air
	Inhalation of Soil-Derived Vapours From Excavation (USEPA 2002 method)
	Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
	Inhalation of Subsurface Soil-Derived Vapours in Outdoor Air

Groundwater Pathways

	Inhalation of Groundwater-Derived Vapours in Indoor Air
	Inhalation of Groundwater-Derived Vapours in Outdoor Air
	Ingestion of Potable Groundwater
	Incidental Ingestion of Groundwater (Bathing or Excavation)
	Dermal Contact with Groundwater (Bathing or Excavation)
	Inhalation of Groundwater Vapours during Irrigation/ Showering
	Ingestion of Vegetables Irrigated with Groundwater
	Inhalation of Groundwater Vapours (Where GW Enters Trench)
x	Inhalation of vapour emissions from flowing water (groundwater in basement)

Y	Soil RBSLs saturation limited?
Y	Groundwater RBSLs solubility limited?

4. Select Chemicals for Quantitative Assessment:

	Target Hazard Index	Target Cancer Risk	5. Enter Chemical Concentrations (if only calculating RBSLs, enter 1 for media for which you want RBSLs):	
	default = 1 (or manually overwrite)	default = 1x10 ⁻⁵ (or manually overwrite)	Soil (mg/kg)	Groundwater (mg/L)
Acenaphthene	0.2	1.00E-05	511	4.48
Acenaphthylene	0.2	1.00E-05	1700	43.2
Ammonia	1	1.00E-05		348
Aniline	1	1.00E-05		0.212
Anthracene	0.2	1.00E-05	2150	15.4
Arsenic, Inorganic	1	1.00E-05		0.024
Barium	1	1.00E-05		2.23
Benz(a)anthracene		1.00E-05	1470	12.6
Benzene	0.25	1.00E-05	1510	40.2
Benzo(a)pyrene		1.00E-05	652	9.26
Benzo(b)fluoranthene		1.00E-05	587	8.33
Benzo(g,h,i)perylene		1.00E-05	305	4.22
Benzo(k)fluoranthene		1.00E-05	231	2.93
Bis(2-ethylhexyl)phalate	1	1.00E-05		0.03
Cadmium (Water)	1	1.00E-05		0.108
Chromium(III), Insoluble Salt	1	1.00E-05	210	0.102
Chromium(VI)	1	1.00E-05	2.3	0.102
Chrysene		1.00E-05	771	9.78
Cobalt	1	1.00E-05		0.057
Cresol, m-&p-	1	1.00E-05	2290	436
Cresol, o-	1	1.00E-05		182
	Blank			
Dibenz(a,h)anthracene		1.00E-05	71.4	0.822
Dibenzofuran	1	1.00E-05	277	10.2
Dimethylphenol, 2,4-	1	1.00E-05		38
Ethylbenzene	0.25	1.00E-05	261	3.02
Fluoranthene		1.00E-05	2440	25.9
Fluorene	0.2	1.00E-05	2100	21.1
Indeno(1,2,3-cd)pyrene		1.00E-05	247	3.05
Iron	1	1.00E-05	60600	187
Lead and Compounds	1	1.00E-05	13600	0.555
Manganese	1	1.00E-05		4.89
Methylnaphthalene, 2-	0.2	1.00E-05	7650	105
Naphthalene	0.2	1.00E-05	10200	283
Nickel Soluble Salts	1	1.00E-05		0.303
Phenanthrene	0.2	1.00E-05	5180	74.1
Phenol	1	1.00E-05		249
Pyrene	0.2	1.00E-05	2640	27.9
Styrene	1	1.00E-05		0.194
Toluene	0.25	1.00E-05	2650	17.6
TPH C06-C09 aliphatic	0.125	1.00E-05	593	6.08
TPH C10-C14 aliphatic	0.125	1.00E-05	69400	1730
TPH C10-C14 aromatic	0.125	1.00E-05	69400	1730
TPH C15-C28 aliphatic	0.125	1.00E-05	93200	1520
TPH C15-C28 aromatic	0.125	1.00E-05	93200	1520
TPH C29-C36 aliphatic	0.125	1.00E-05	20600	332
TPH C29-C36 aromatic	0.125	1.00E-05	20600	332
Trimethylbenzene, 1,2,4-	1	1.00E-05	220	0.92
Vanadium and compounds	1	1.00E-05	248	0.0228
Xylenes (total)	0.25	1.00E-05	2576	6.7

6. Confirm/Modify Exposure Parameters:

		Site-Specific Value (leave blank to use default value)		Value Used in Calculations	
		Adult	Child	Adult	Child

General receptor parameters:		Units			
Body weight	kg	70	13	70	13
Exposure duration	yr	64	6	64	6
Averaging time (carcinogens)	yr	70	70	70	70
Averaging time (non-carcinogens)	yr	30	6	30	6

Incidental Soil Ingestion

Daily soil ingestion rate	mg/day				
Exposure frequency for soil ingestion	days/yr				
Fraction of daily soil intake from site	unitless				

Dermal Absorption of Soil

Exposed skin surface area for soil contact	cm2				
Soil to skin adherence factor	mg/cm2				
Exposure frequency for dermal contact with soil	days/yr				

Indoor Inhalation

Exposure time (indoor air)	hrs/day				
Exposure frequency (indoor air)	days/yr				
Particulate emission factor (indoor air)	m3/kg				

Outdoor Inhalation

Exposure time (outdoor air)	hrs/day				
Exposure frequency (outdoor air)	days/yr				
Particulate emission factor (outdoor air)	m3/kg				

Potable Water Ingestion

Potable water intake rate	L/day				
Exposure frequency for potable water intake	days/yr				

Incidental Water Ingestion

Incidental ingestion rate	L/day				
Exposure frequency for incidental water ingestion	days/yr				

Dermal Contact with Water

Exposed skin surface for water contact	cm2				
Exposure time for dermal water contact	hr/day				
Exposure frequency for dermal water contact	days/yr				

Vapour Inhalation Shower/ Sprinkler

Exposure frequency	days/yr				
Exposure time	min/ day				
Inhalation rate	m3/hr				
Inhalation Absorption Adjustment Factor	mg/mg				
Lung retention factor	unitless				

Ingestion of Home Grown Produce

Proportion of homegrown produce ingested					
Exposure frequency	days/year				

Inhalation of Vapours from Flowing Water

Exposure time	hrs/day	8	1	8	1
Exposure frequency	days/year	240	350	240	350

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Calculation of Vapour Emissions from Water with Flow
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Odour Based Calculations) Scenario

PARAMETERS						Dimensions of Wet Section of Basement/ Impoundment										Air exchange rate (exchanges/day)	
Concrete permeability		(select from drop down list)	High permeability		Length (m)		59.0		Air exchange rate (exchanges/day)		7.60E+01						
Permeability Rate (m/day)			8.6.E-02		Width (m)		25.0		Windspeed (m/s)		if < 3.5m/sec 3.00E-02						
Water Temperature (deg. C)			18.0		Depth of Water (m)		0.01		if = or > 3.5m/sec								
Dimensions of Basement / Impoundment						Fetch/ Depth (m) ratio of Wet Basement Section		2500									
Height (m)			4.5		Volume of wet basement/ impoundment (m3)		14.7500										
Width (m)			50.0		Area covered in water (m2)		1475										
Depth (m)			50.0		Effective diameter of impoundment/ basement) (m)		43.3										
Volume total basement/ impoundment (m3)			11250		Volume of water entering basement (m³/sec)		1.48E-05										

Parameter Definition	Volatile	Chemical Concentration in Water (mg/L)	Molecular weight (g/mol)	Vapour Pressure (mmHg)	Vapour Pressure (atm)	Henry's Law Coefficient (unitless)	Henry's Law Coefficient (calculated)	Equilibrium Coefficient (at 25 deg C)	Diffusivity in Water (cm²/sec)	Schmidt Number on Gas Side (*)	Gas Phase Mass Transfer Coefficient (m/sec)	Schmidt Number on Liquid Side #	Liquid Phase Mass Transfer Coefficient (m/sec) **	Overall Mass Transfer Coefficient (m/s) (windspeed <3.5 m/s)	Diffusivity in Air (cm2/sec)	Equilibrium Concentration of water in Basement/ Impoundment (g/m³)	Air Emission Rate from Liquid Surface (g/sec)	Air Emission Rate from Liquid Surface (mg/day)	Air Emission Rate from Basement Air (includes air exchange) (mg/m3)
		C	MW	Vap	Vap	unitless	atm.m3/g mol	K _{eq}	D _{water}	Sc _G	k _G	Sc _L	k _L	K	D _{air}	C _L		E	
Acenaphthene	Y	4.48	154	2.15E-03	2.83E-06	7.52E-03	1.80E-04	7.345E-03	8.33E-06	3.0E+00	9.939E-05	1.08E+03	2.74E-07	2.0E-07	0.0506	1.6E-01	4.63E-05	4.00E+03	4.68E-03
Acenaphthylene	Y	43.2	152	6.68E-03	8.79E-06	4.66E-03	1.11E-04	4.551E-03	6.98E-06	3.4E+00	9.188E-05	1.29E+03	2.44E-07	1.5E-07	0.045	1.7E+00	3.87E-04	3.34E+04	3.91E-02
Ammonia	Y	348	17	-	-	6.58E-04	1.57E-05	6.427E-04	1.10E-05	6.6E-01	2.725E-04	8.18E+02	3.30E-07	1.1E-07	0.228	1.0E+01	1.73E-03	1.49E+05	1.74E-01
Aniline	Y	0.212	93.1	4.90E-01	6.45E-04	8.26E-05	1.97E-06	8.067E-05	1.01E-05	1.8E+00	1.385E-04	8.91E+02	3.12E-07	1.1E-08	0.083	6.6E-03	1.05E-07	9.05E+00	1.06E-05
Anthracene	Y	15.4	178	6.53E-06	8.59E-09	2.27E-03	5.42E-05	2.217E-03	7.85E-06	3.9E+00	8.348E-05	1.15E+03	2.64E-07	1.1E-07	0.039	5.6E-01	9.03E-05	7.80E+03	9.12E-03
Arsenic, Inorganic	N	0.024	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	N	2.23	137	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	N	12.6	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	Y	40.2	78.1	9.48E+01	1.25E-01	2.27E-01	5.42E-03	2.217E-01	1.03E-05	1.7E+00	1.456E-04	8.74E+02	3.16E-07	3.1E-07	0.0895	1.2E+00	5.69E-04	4.92E+04	5.75E-02
Benzo(a)pyrene	N	9.26	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	N	8.33	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	N	4.22	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	N	2.93	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	N	0.03	391	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	N	0.108	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	N	0.102	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	N	0.102	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	N	9.78	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	N	0.057	58.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	Y	436	108	1.10E-01	1.45E-04	3.50E-05	8.36E-07	3.418E-05	9.32E-06	2.1E+00	1.269E-04	9.66E+02	2.96E-07	4.3E-09	0.0729	1.4E+01	9.00E-05	7.78E+03	9.09E-03
Cresol, o-	N	182	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	N	0.822	278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	Y	10.2	168	2.48E-03	3.26E-06	8.71E-03	2.08E-04	8.507E-03	7.38E-06	3.7E+00	8.632E-05	1.22E+03	2.53E-07	1.9E-07	0.041	3.9E-01	1.08E-04	9.30E+03	1.09E-02
Dimethylphenol, 2,4-	Y	38	122	1.02E-01	1.34E-04	3.89E-05	9.29E-07	3.799E-05	8.31E-06	2.4E+00	1.141E-04	1.08E+03	2.74E-07	4.3E-09	0.0622	1.3E+00	8.43E-06	7.28E+02	8.52E-04
Ethylbenzene	Y	3.02	106	9.60E+00	1.26E-02	3.22E-01	7.69E-03	3.145E-01	8.46E-06	2.2E+00	1.217E-04	1.06E+03	2.77E-07	2.8E-07	0.0685	1.1E-01	4.27E-05	3.69E+03	4.31E-03
Fluoranthene	N	25.9	202	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	Y	21.1	166	6.00E-04	7.90E-07	3.93E-03	9.38E-05	3.838E-03	7.89E-06	3.4E+00	9.050E-05	1.14E+03	2.65E-07	1.5E-07	0.044	7.7E-01	1.70E-04	1.47E+04	1.72E-02
Indeno(1,2,3-cd)pyrene	N	3.05	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	N	187	55.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	N	0.555	207	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	N	4.89	54.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	Y	105	142	5.50E-02	7.24E-05	2.12E-02	5.06E-04	2.071E-02	7.78E-06	2.9E+00	1.017E-04	1.16E+03	2.62E-07	2.3E-07	0.0524	3.9E+00	1.33E-03	1.15E+05	1.34E-01
Naphthalene	Y	283	128	8.50E-02	1.12E-04	1.80E-02	4.30E-04	1.758E-02	8.38E-06	2.5E+00	1.120E-04	1.07E+03	2.75E-07	2.4E-07	0.0605	9.9E+00	3.53E-03	3.05E+05	3.57E-01
Nickel Soluble Salts	N	0.303	58.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	Y	74.1	178	1.21E-04	1.59E-07	1.73E-03	4.13E-05	1.690E-03	6.69E-06	4.4E+00	7.689E-05	1.35E+03	2.37E-07	8.4E-08	0.0345	3.0E+00	3.71E-04	3.21E+04	3.75E-02
Phenol	Y	249	94.1	3.50E-01	4.61E-04	1.36E-05	3.25E-07	1.328E-05	1.03E-05	1.8E+00	1.389E-04	8.74E+02	3.16E-07	1.8E-09	0.0834	7.6E+00	2.07E-05	1.79E+03	2.09E-03
Pyrene	Y	27.9	202	4.50E-06	5.92E-09	4.87E-04	1.16E-05	4.756E-04	7.25E-06	5.4E+00	6.654E-05	1.24E+03	2.50E-07	2.8E-08	0.0278	1.1E+00	4.45E-05	3.84E+03	4.49E-03
Styrene	Y	0.194	104	6.40E+00	8.42E-03	1.12E-01	2.67E-03	1.094E-01	8.78E-06	2.1E+00	1.248E-04	1.03E+03	2.84E-07	2.8E-07	0.0711	6.6E-03	2.71E-06	2.34E+02	2.74E-04
Toluene	Y	17.6	92.1	2.84E+01	3.74E-02	2.71E-01	6.47E-03	2.647E-01	9.20E-06	1.9E+00	1.326E-04	9.78E+02	2.93E-07	2.9E-07	0.0778	5.8E-01	2.49E-04	2.15E+04	2.52E-02
TPH C06-C09 aliphatic	Y	6.08	103	9.16E+01	1.21E-01	5.05E+01	1.21E+00	4.932E+01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.10E-07	3.1E-07	0.1	1.9E-01	8.69E-05	7.51E+03	8.78E-03
TPH C10-C14 aliphatic	Y	1730	170	1.16E+00	1.53E-03	6.26E+01	1.49E+00	6.114E+01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.10E-07	3.1E-07	0.1	5.4E+01	2.47E-02	2.14E+06	2.50E+00
TPH C10-C14 aromatic	Y	1730	136	1.16E+00	1.53E-03	1.41E-01	3.37E-03	1.377E-01	1.00E-05	1.5E+00	1.569E-04	9.00E+02	3.10E-07	3.1E-07	0.1	5.4E+01	2.44E-02	2.11E+06	2.46E+00
TPH C15-C28 aliphatic	n	1520	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	n	1520	209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	n	332	270	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	N	332	240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	Y	0.92	120	2.10E+00	2.76E-03	2.52E-01	6.02E-03	2.461E-01	7.92E-06	2.5E+00	1.123E-04	1.14E+03	2.65E-07	2.6E-07	0.0607	3.3E-02	1.30E-05	1.12E+03	1.31E-03
Vanadium and compounds	N	0.0228	50.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	Y	6.7	106	7.99E+00	1.05E-02	2.12E-01	5.06E-03	2.071E-01	9.90E-06	1.8E+00	1.404E-04	9.09E+02	3.08E-07	3.0E-07	0.0847	2.1E-01	9.47E-05	8.18E+03	9.57E-03

Notes:
Assumes viscosity of air at 25 deg C
(*) Adopted density and viscosity of air values are those published in USEPA Air Emissions for Wast and Waste Water Nov 1994. (viscosity = 1.81 x 10⁻⁴, density = 1.2 x 10⁻³)
** where windspeeds are greater than 3.25 m/s, F/D ratios greater than 51.2 and diffusivity of ether is 8.5 x 10⁻⁵
Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Summary of Derived RBSLs

[Back to User Input Sheet](#)

Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement (Odour Based Calculations) Scenario

Chemical	Soil RBSLs (mg/kg)						Groundwater RBSLs (mg/L)					
	Adult Threshold	Child Threshold	Non- Threshold (Lifetime)	Adopted RBSL (Lowest)	Saturation Limited?	Site Concentra tion	Adult Threshold	2.58E+01	Non- Threshold (Lifetime)	Adopted RBSL (Lowest)	Solubility Limited?	Site Concentration
Acenaphthene	-	-	-	-	-	-	1.79E+02	2.10E+03	-	1.79E+02	>Sol	4.48E+00
Acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia	-	-	-	-	-	-	7.68E+04	8.98E+05	-	7.68E+04	-	3.48E+02
Aniline	-	-	-	-	-	-	1.79E+05	2.10E+06	-	1.79E+05	>Sol	2.12E-01
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	-	-	-	-	-	4.07E+04	4.77E+05	-	4.07E+04	>Sol	4.02E+01
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	-	-	-	-	-	-	1.27E+02	1.49E+03	-	1.27E+02	-	4.36E+02
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	-	-	-	-	-	-	6.10E+02	7.13E+03	-	6.10E+02	>Sol	1.02E+01
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	-	-	-	-	-	-	7.49E+02	8.76E+03	-	7.49E+02	>Sol	3.02E+00
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	-	-	-	-	-	-	4.56E+00	5.34E+01	-	4.56E+00	-	1.05E+02
Naphthalene	-	-	-	-	-	-	1.63E+01	1.91E+02	-	1.63E+01	-	2.83E+02
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	3.93E+04	4.59E+05	-	3.93E+04	-	2.49E+02
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	2.06E+03	2.41E+04	-	2.06E+03	>Sol	1.94E-01
Toluene	-	-	-	-	-	-	1.13E+04	1.32E+05	-	1.13E+04	>Sol	1.76E+01
TPH C06-C09 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	-	-	-	-	-	-	2.95E+03	3.45E+04	-	2.95E+03	>Sol	9.20E-01
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	-	-	-	-	-	-	1.62E+03	1.90E+04	-	1.62E+03	>Sol	6.70E+00

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Pathways included in derivation of Soil RBSL:

Pathways included in derivation of Soil Vapour RBSL:

Pathways included in derivation of Groundwater RBSL:

Health Risk Calculations - Vapours from Flowing Water
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement A (Odour Based Calculations) Scenario

Chemical	Vapour Concentration in Basement/ Impoundment	Aqueous Solubility	Threshold Intake and Risk Calculations						
			Inhalation RfC	Adult Exposure Factor (threshold)	Adult Exposure Adjusted Air Concentration (threshold)	Hazard Index (Adult)	Child Exposure Factor (threshold)	Child Exposure Adjusted Air Concentration (threshold)	Hazard Index (Child)
	mg/m ³	(mg/L)	(mg/m3)	(L/m3)	(mg/m3)	(unitless)	(L/m3)	(mg/m3)	(unitless)
Acenaphthene	4.68E-03	3.90E+00	5.04E-01	4.68E-01	2.19E-03	4.35E-03	4.00E-02	1.87E-04	3.71E-04
Acenaphthylene	3.91E-02	1.61E+01	-	4.68E-01	-	-	4.00E-02	-	-
Ammonia	1.74E-01	4.82E+05	1.80E+01	4.68E-01	8.16E-02	4.53E-03	4.00E-02	6.97E-03	3.87E-04
Aniline	1.06E-05	3.60E+04	4.19E+00	4.68E-01	4.95E-06	1.18E-06	4.00E-02	4.23E-07	1.01E-07
Anthracene	9.12E-03	4.34E-02	-	4.68E-01	-	-	4.00E-02	-	-
Arsenic, Inorganic	-	0.00E+00	-	-	-	-	-	-	-
Barium	-	0.00E+00	-	-	-	-	-	-	-
Benz(a)anthracene	-	9.40E-03	-	-	-	-	-	-	-
Benzene	5.75E-02	1.79E+03	1.09E+02	4.68E-01	2.69E-02	2.47E-04	4.00E-02	2.30E-03	2.11E-05
Benzo(a)pyrene	-	1.62E-03	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	1.50E-03	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	2.60E-04	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	8.00E-04	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	2.70E-01	-	-	-	-	-	-	-
Cadmium (Water)	-	0.00E+00	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	0.00E+00	-	-	-	-	-	-	-
Chromium(VI)	-	1.69E+06	-	-	-	-	-	-	-
Chrysene	-	2.00E-03	-	-	-	-	-	-	-
Cobalt	-	0.00E+00	-	-	-	-	-	-	-
Cresol, m-&p-	9.09E-03	2.27E+04	1.24E-03	4.68E-01	4.25E-03	3.43E+00	4.00E-02	3.63E-04	2.93E-01
Cresol, o-	-	2.59E+04	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	2.49E-03	-	-	-	-	-	-	-
Dibenzofuran	1.09E-02	3.10E+00	1.00E+00	4.68E-01	5.09E-03	5.09E-03	4.00E-02	4.35E-04	4.35E-04
Dimethylphenol, 2,4-	8.52E-04	7.87E+03	-	4.68E-01	-	-	4.00E-02	-	-
Ethylbenzene	4.31E-03	1.69E+02	2.00E+00	4.68E-01	2.02E-03	1.01E-03	4.00E-02	1.72E-04	8.62E-05
Fluoranthene	-	2.60E-01	-	-	-	-	-	-	-
Fluorene	1.72E-02	1.69E+00	-	4.68E-01	-	-	4.00E-02	-	-
Indeno(1,2,3-cd)pyrene	-	1.90E-04	-	-	-	-	-	-	-
Iron	-	0.00E+00	-	-	-	-	-	-	-
Lead and Compounds	-	0.00E+00	-	-	-	-	-	-	-
Manganese	-	0.00E+00	-	-	-	-	-	-	-
Methylnaphthalene, 2-	1.34E-01	2.46E+01	5.81E-02	4.68E-01	6.27E-02	1.08E+00	4.00E-02	5.36E-03	9.22E-02
Naphthalene	3.57E-01	3.10E+01	4.40E-01	4.68E-01	1.67E-01	3.79E-01	4.00E-02	1.43E-02	3.24E-02
Nickel Soluble Salts	-	0.00E+00	-	-	-	-	-	-	-
Phenanthrene	3.75E-02	1.15E+00	-	4.68E-01	-	-	4.00E-02	-	-
Phenol	2.09E-03	8.28E+04	1.54E-01	4.68E-01	9.77E-04	6.34E-03	4.00E-02	8.34E-05	5.42E-04
Pyrene	4.49E-03	1.35E-01	-	4.68E-01	-	-	4.00E-02	-	-
Styrene	2.74E-04	3.10E+02	1.36E+00	4.68E-01	1.28E-04	9.41E-05	4.00E-02	1.09E-05	8.04E-06
Toluene	2.52E-02	5.26E+02	3.01E+01	4.68E-01	1.18E-02	3.90E-04	4.00E-02	1.01E-03	3.34E-05
TPH C06-C09 aliphatic	8.78E-03	1.18E+01	-	4.68E-01	-	-	4.00E-02	-	-
TPH C10-C14 aliphatic	2.50E+00	9.99E-02	-	4.68E-01	-	-	4.00E-02	-	-
TPH C10-C14 aromatic	2.46E+00	2.53E+01	-	4.68E-01	-	-	4.00E-02	-	-
TPH C15-C28 aliphatic	-	1.11E-04	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	1.06E+00	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	2.50E-06	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	6.60E-03	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	1.31E-03	5.70E+01	1.96E+00	4.68E-01	6.12E-04	3.12E-04	4.00E-02	5.23E-05	2.66E-05
Vanadium and compounds	-	-	-	-	-	-	-	-	-
Xylenes (total)	9.57E-03	1.06E+02	4.34E+00	4.68E-01	4.48E-03	1.03E-03	4.00E-02	3.82E-04	8.82E-05

TOTAL

4.92E+00

4.20E-01

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement A (Odour Based Calculations) Scenario

Chemical	Cgw mg/L	Solubility mg/L	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL mg/L	Pathway Contributions to Total Estimated Risk at RBSL	
			GW vapours from flowing water	TOTAL (All Pathways)	GW vapours from flowing water	Total Vapour Pathways	TOTAL (All Pathways)					GW vapours from flowing water	TOTAL
	mg/L	mg/L	unitless	unitless	unitless	L/mg	L/mg	mg/L				%	%
Acenaphthene	4.48	3.90E+00	4.35E-03	4.35E-03	1.11E-03	1.11E-03	1.11E-03	1.79E+02	4.35E-03	4.35E-03	1.79E+02	2.2%	2.17%
Acenaphthylene	43.2	1.61E+01	-	-	-	-	-	-	-	-	-	-	-
Ammonia	348	4.82E+05	4.53E-03	4.53E-03	1.30E-05	1.30E-05	1.30E-05	7.68E+04	1.00E+00	-	7.68E+04	100.0%	100.00%
Aniline	0.212	3.60E+04	1.18E-06	1.18E-06	5.57E-06	5.57E-06	5.57E-06	1.79E+05	2.01E-01	2.01E-01	1.79E+05	20.1%	20.06%
Anthracene	15.4	4.34E-02	-	-	-	-	-	-	-	-	-	-	-
Arsenic, Inorganic	0.024		-	-	-	-	-	-	-	-	-	-	-
Barium	2.23		-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-	-	-	-	-	-	-	-	-
Benzene	40.2	1.79E+03	2.47E-04	2.47E-04	6.14E-06	6.14E-06	6.14E-06	4.07E+04	1.10E-02	1.10E-02	4.07E+04	4.4%	4.39%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-	-	-	-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-	-	-	-	-	-	-	-	-
Cobalt	0.057		-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	3.43E+00	3.43E+00	7.87E-03	7.87E-03	7.87E-03	1.27E+02	1.00E+00	-	1.27E+02	100.0%	100.00%
Cresol, o-	182	2.59E+04	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	5.09E-03	5.09E-03	1.64E-03	1.64E-03	1.64E-03	6.10E+02	5.09E-03	5.09E-03	6.10E+02	0.5%	0.51%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	1.01E-03	1.01E-03	3.34E-04	3.34E-04	3.34E-04	7.49E+02	5.64E-02	5.64E-02	7.49E+02	22.6%	22.57%
Fluoranthene	25.9	2.60E-01	-	-	-	-	-	-	-	-	-	-	-
Fluorene	21.1	1.69E+00	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-	-	-	-	-	-	-	-	-
Iron	187		-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-	-	-	-	-	-	-	-	-
Manganese	4.89		-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	105	2.46E+01	1.08E+00	1.08E+00	4.39E-02	4.39E-02	4.39E-02	4.56E+00	2.00E-01	-	4.56E+00	100.0%	100.00%
Naphthalene	283	3.10E+01	3.79E-01	3.79E-01	1.22E-02	1.22E-02	1.22E-02	1.63E+01	2.00E-01	-	1.63E+01	100.0%	100.00%
Nickel Soluble Salts	0.303		-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	-	-	-	-	-	-	-	-	-	-	-
Phenol	249	8.28E+04	6.34E-03	6.34E-03	2.55E-05	2.55E-05	2.55E-05	3.93E+04	1.00E+00	-	3.93E+04	100.0%	100.00%
Pyrene	27.9	1.35E-01	-	-	-	-	-	-	-	-	-	-	-
Styrene	0.194	3.10E+02	9.41E-05	9.41E-05	4.85E-04	4.85E-04	4.85E-04	2.06E+03	1.50E-01	1.50E-01	2.06E+03	15.0%	15.03%
Toluene	17.6	5.26E+02	3.90E-04	3.90E-04	2.22E-05	2.22E-05	2.22E-05	1.13E+04	1.17E-02	1.17E-02	1.13E+04	4.7%	4.67%
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	3.12E-04	3.12E-04	3.39E-04	3.39E-04	3.39E-04	2.95E+03	1.93E-02	1.93E-02	2.95E+03	1.9%	1.93%
Vanadium and compounds	0.0228	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	1.03E-03	1.03E-03	1.54E-04	1.54E-04	1.54E-04	1.62E+03	1.63E-02	1.63E-02	1.62E+03	6.5%	6.53%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Child Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 1 - Lower Basement A(Odour Based Calculations) Scenario

Chemical	Cgw	Solubility	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit)	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			GW Vapurs from Flowing Water	TOTAL (All Pathways)	GW Vapour from Flowing Water	Total Vapour Pathways	TOTAL (All Pathways)					GW Vapours from Flowing Water	TOTAL
	mg/L	mg/L	unitless	unitless	unitless	L/mg	L/mg	mg/L			mg/L	%	%
Acenaphthene	4.48	3.90E+00	3.71E-04	3.71E-04	9.52E-05	9.52E-05	9.52E-05	2.10E+03	3.71E-04	3.71E-04	2.10E+03	0.2%	0.19%
Acenaphthylene	43.2	1.61E+01	-	-	-		-	-	-	-	-	-	-
Ammonia	348	4.82E+05	3.87E-04	3.87E-04	1.11E-06	1.11E-06	1.11E-06	8.98E+05	5.36E-01	5.36E-01	8.98E+05	53.6%	53.65%
Aniline	0.212	3.60E+04	1.01E-07	1.01E-07	4.76E-07	4.76E-07	4.76E-07	2.10E+06	1.71E-02	1.71E-02	2.10E+06	1.7%	1.71%
Anthracene	15.4	4.34E-02	-	-	-		-	-	-	-	-	-	-
Arsenic, Inorganic	0.024		-	-	-		-	-	-	-	-	-	-
Barium	2.23		-	-	-		-	-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-		-	-	-	-	-	-	-
Benzene	40.2	1.79E+03	2.11E-05	2.11E-05	5.24E-07	5.24E-07	5.24E-07	4.77E+05	9.39E-04	9.39E-04	4.77E+05	0.4%	0.38%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-		-	-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-		-	-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-		-	-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-		-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-		-	-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-		-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-		-	-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-		-	-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-		-	-	-	-	-	-	-
Cobalt	0.057		-	-	-		-	-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	2.93E-01	2.93E-01	6.73E-04	6.73E-04	6.73E-04	1.49E+03	1.00E+00	-	1.49E+03	100.0%	100.00%
Cresol, o-	182	2.59E+04	-	-	-		-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-		-	-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	4.35E-04	4.35E-04	1.40E-04	1.40E-04	1.40E-04	7.13E+03	4.35E-04	4.35E-04	7.13E+03	0.0%	0.04%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-		-	-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	8.62E-05	8.62E-05	2.85E-05	2.85E-05	2.85E-05	8.76E+03	4.82E-03	4.82E-03	8.76E+03	1.9%	1.93%
Fluoranthene	25.9	2.60E-01	-	-	-		-	-	-	-	-	-	-
Fluorene	21.1	1.69E+00	-	-	-		-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-		-	-	-	-	-	-	-
Iron	187		-	-	-		-	-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-		-	-	-	-	-	-	-
Manganese	4.89		-	-	-		-	-	-	-	-	-	-
Methylnaphthalene, 2-Naphthalene	105	2.46E+01	9.22E-02	9.22E-02	3.75E-03	3.75E-03	3.75E-03	5.34E+01	9.22E-02	9.22E-02	5.34E+01	46.1%	46.10%
	283	3.10E+01	3.24E-02	3.24E-02	1.05E-03	1.05E-03	1.05E-03	1.91E+02	3.24E-02	3.24E-02	1.91E+02	16.2%	16.21%
Nickel Soluble Salts	0.303		-	-	-		-	-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	-	-	-		-	-	-	-	-	-	-
Phenol	249	8.28E+04	5.42E-04	5.42E-04	2.18E-06	2.18E-06	2.18E-06	4.59E+05	1.80E-01	1.80E-01	4.59E+05	18.0%	18.03%
Pyrene	27.9	1.35E-01	-	-	-		-	-	-	-	-	-	-
Styrene	0.194	3.10E+02	8.04E-06	8.04E-06	4.14E-05	4.14E-05	4.14E-05	2.41E+04	1.28E-02	1.28E-02	2.41E+04	1.3%	1.28%
Toluene	17.6	5.26E+02	3.34E-05	3.34E-05	1.90E-06	1.90E-06	1.90E-06	1.32E+05	9.97E-04	9.97E-04	1.32E+05	0.4%	0.40%
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-		-	-	-	-	-	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-		-	-	-	-	-	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-		-	-	-	-	-	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-		-	-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-		-	-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-		-	-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-		-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	2.66E-05	2.66E-05	2.90E-05	2.90E-05	2.90E-05	3.45E+04	1.65E-03	1.65E-03	3.45E+04	0.2%	0.17%
Vanadium and compounds	0.0228	-	-	-	-		-	-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	8.82E-05	8.82E-05	1.32E-05	1.32E-05	1.32E-05	1.90E+04	1.40E-03	1.40E-03	1.90E+04	0.6%	0.56%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

1. General Information:

Site:

Barangaroo

Address:

Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Client:

Lend Lease

Scenario:

Scenario 2 - Upper Basement (Odour Based Calculations)

Header Colour (Defaults = Blue):

Blue

2. Select Receptor:

Commercial/Industrial

3. Select Exposure Pathways to Include:

Enter "x" in box, or select from dropdown box.

Soil Pathways

Incidental Ingestion of Soil

Dermal Contact with Soil

Inhalation of Surface Soil-Derived Dust in Indoor Air

Inhalation of Surface Soil-Derived Dust in Outdoor Air

Inhalation of Surface Soil-Derived Vapours in Outdoor Air

Inhalation of Soil-Derived Vapours From Excavation (USEPA 2002 method)

x

Inhalation of Subsurface Soil-Derived Vapours in Indoor Air

Inhalation of Subsurface Soil-Derived Vapours in Outdoor Air

Groundwater Pathways

Inhalation of Groundwater-Derived Vapours in Indoor Air

Inhalation of Groundwater-Derived Vapours in Outdoor Air

Ingestion of Potable Groundwater

Incidental Ingestion of Groundwater (Bathing or Excavation)

Dermal Contact with Groundwater (Bathing or Excavation)

Inhalation of Groundwater Vapours during Irrigation/ Showering

Ingestion of Vegetables Irrigated with Groundwater

Inhalation of Groundwater Vapours (Where GW Enters Trench)

x

Inhalation of vapour emissions from flowing water (groundwater in basement)

Inhalation of Soil Vapour-Derived Vapours in Indoor Air

Inhalation of Soil Vapour-Derived Vapours in Outdoor Air

Y

Soil RBSLs saturation limited?

Y

Groundwater RBSLs solubility limited?

4. Select Chemicals for Quantitative Assessment:	Target Hazard Index	Target Cancer Risk	5. Enter Chemical Concentrations (if only calculating RBSLs, enter 1 for media for which you want RBSLs):	
	default = 1 (or manually overwrite)	default = 1x10 ⁻⁵ (or manually overwrite)	Soil (mg/kg)	Groundwater (mg/L)
Acenaphthene	0.2	1.00E-05	511	4.48
Acenaphthylene	0.2	1.00E-05	1700	43.2
Ammonia	1	1.00E-05		348
Aniline	1	1.00E-05		0.212
Anthracene	0.2	1.00E-05	2150	15.4
Arsenic, Inorganic	1	1.00E-05		0.024
Barium	1	1.00E-05		2.23
Benz(a)anthracene		1.00E-05	1470	12.6
Benzene	0.25	1.00E-05	1510	40.2
Benzo(a)pyrene		1.00E-05	652	9.26
Benzo(b)fluoranthene		1.00E-05	587	8.33
Benzo(g,h,i)perylene		1.00E-05	305	4.22
Benzo(k)fluoranthene		1.00E-05	231	2.93
Bis(2-ethylhexyl)phalate	1	1.00E-05		0.03
Cadmium (Water)	1	1.00E-05		0.108
Chromium(III), Insoluble Salt	1	1.00E-05	210	0.102
Chromium(VI)	1	1.00E-05	2.3	0.102
Chrysene		1.00E-05	771	9.78
Cobalt	1	1.00E-05		0.057
Cresol, m-&p-	1	1.00E-05	2290	436
Cresol, o-	1	1.00E-05		182
		Blank		
Dibenz(a,h)anthracene		1.00E-05	71.4	0.822
Dibenzofuran	1	1.00E-05	277	10.2
Dimethylphenol, 2,4-	1	1.00E-05		38
Ethylbenzene	0.25	1.00E-05	261	3.02
Fluoranthene		1.00E-05	2440	25.9
Fluorene	0.2	1.00E-05	2100	21.1
Indeno(1,2,3-cd)pyrene		1.00E-05	247	3.05
Iron	1	1.00E-05	60600	187
Lead and Compounds	1	1.00E-05	13600	0.555
Manganese	1	1.00E-05		4.89
Methylnaphthalene, 2-	0.2	1.00E-05	7650	105
Naphthalene	0.2	1.00E-05	10200	283
Nickel Soluble Salts	1	1.00E-05		0.303
Phenanthrene	0.2	1.00E-05	5180	74.1
Phenol	1	1.00E-05		249
Pyrene	0.2	1.00E-05	2640	27.9
Styrene	1	1.00E-05		0.194
Toluene	0.25	1.00E-05	2650	17.6
TPH C06-C09 aliphatic	0.125	1.00E-05	593	6.08
TPH C10-C14 aliphatic	0.125	1.00E-05	69400	1730
TPH C10-C14 aromatic	0.125	1.00E-05	69400	1730
TPH C15-C28 aliphatic	0.125	1.00E-05	93200	1520
TPH C15-C28 aromatic	0.125	1.00E-05	93200	1520
TPH C29-C36 aliphatic	0.125	1.00E-05	20600	332
TPH C29-C36 aromatic	0.125	1.00E-05	20600	332
Trimethylbenzene, 1,2,4-	1	1.00E-05	220	0.92
Vanadium and compounds	1	1.00E-05	248	0.0228
Xylenes (total)	0.25	1.00E-05	2576	6.7

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

6. Confirm/Modify Exposure Parameters:

	Units	Site-Specific Value (leave blank to use default value)		Value Used in Calculations	
		Adult	Child	Adult	Child
General receptor parameters:					
Body weight	kg	70	na	70	
Exposure duration	yr	30	na	30	
Averaging time (carcinogens)	yr	70	na	70	
Averaging time (non-carcinogens)	yr	30	na	30	
Incidental Soil Ingestion					
Daily soil ingestion rate	mg/day				
Exposure frequency for soil ingestion	days/yr				
Fraction of daily soil intake from site	unitless				
Dermal Absorption of Soil					
Exposed skin surface area for soil contact	cm2				
Soil to skin adherence factor	mg/cm2				
Exposure frequency for dermal contact with soil	days/yr				
Indoor Inhalation					
Exposure time (indoor air)	hrs/day	8		8	
Exposure frequency (indoor air)	days/yr	240		240	
Particulate emission factor (indoor air)	m3/kg				
Outdoor Inhalation					
Exposure time (outdoor air)	hrs/day				
Exposure frequency (outdoor air)	days/yr				
Particulate emission factor (outdoor air)	m3/kg				
Potable Water Ingestion					
Potable water intake rate	L/day				
Exposure frequency for potable water intake	days/yr				
Incidental Water Ingestion					
Incidental ingestion rate	L/day				
Exposure frequency for incidental water ingestion	days/yr				
Dermal Contact with Water					
Exposed skin surface for water contact	cm2				
Exposure time for dermal water contact	hr/day				
Exposure frequency for dermal water contact	days/yr				
Vapour Inhalation Shower/ Sprinkler					
Exposure frequency	days/yr				
Exposure time	min/ day				
Inhalation rate	m3/hr				
Inhalation Absorption Adjustment Factor	mg/mg				
Lung retention factor	unitless				
Ingestion of Home Grown Produce					
Proportion of homegrown produce ingested					
Exposure frequency	days/year				
Inhalation of Vapours from Flowing Water					
Exposure time	hrs/day	8	8	8	8
Exposure frequency	days/year	240	240	240	240

A. Model Input Parameters

Parameter Definition	Units	Default Value (Shell 2007 unless otherwise noted)	Notes	Site-Specific Value (leave blank if adopting Shell default)	Label	Adopted Value for Model	Justification for Site-specific value, if applicable
Lower depth of surficial soil zone	cm	100			LDSSZ	100	
Depth to subsurface soil sources (below building, ground surface or trench)	cm	100			LS	0.001	Autocalculates from layer thicknesses
<u>Vadose Zone Layer 1 (soil type where source is)</u>							
Thickness	cm	100		0.001	HV	0.001	Negligible distance - assumes soil is adjacent building foundataion.
				Sand and gravel (<12% fines)			Conservative assumption for mixed fill.
SCS Soil Type:							
Fraction of organic carbon	unitless	0.01		0.002	OC	0.002	
Soil bulk density	g/cm3	1.7		1.66	sbd	1.66	
Air-filled porosity (volumetric)	cm3/cm3	0.26		0.321	VACS	0.321	
Water-filled porosity (volumetric)	cm3/cm3	0.12		0.054	wvcvz	0.054	
Total soil porosity	cm3/cm3	0.38		0.375	TPOR	0.375	
Vapour phase source partitioning adjustment	unitless	1		10	VPPA	10	Adjustment for vapour partitioning; see text.
Vadose zone biodegradation adjustment	unitless	1		1	BioA	1	Conservatively assumes no soil vapour biodegradation
<u>Building Characteristics</u>							
Enclosed-space volume/infiltration area (ratio)	cm	300	(a)	5625	LB	5625	Assumes 25 m by 25 m by 4.5 m high basement section, with soil vapour infiltration through upper 2 m of 2 of 4 walls only, ie volume = 11250 m3 and infiltration area = 200 m2. See text.
Enclosed-space foundation or wall thickness	cm	15		15	Lcrack	15	600 mm diaphragm outer wall assumed, as per LLD
Enclosed-space air exchange rate	1/s	0.00055556		0.00088	ENCAER	8.80E-04	4 per hour, in accordance with AS1668.2
Areal fraction of cracks in foundations/walls	cm ² -cracks/cm ² -total area	0.0019	(b)	0.0002	NU	0.0002	USEPA (2004) default for basement foundation.
Volumetric air content in found./wall cracks	cc/cc	0.26		0.321	VACF	0.321	Assumes cracks in concrete are filled with sand.
Volumetric water content in found./wall cracks	cc/cc	0.12		0.054	wvcfnd	0.054	Assumes cracks in concrete are filled with sand.
<u>Convective vapour flow term</u>							
Calculate convective flow term?		Y		y	Conv	y	
Convective flow rate (if specified directly)	cm3/sec			0.001			Negligible rate to account for assumption that advective flow not likely. Air flow will not be possible with wetted wall.
Convective flow through slab (calculated)	cm3/sec	10.88		380.3828744	Qs	380.38	
Slab Area	cm2	700000		2.70E+07	Ab	27000000	Conservatively assumes area of 2 walls and floor
Areal fraction of cracks in foundations/walls	cm ² -cracks/cm ² -total area	0.0019		0.0002	Nuc		
Soil vapour permeability	cm ²	1.00E-08		1.00E-07	kv	1.00E-07	
Indoor-outdoor pressure differential	g/cm-s ²	40		4.00E+01	dP	40	
Slab perimeter	cm	3400		2.00E+04	Xcrack	20000	
Depth below ground to bottom of slab	cm	15		2.00E+02	Zcrack	200	
Viscosity of air	g/cm-s	1.81E-04		1.81E-04	uair	1.81E-04	

(a) Building Code of Australia minimum ceiling height for habitable dwelling.
(b) USEPA (2004) upper limit of range for slab on grade foundation.
(c) If receptor is construction/excavation worker, wind speed is default wind speed of 225 cm/s reduced by factor of 10 to account for reduced wind circulation within excavation. For other receptors, wind speed is default of 225 cm/s.
(d) For construction/excavation worker, default is 400 cm (assumes trench is 2 m long and 2 m deep, and vapours enter through both walls and floor). For other receptors, Shell (2007) default of 4500 cm is assumed.
(e) Equals exposure duration for selected receptor. For residential scenario, shortest (child) exposure duration is selected for conservative purposes.
(f) USEPA (2002) default (0.5 acre).

B. Chemical-Specific Fate and Transport Parameters

CHEMICAL	K _{oc}	K _d	H ⁺	S	D ^{so}	D ^{soil}	MW	VP	Volatile?
	(cm ² /g)	(cm ² /g)	(cc-H ₂ O / cc-air)	(mg/l-water)	(cm ² /s)	(cm ² /s)	(g/mol)	(mmHg)	
Acenaphthene	5.03E+03	1.01E+01	7.52E-03	3.90E+00	5.06E-02	8.33E-06	1.54E+02	2.15E-03	Y
Acenaphthylene	5.03E+03	1.01E+01	4.66E-03	1.61E+01	4.50E-02	6.98E-06	1.52E+02	6.68E-03	Y
Ammonia	3.10E+00	6.20E-03	6.58E-04	4.82E+05	2.28E-01	1.10E-05	1.70E+01	-	Y
Aniline	7.02E+01	1.40E-01	8.26E-05	3.60E+04	8.30E-02	1.01E-05	9.31E+01	4.90E-01	Y
Anthracene	1.64E+04	3.28E+01	2.27E-03	4.34E-02	3.90E-02	7.85E-06	1.78E+02	6.53E-06	Y
Arsenic, Inorganic	-	-	-	-	-	-	7.80E+01	-	N
Barium	-	-	-	-	-	-	1.37E+02	-	N
Benz(a)anthracene	1.77E+05	3.54E+02	1.37E-04	9.40E-03	5.10E-02	9.00E-06	2.28E+02	2.10E-07	N
Benzene	1.46E+02	2.92E-01	2.27E-01	1.79E+03	8.95E-02	1.03E-05	7.81E+01	9.48E+01	Y
Benzo(a)pyrene	5.87E+05	1.17E+03	1.87E-05	1.62E-03	4.30E-02	9.00E-06	2.52E+02	5.49E-09	N
Benzo(b)fluoranthene	5.99E+05	1.20E+03	2.69E-05	1.50E-03	2.26E-02	5.56E-06	2.52E+02	5.00E-07	N
Benzo(g,h,i)perylene	1.95E+06	3.90E+03	1.35E-05	2.60E-04	4.90E-02	5.56E-06	2.76E+02	1.00E-10	N
Benzo(k)fluoranthene	5.87E+05	1.17E+03	2.39E-05	8.00E-04	2.26E-02	5.56E-06	2.52E+02	9.65E-10	N
Bis(2-ethylhexyl)phalate	1.20E+05	2.40E+02	1.10E-05	2.70E-01	3.51E-02	3.66E-06	3.91E+02	1.42E-07	N
Cadmium (Water)	-	-	-	-	-	-	1.12E+02	-	N
Chromium(III), Insoluble Salts	-	-	-	-	-	-	5.20E+01	-	N
Chromium(VI)	-	-	-	1.69E+06	-	-	5.20E+01	-	N
Chrysene	1.81E+05	3.62E+02	2.14E-04	2.00E-03	2.48E-02	6.21E-06	2.28E+02	6.23E-09	N
Cobalt	-	-	-	-	-	-	5.89E+01	-	N
Cresol, m-&p-	3.00E+02	6.00E-01	3.50E-05	2.27E+04	7.29E-02	9.32E-06	1.08E+02	1.10E-01	Y
Cresol, o-	3.07E+02	6.14E-01	4.91E-05	2.59E+04	7.28E-02	9.32E-06	1.08E+02	1.70E-01	N
Dibenz(a,h)anthracene	1.91E+06	3.82E+03	5.76E-06	2.49E-03	2.00E-02	5.24E-06	2.78E+02	9.55E-10	N

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

[Back to User Input Sheet](#)

Dibenzofuran	9.16E+03	1.83E+01	8.71E-03	3.10E+00	4.10E-02	7.38E-06	1.68E+02	2.48E-03	Y
Dimethylphenol, 2,4-	4.92E+02	9.84E-01	3.89E-05	7.87E+03	6.22E-02	8.31E-06	1.22E+02	1.02E-01	Y
Ethylbenzene	4.46E+02	8.92E-01	3.22E-01	1.69E+02	6.85E-02	8.46E-06	1.06E+02	9.60E+00	Y
Fluoranthene	5.55E+04	1.11E+02	3.62E-04	2.60E-01	3.02E-02	6.35E-06	2.02E+02	9.22E-06	N
Fluorene	9.16E+03	1.83E+01	3.93E-03	1.69E+00	4.40E-02	7.89E-06	1.66E+02	6.00E-04	Y
Indeno(1,2,3-cd)pyrene	1.95E+06	3.90E+03	1.42E-05	1.90E-04	2.30E-02	4.41E-06	2.76E+02	1.25E-10	N
Iron	-	-	-	-	-	-	5.59E+01	-	N
Lead and Compounds	-	-	-	-	-	-	2.07E+02	-	N
Manganese	-	-	-	-	-	-	5.49E+01	-	N
Methylnaphthalene, 2-	2.48E+03	4.96E+00	2.12E-02	2.46E+01	5.24E-02	7.78E-06	1.42E+02	5.50E-02	Y
Naphthalene	1.54E+03	3.08E+00	1.80E-02	3.10E+01	6.05E-02	8.38E-06	1.28E+02	8.50E-02	Y
Nickel Soluble Salts	-	-	-	-	-	-	5.87E+01	-	N
Phenanthrene	1.67E+04	3.34E+01	1.73E-03	1.15E+00	3.45E-02	6.69E-06	1.78E+02	1.21E-04	Y
Phenol	1.87E+02	3.74E-01	1.36E-05	8.28E+04	8.34E-02	1.03E-05	9.41E+01	3.50E-01	Y
Pyrene	5.43E+04	1.09E+02	4.87E-04	1.35E-01	2.78E-02	7.25E-06	2.02E+02	4.50E-06	Y
Styrene	4.46E+02	8.92E-01	1.12E-01	3.10E+02	7.11E-02	8.78E-06	1.04E+02	6.40E+00	Y
Toluene	2.34E+02	4.68E-01	2.71E-01	5.26E+02	7.78E-02	9.20E-06	9.21E+01	2.84E+01	Y
TPH C06-C09 aliphatic	4.47E+03	8.94E+00	5.05E+01	1.18E+01	1.00E-01	1.00E-05	1.03E+02	9.16E+01	Y
TPH C10-C14 aliphatic	5.50E+05	1.10E+03	6.26E+01	9.99E-02	1.00E+03	1.00E-05	1.70E+02	1.16E+00	Y
TPH C10-C14 aromatic	3.02E+03	6.04E+00	1.41E-01	2.53E+01	1.00E-01	1.00E-05	1.36E+02	1.16E+00	Y
TPH C15-C28 aliphatic	3.16E+08	6.32E+05	8.27E+01	1.11E-04	1.00E-01	1.00E-05	2.60E+02	5.93E-03	n
TPH C15-C28 aromatic	3.79E+04	7.58E-01	4.90E-03	1.06E+00	1.00E-01	1.00E-05	2.09E+02	5.51E-03	N
TPH C29-C36 aliphatic	6.31E+08	1.26E+06	8.50E+01	2.50E-06	1.00E-01	1.00E-05	2.70E+02	8.36E-04	N
TPH C29-C36 aromatic	1.26E+05	2.52E+02	1.70E-05	6.60E-03	1.00E-01	1.00E-05	2.40E+02	3.34E-07	N
Trimethylbenzene, 1,2,4-	6.14E+02	1.23E+00	2.52E-01	5.70E+01	6.07E-02	7.92E-06	1.20E+02	2.10E+00	Y
Vanadium and compounds	-	-	-	-	-	-	5.09E+01	-	N
Xylenes (total)	3.83E+02	7.66E-01	2.12E-01	1.06E+02	8.47E-02	9.90E-06	1.06E+02	7.99E+00	Y

Definition of Parameters

Koc	Organic carbon partition coefficient	D ^{air}	Diffusion coefficient in air
Kd	Soil-water partition coefficient	D ^{wat}	Diffusion coefficient in water
H'	Dimensionless Henry's Law Constant	MW	Molecular weight
S	Solubility	VP	Vapopur pressure

C. Chemical-Specific Diffusion Coefficients

CHEMICAL	D _{e1}	D _{e2}	D _{e3}	D _{cont}	D _{crack}	C _{soil}	Convective Factor	D _o	M _{outlet}
	(cm ² /s)	(cm ² /s)	(cm ² /s)	(cm ² /s)	(cm ² /s)	(mg/kg)	(unitless)	(cm ² /s)	(g)
Acenaphthene	8.18E-03	-	-	8.18E-03	8.18E-03	3.94E+01	1.29E+02	3.66E-06	7.25E+04
Acenaphthylene	7.28E-03	-	-	7.28E-03	7.28E-03	1.63E+02	1.45E+02	2.02E-06	5.38E+04
Ammonia	3.69E-02	-	-	3.69E-02	3.69E-02	1.87E+04	2.87E+01	3.75E-04	7.34E+05
Aniline	1.35E-02	-	-	1.35E-02	1.35E-02	6.23E+03	7.84E+01	3.86E-06	7.45E+04
Anthracene	6.31E-03	-	-	6.31E-03	6.31E-03	1.42E+00	1.68E+02	2.62E-07	1.94E+04
Arsenic, Inorganic	NV	NV	NV	NV	NV	-	NV	NV	NV
Barium	NV	NV	NV	NV	NV	-	NV	NV	NV
Benz(a)anthracene	NV	NV	NV	NV	NV	3.33E+00	NV	NV	NV
Benzene	1.45E-02	-	-	1.45E-02	1.45E-02	6.59E+02	7.30E+01	5.35E-03	2.77E+06
Benzo(a)pyrene	NV	NV	NV	NV	NV	1.90E+00	NV	NV	NV
Benzo(b)fluoranthene	NV	NV	NV	NV	NV	1.80E+00	NV	NV	NV
Benzo(g,h,i)perylene	NV	NV	NV	NV	NV	1.01E+00	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	NV	NV	NV	9.39E-01	NV	NV	NV
Bis(2-ethylhexyl)phalate	NV	NV	NV	NV	NV	6.48E+01	NV	NV	NV
Cadmium (Water)	NV	NV	NV	NV	NV	-	NV	NV	NV
Chromium(III), Insoluble Salts	NV	NV	NV	NV	NV	-	NV	NV	NV
Chromium(VI)	NV	NV	NV	NV	NV	-	NV	NV	NV
Chrysene	NV	NV	NV	NV	NV	7.24E-01	NV	NV	NV
Cobalt	NV	NV	NV	NV	NV	-	NV	NV	NV
Cresol, m-&p-	1.19E-02	-	-	1.19E-02	1.19E-02	1.44E+04	8.88E+01	3.95E-07	2.38E+04
Cresol, o-	NV	NV	NV	NV	NV	1.67E+04	NV	NV	NV
Blank	NV	NV	NV	NV	NV	6.48E+01	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	NV	NV	NV	9.51E+00	NV	NV	NV
Dibenzofuran	6.63E-03	-	-	6.63E-03	6.63E-03	5.69E+01	1.59E+02	1.89E-06	5.21E+04
Dimethylphenol, 2,4-	1.01E-02	-	-	1.01E-02	1.01E-02	8.00E+03	1.04E+02	2.33E-07	1.83E+04
Ethylbenzene	1.11E-02	-	-	1.11E-02	1.11E-02	1.67E+02	9.54E+01	2.17E-03	1.77E+06
Fluoranthene	NV	NV	NV	NV	NV	2.89E+01	NV	NV	NV
Fluorene	7.11E-03	-	-	7.11E-03	7.11E-03	3.10E+01	1.49E+02	9.14E-07	3.62E+04
Indeno(1,2,3-cd)pyrene	NV	NV	NV	NV	NV	7.41E-01	NV	NV	NV
Iron	NV	NV	NV	NV	NV	-	NV	NV	NV
Lead and Compounds	NV	NV	NV	NV	NV	-	NV	NV	NV
Manganese	NV	NV	NV	NV	NV	-	NV	NV	NV
Methylnaphthalene, 2-	8.47E-03	-	-	8.47E-03	8.47E-03	1.23E+02	1.25E+02	2.16E-05	1.76E+05
Naphthalene	9.78E-03	-	-	9.78E-03	9.78E-03	9.66E+01	1.08E+02	3.39E-05	2.21E+05
Nickel Soluble Salts	NV	NV	NV	NV	NV	-	NV	NV	NV
Phenanthrene	5.58E-03	-	-	5.58E-03	5.58E-03	3.84E+01	1.89E+02	1.73E-07	1.58E+04
Phenol	1.38E-02	-	-	1.38E-02	1.38E-02	3.37E+04	7.65E+01	2.77E-07	2.00E+04
Pyrene	4.50E-03	-	-	4.50E-03	4.50E-03	1.47E+01	2.35E+02	1.21E-08	4.17E+03
Styrene	1.15E-02	-	-	1.15E-02	1.15E-02	2.93E+02	9.19E+01	8.17E-04	1.08E+06
Toluene	1.26E-02	-	-	1.26E-02	1.26E-02	2.91E+02	8.40E+01	3.70E-03	2.31E+06
TPH C06-C09 aliphatic	1.62E-02	-	-	1.62E-02	1.62E-02	2.21E+02	6.54E+01	2.61E-02	6.13E+06
TPH C10-C14 aliphatic	1.62E-02	-	-	1.62E-02	1.62E-02	1.11E+02	6.54E+01	5.46E-04	8.86E+05
TPH C10-C14 aromatic	1.62E-02	-	-	1.62E-02	1.62E-02	1.54E+02	6.54E+01	2.24E-04	5.68E+05
TPH C15-C28 aliphatic	NV	NV	NV	NV	NV	7.02E+01	NV	NV	NV
TPH C15-C28 aromatic	NV	NV	NV	NV	NV	8.04E+01	NV	NV	NV
TPH C29-C36 aliphatic	NV	NV	NV	NV	NV	3.16E+00	NV	NV	NV
TPH C29-C36 aromatic	NV	NV	NV	NV	NV	1.66E+00	NV	NV	NV

Vapour Modelling - Soil to Outdoor and Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

[Back to User Input Sheet](#)

Trimethylbenzene, 1,2,4-	9.81E-03	-	-	9.81E-03	9.81E-03	7.46E+01	1.08E+02	1.13E-03	1.28E+06
Vanadium and compounds	NV	NV	NV	NV	NV	-	NV	NV	NV
Xylenes (total)	1.37E-02	-	-	1.37E-02	1.37E-02	8.90E+01	7.72E+01	2.08E-03	1.73E+06

Definition of Parameters

D _s	Effective diffusion coefficient in soil based on vapor-phase concentration	D _a = Apparent diffusivity (for construction scenario Volatilisation Factor)
D _{crack}	Effective diffusion coefficient through foundation cracks	M _{excav} = Cumulative unit mass emitted from excavation (Eq E-13 in USEPA, 2002).
C _{sat}	Soil concentration at which dissolved pore-water and vapor phases become saturated	

D. Chemical-Specific Volatilisation Factors

CHEMICAL	VF _{asL}	VF _{as2}	VF _{p (indoor)}	VF _{p (outdoor)}	VF _{samb}	VF _{sasp}	VF _{excav}
	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-s)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)	(mg/m ³ -air / mg/kg-soil)
Acenaphthene	1.17E-05	1.75E-05	-	-	3.35E-01	2.12E-06	-3.12E+08
Acenaphthylene	8.66E-06	1.75E-05	-	-	1.94E-01	1.31E-06	-2.32E+08
Ammonia	1.18E-04	1.75E-05	-	-	1.33E+01	4.82E-05	-3.16E+09
Aniline	1.20E-05	1.75E-05	-	-	2.74E-01	1.36E-06	-3.21E+08
Anthracene	3.12E-06	1.75E-05	-	-	2.67E-02	1.97E-07	-8.35E+07
Arsenic, Inorganic	NV	NV	-	-	NV	NV	NV
Barium	NV	NV	-	-	NV	NV	NV
Benz(a)anthracene	NV	NV	-	-	NV	NV	NV
Benzene	4.46E-04	1.75E-05	-	-	3.64E+02	1.75E-03	-1.19E+10
Benzo(a)pyrene	NV	NV	-	-	NV	NV	NV
Benzo(b)fluoranthene	NV	NV	-	-	NV	NV	NV
Benzo(g,h,i)perylene	NV	NV	-	-	NV	NV	NV
Benzo(k)fluoranthene	NV	NV	-	-	NV	NV	NV
Bis(2-ethylhexyl)phalate	NV	NV	-	-	NV	NV	NV
Cadmium (Water)	NV	NV	-	-	NV	NV	NV
Chromium(III), Insoluble Salts	NV	NV	-	-	NV	NV	NV
Chromium(VI)	NV	NV	-	-	NV	NV	NV
Chrysene	NV	NV	-	-	NV	NV	NV
Cobalt	NV	NV	-	-	NV	NV	NV
Cresol, m-&p-	3.84E-06	1.75E-05	-	-	3.01E-02	1.57E-07	-1.03E+08
Cresol, o-	NV	NV	-	-	NV	NV	NV
Dibenz(a,h)anthracene	NV	NV	-	-	NV	NV	NV
Dibenzofuran	8.38E-06	1.75E-05	-	-	1.89E-01	1.35E-06	-2.24E+08
Dimethylphenol, 2,4-	2.95E-06	1.75E-05	-	-	1.93E-02	1.09E-07	-7.88E+07
Ethylbenzene	2.84E-04	1.75E-05	-	-	1.71E+02	9.29E-04	-7.61E+09
Fluoranthene	NV	NV	-	-	NV	NV	NV
Fluorene	5.84E-06	1.75E-05	-	-	8.90E-02	6.09E-07	-1.56E+08
Indeno(1,2,3-cd)pyrene	NV	NV	-	-	NV	NV	NV
Iron	NV	NV	-	-	NV	NV	NV
Lead and Compounds	NV	NV	-	-	NV	NV	NV
Manganese	NV	NV	-	-	NV	NV	NV
Methylnaphthalene, 2-	2.83E-05	1.75E-05	-	-	1.95E+00	1.21E-05	-7.59E+08
Naphthalene	3.55E-05	1.75E-05	-	-	2.86E+00	1.64E-05	-9.51E+08
Nickel Soluble Salts	NV	NV	-	-	NV	NV	NV
Phenanthrene	2.54E-06	1.75E-05	-	-	1.85E-02	1.47E-07	-6.80E+07
Phenol	3.21E-06	1.75E-05	-	-	1.94E-02	9.52E-08	-8.60E+07
Pyrene	6.72E-07	1.75E-05	-	-	1.39E-03	1.28E-08	-1.80E+07
Styrene	1.74E-04	1.75E-05	-	-	6.33E+01	3.37E-04	-4.67E+09
Toluene	3.71E-04	1.75E-05	-	-	2.73E+02	1.39E-03	-9.93E+09
TPH C06-C09 aliphatic	9.87E-04	1.75E-05	-	-	1.67E+03	7.67E-03	-2.64E+10
TPH C10-C14 aliphatic	1.43E-04	1.75E-05	-	-	3.48E+01	1.60E-04	-3.82E+09
TPH C10-C14 aromatic	9.14E-05	1.75E-05	-	-	1.43E+01	6.58E-05	-2.45E+09
TPH C15-C28 aliphatic	NV	NV	-	-	NV	NV	NV
TPH C15-C28 aromatic	NV	NV	-	-	NV	NV	NV
TPH C29-C36 aliphatic	NV	NV	-	-	NV	NV	NV
TPH C29-C36 aromatic	NV	NV	-	-	NV	NV	NV
Trimethylbenzene, 1,2,4-	2.05E-04	1.75E-05	-	-	9.53E+01	5.48E-04	-5.50E+09
Vanadium and compounds	NV	NV	-	-	NV	NV	NV
Xylenes (total)	2.78E-05	1.75E-05	-	-	1.46E+01	7.19E-05	-7.44E+09

Definition of Parameters

VF _{as}	Volatilization factor from surficial soils to ambient air (vapors) - use lower of two values
VF _p	Volatilization factor from surficial soils to ambient air (particulates)
VF _{samb}	Volatilization factor from subsurface soils to ambient air
VF _{sasp}	Volatilization factor from soil to enclosed-space vapors
VF _{excav}	Volatilisation factor from subsurface soil to trench air (where soil contamination is below base of trench)

Calculation of Vapour Emissions from Water with Flow
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

PARAMETERS

Concrete permeability	(select from drop down list)	High permeability
Permeability Rate (m/day)		8.6.E-02
Water Temperature (deg. C)		18.0
Dimensions of Basement / Impoundment		
Height (m)		4.5
Width (m)		50.0
Depth (m)		50.0
Volume total basement/ impoundment (m3)		11250

Dimensions of Wet Section of Basement/ Impoundment

Length (m)	25.00
Width (m)	5.0
Depth of Water (m)	0.01
Fetch/ Depth (m) ratio of Wet Basement Section	500
Volume of wet basement/ impoundment (m3)	1.2500
Area covered in water (m2)	125
Effective diameter of impoundment/ basement) (m)	12.6
Volume of water entering basement (m³/sec)	1.25E-06

Air exchange rate (exchanges/day)	7.60E+01
Windspeed (m/s)	if < 3.5m/sec if = or > 3.5m/sec
	3.00E-02

Parameter Definition	Volatile	Chemical Concentration in Water (mg/L)	Molecular weight (g/mol)	Vapour Pressure (mmHg)	Vapour Pressure (atm)	Henry's Law Coefficient (unitless)	Henry's Law Coefficient (calculated)	Equilibrium Coefficient (at 25 deg C)	Diffusivity in Water (cm²/sec)	Schmidt Number on Gas Side (*)	Gas Phase Mass Transfer Coefficient (m/sec)	Schmidt Number on Liquid Side #	Liquid Phase Mass Transfer Coefficient (m/sec) **	Overall Mass Transfer Coefficient (m/s) (windspeed <3.5 m/s)	Diffusivity in Air (cm2/sec)	Equilibrium Concentration of water in Basement/ Impoundment (g/m³)	Air Emission Rate from Liquid Surface (g/sec)	Air Emission Rate from Liquid Surface (mg/day)	Adjusted Concentration in Basement Air (includes air exchange) (mg/m3)
		C	MW	Vap	Vap	unitless	atm.m3/g mol	K _{eq}	D _{water}	Sc _G	k _G	Sc _L	k _L	K	D _{air}	C _L		E	
Acenaphthene	Y	4.48	154	2.15E-03	2.83E-06	7.52E-03	1.80E-04	7.345E-03	8.33E-06	3.0E+00	1.138E-04	1.08E+03	2.74E-07	2.1E-07	0.0506	1.6E-01	4.07E-06	3.52E+02	4.11E-04
Acenaphthylene	Y	43.2	152	6.68E-03	8.79E-06	4.66E-03	1.11E-04	4.551E-03	6.98E-06	3.4E+00	1.052E-04	1.29E+03	2.44E-07	1.6E-07	0.045	1.7E+00	3.44E-05	2.97E+03	3.47E-03
Ammonia	Y	348	17	-	-	6.58E-04	1.57E-05	6.427E-04	1.10E-05	6.6E-01	3.121E-04	8.18E+02	3.30E-07	1.2E-07	0.228	1.0E+01	1.60E-04	1.38E+04	1.61E-02
Aniline	Y	0.212	93.1	4.90E-01	6.45E-04	8.26E-05	1.97E-06	8.067E-05	1.01E-05	1.8E+00	1.586E-04	8.91E+02	3.12E-07	1.2E-08	0.083	6.6E-03	1.01E-08	8.74E-01	1.02E-06
Anthracene	Y	15.4	178	6.53E-06	8.59E-09	2.27E-03	5.42E-05	2.217E-03	7.85E-06	3.9E+00	9.561E-05	1.15E+03	2.64E-07	1.2E-07	0.039	5.6E-01	8.27E-06	7.14E+02	8.35E-04
Arsenic, Inorganic	N	0.024	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	N	2.23	137	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	N	12.6	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	Y	40.2	78.1	9.48E+01	1.25E-01	2.27E-01	5.42E-03	2.217E-01	1.03E-05	1.7E+00	1.668E-04	8.74E+02	3.16E-07	3.1E-07	0.0895	1.2E+00	4.83E-05	4.17E+03	4.88E-03
Benzo(a)pyrene	N	9.26	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	N	8.33	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	N	4.22	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	N	2.93	252	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	N	0.03	391	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	N	0.108	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	N	0.102	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	N	0.102	52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	N	9.78	228	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	N	0.057	58.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	Y	436	108	1.10E-01	1.45E-04	3.50E-05	8.36E-07	3.418E-05	9.32E-06	2.1E+00	1.454E-04	9.66E+02	2.96E-07	4.9E-09	0.0729	1.4E+01	8.72E-06	7.53E+02	8.81E-04
Cresol, o-	N	182	108	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	N	0.822	278	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	Y	10.2	168	2.48E-03	3.26E-06	8.71E-03	2.08E-04	8.507E-03	7.38E-06	3.7E+00	9.887E-05	1.22E+03	2.53E-07	1.9E-07	0.041	3.9E-01	9.43E-06	8.15E+02	9.53E-04
Dimethylphenol, 2,4-	Y	38	122	1.02E-01	1.34E-04	3.89E-05	9.29E-07	3.799E-05	8.31E-06	2.4E+00	1.307E-04	1.08E+03	2.74E-07	4.9E-09	0.0622	1.3E+00	8.16E-07	7.05E+01	8.25E-05
Ethylbenzene	Y	3.02	106	9.60E+00	1.26E-02	3.22E-01	7.69E-03	3.145E-01	8.46E-06	2.2E+00	1.395E-04	1.06E+03	2.77E-07	2.8E-07	0.0685	1.1E-01	3.62E-06	3.13E+02	3.66E-04
Fluoranthene	N	25.9	202	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	Y	21.1	166	6.00E-04	7.90E-07	3.93E-03	9.38E-05	3.838E-03	7.89E-06	3.4E+00	1.037E-04	1.14E+03	2.65E-07	1.6E-07	0.044	7.7E-01	1.53E-05	1.32E+03	1.54E-03
Indeno(1,2,3-cd)pyrene	N	3.05	276	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	N	187	55.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	N	0.555	207	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	N	4.89	54.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	Y	105	142	5.50E-02	7.24E-05	2.12E-02	5.06E-04	2.071E-02	7.78E-06	2.9E+00	1.165E-04	1.16E+03	2.62E-07	2.4E-07	0.0524	3.9E+00	1.14E-04	9.85E+03	1.15E-02
Naphthalene	Y	283	128	8.50E-02	1.12E-04	1.80E-02	4.30E-04	1.758E-02	8.38E-06	2.5E+00	1.283E-04	1.07E+03	2.75E-07	2.5E-07	0.0605	9.9E+00	3.04E-04	2.63E+04	3.07E-02
Nickel Soluble Salts	N	0.303	58.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	Y	74.1	178	1.21E-04	1.59E-07	1.73E-03	4.13E-05	1.690E-03	6.69E-06	4.4E+00	8.807E-05	1.35E+03	2.37E-07	9.1E-08	0.0345	3.0E+00	3.43E-05	2.96E+03	3.46E-03
Phenol	Y	249	94.1	3.50E-01	4.61E-04	1.36E-05	3.25E-07	1.328E-05	1.03E-05	1.8E+00	1.591E-04	8.74E+02	3.16E-07	2.1E-09	0.0834	7.6E+00	2.00E-06	1.73E+02	2.03E-04
Pyrene	Y	27.9	202	4.50E-06	5.92E-09	4.87E-04	1.16E-05	4.756E-04	7.25E-06	5.4E+00	7.621E-05	1.24E+03	2.50E-07	3.2E-08	0.0278	1.1E+00	4.25E-06	3.67E+02	4.29E-04
Styrene	Y	0.194	104	6.40E+00	8.42E-03	1.12E-01	2.67E-03	1.094E-01	8.78E-06	2.1E+00	1.430E-04	1.03E+03	2.84E-07	2.8E-07	0.0711	6.6E-03	2.30E-07	1.99E+01	2.32E-05
Toluene	Y	17.6	92.1	2.84E+01	3.74E-02	2.71E-01	6.47E-03	2.647E-01	9.20E-06	1.9E+00	1.519E-04	9.78E+02	2.93E-07	2.9E-07	0.0778	5.8E-01	2.11E-05	1.82E+03	2.13E-03
TPH C06-C09 aliphatic	Y	6.08	103	9.16E+01	1.21E-01	5.05E+01	1.21E+00	4.932E+01	1.00E-05	1.5E+00	1.797E-04	9.00E+02	3.10E-07	3.1E-07	0.1	1.9E-01	7.36E-06	6.36E+02	7.44E-04
TPH C10-C14 aliphatic	Y	1730	170	1.16E+00	1.53E-03	6.26E+01	1.49E+00	6.114E+01	1.00E-05	1.5E+00	1.797E-04	9.00E+02	3.10E-07	3.1E-07	0.1	5.4E+01	2.09E-03	1.81E+05	2.12E-01
TPH C10-C14 aromatic	Y	1730	136	1.16E+00	1.53E-03	1.41E-01	3.37E-03	1.377E-01	1.00E-05	1.5E+00	1.797E-04	9.00E+02	3.10E-07	3.1E-07	0.1	5.4E+01	2.07E-03	1.79E+05	2.09E-01
TPH C15-C28 aliphatic	N	1520	260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	N	1520	209	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	N	332	270	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	N	332	240	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	Y	0.92	120	2.10E+00	2.76E-03	2.52E-01	6.02E-03	2.461E-01	7.92E-06	2.5E+00	1.286E-04	1.14E+03	2.65E-07	2.6E-07	0.0607	3.3E-02	1.10E-06	9.50E+01	1.11E-04
Vanadium and compounds	N	0.0228	50.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	Y	6.7	106	7.99E+00	1.05E-02	2.12E-01	5.06E-03	2.071E-01	9.90E-06	1.8E+00	1.608E-04	9.09E+02	3.08E-07	3.0E-07	0.0847	2.1E-01	8.04E-06	6.94E+02	8.12E-04

Notes:
Assumes viscosity of air at 25 deg C
(*) Adopted density and viscosity of air values are those published in USEPA Air Emissions for Wast and Waste Water Nov 1994. (viscosity = 1.81 x 10⁻⁴, density = 1.2 x 10⁻³)
** where windspeeds are greater than 3.25 m/s, F/D ratios greater than 51.2 and diffusivity of ether is 8.5 x 10-5
Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Summary of Derived RBSLs
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

[Back to User Input Sheet](#)

Chemical	Soil RBSLs (mg/kg)						Groundwater RBSLs (mg/L)					
	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Saturation Limited?	Site Concentration	Adult Threshold	Child Threshold	Non-Threshold (Lifetime)	Adopted RBSL (Lowest)	Solubility Limited?	Site Concentration
Acenaphthene	2.17E+05	-	-	2.17E+05	>Sat	5.11E+02	4.36E+03	-	-	4.36E+03	>Sol	4.48E+00
Acenaphthylene	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia	-	-	-	-	-	-	1.77E+06	-	-	1.77E+06	>Sol	3.48E+02
Aniline	-	-	-	-	-	-	3.96E+06	-	-	3.96E+06	>Sol	2.12E-01
Anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	7.09E+04	-	-	7.09E+04	>Sat	1.51E+03	1.02E+06	-	-	1.02E+06	>Sol	4.02E+01
Benzo(a)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	3.59E+04	-	-	3.59E+04	>Sat	2.29E+03	2.80E+03	-	-	2.80E+03	-	4.36E+02
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	3.38E+06	-	-	3.38E+06	>Sat	2.77E+02	1.48E+04	-	-	1.48E+04	>Sol	1.02E+01
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	2.46E+03	-	-	2.46E+03	>Sat	2.61E+02	1.88E+04	-	-	1.88E+04	>Sol	3.02E+00
Fluoranthene	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	4.39E+03	-	-	4.39E+03	>Sat	7.65E+03	1.13E+02	-	-	1.13E+02	>Sol	1.05E+02
Naphthalene	2.44E+04	-	-	2.44E+04	>Sat	1.02E+04	4.05E+02	-	-	4.05E+02	>Sol	2.83E+02
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	8.63E+05	-	-	8.63E+05	>Sol	2.49E+02
Pyrene	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	5.18E+04	-	-	5.18E+04	>Sol	1.94E-01
Toluene	2.46E+04	-	-	2.46E+04	>Sat	2.65E+03	2.83E+05	-	-	2.83E+05	>Sol	1.76E+01
TPH C06-C09 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	-	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	-	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	1.64E+04	-	-	1.64E+04	>Sat	2.20E+02	7.42E+04	-	-	7.42E+04	>Sol	9.20E-01
Vanadium and compounds	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	6.88E+04	-	-	6.88E+04	>Sat	2.58E+03	4.08E+04	-	-	4.08E+04	>Sol	6.70E+00

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Pathways included in derivation of Soil RBSL:

Pathways included in derivation of Soil Vapour RBSL:

Pathways included in derivation of Groundwater RBSL:

Health Risk Calculations - Inhalation of Subsurface Soil-Derived Vapours in Indoor Air
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

Chemical	Soil Conc. (mg/kg)	Csat (mg/kg)	Volatilisation Factor from Subsurface Soil to Indoor Air [(mg/m3)/(mg/kg)]	Vapour Concentration in Indoor Air (From Subsurface Soil) (mg/m3)	Threshold Intake and Risk Calculations			
					Inhalation RfC (mg/m3)	Adult Exposure Factor (threshold) (kg/m3)	Adult Exposure Adjusted Air Concentration (threshold) (mg/m3)	Hazard Index (Adult) (unitless)
Acenaphthene	511	3.94E+01	2.12E-06	8.35E-05	5.04E-01	4.65E-07	1.83E-05	3.63E-05
Acenaphthylene	1700	1.63E+02	1.31E-06	2.14E-04	-	-	-	-
Ammonia	-	-	-	-	-	-	-	-
Aniline	-	-	-	-	-	-	-	-
Anthracene	2150	1.42E+00	1.97E-07	2.80E-07	-	-	-	-
Arsenic, Inorganic	-	-	NV	-	-	-	-	-
Barium	-	-	NV	-	-	-	-	-
Benz(a)anthracene	1470	3.33E+00	NV	-	-	-	-	-
Benzene	1510	6.59E+02	1.75E-03	1.16E+00	1.09E+02	3.84E-04	2.53E-01	2.33E-03
Benzo(a)pyrene	652	1.90E+00	NV	-	-	-	-	-
Benzo(b)fluoranthene	587	1.80E+00	NV	-	-	-	-	-
Benzo(g,h,i)perylene	305	1.01E+00	NV	-	-	-	-	-
Benzo(k)fluoranthene	231	9.39E-01	NV	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	NV	-	-	-	-	-
Cadmium (Water)	-	-	NV	-	-	-	-	-
Chromium(III), Insoluble Salts	210	-	NV	-	-	-	-	-
Chromium(VI)	2.3	-	NV	-	-	-	-	-
Chrysene	771	7.24E-01	NV	-	-	-	-	-
Cobalt	-	-	NV	-	-	-	-	-
Cresol, m-&p-	2290	1.44E+04	1.57E-07	3.61E-04	1.24E-03	3.45E-08	7.90E-05	6.38E-02
Cresol, o-	-	-	NV	-	-	-	-	-
Blank	-	-	NV	-	-	-	-	-
Dibenz(a,h)anthracene	71.4	9.51E+00	NV	-	-	-	-	-
Dibenzofuran	277	5.69E+01	1.35E-06	7.68E-05	1.00E+00	2.96E-07	1.68E-05	1.68E-05
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-
Ethylbenzene	261	1.67E+02	9.29E-04	1.55E-01	2.00E+00	2.04E-04	3.39E-02	1.70E-02
Fluoranthene	2440	2.89E+01	NV	-	-	-	-	-
Fluorene	2100	3.10E+01	6.09E-07	1.89E-05	-	-	-	-
Indeno(1,2,3-cd)pyrene	247	7.41E-01	NV	-	-	-	-	-
Iron	60600	-	NV	-	-	-	-	-
Lead and Compounds	13600	-	NV	-	-	-	-	-
Manganese	-	-	NV	-	-	-	-	-
Methylnaphthalene, 2-	7650	1.23E+02	1.21E-05	1.48E-03	5.81E-02	2.65E-06	3.25E-04	5.60E-03
Naphthalene	10200	9.66E+01	1.64E-05	1.59E-03	4.40E-01	3.60E-06	3.48E-04	7.91E-04
Nickel Soluble Salts	-	-	NV	-	-	-	-	-
Phenanthrene	5180	3.84E+01	1.47E-07	5.66E-06	-	-	-	-
Phenol	-	-	-	-	-	-	-	-
Pyrene	2640	1.47E+01	1.28E-08	1.87E-07	-	-	-	-
Styrene	-	-	-	-	-	-	-	-
Toluene	2650	2.91E+02	1.39E-03	4.06E-01	3.01E+01	3.06E-04	8.89E-02	2.95E-03
TPH C06-C09 aliphatic	593	2.21E+02	7.67E-03	1.70E+00	-	-	-	-
TPH C10-C14 aliphatic	69400	1.11E+02	1.60E-04	1.78E-02	-	-	-	-
TPH C10-C14 aromatic	69400	1.54E+02	6.58E-05	1.02E-02	-	-	-	-
TPH C15-C28 aliphatic	93200	7.02E+01	NV	-	-	-	-	-
TPH C15-C28 aromatic	93200	8.04E+01	NV	-	-	-	-	-
TPH C29-C36 aliphatic	20600	3.16E+00	NV	-	-	-	-	-
TPH C29-C36 aromatic	20600	1.66E+00	NV	-	-	-	-	-
Trimethylbenzene, 1,2,4-	220	7.46E+01	5.48E-04	4.09E-02	1.96E+00	1.20E-04	8.96E-03	4.56E-03
Vanadium and compounds	248	-	NV	-	-	-	-	-
Xylenes (total)	2576	8.90E+01	7.19E-05	6.40E-03	4.34E+00	1.58E-05	1.40E-03	3.23E-04

TOTAL

9.74E-02

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Health Risk Calculations - Vapours from Flowing Water
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000

Scenario 2 - Upper Basement (Residential Receptor) (Odour Based Calculations) Scenario

Chemical	Vapour Concentration in Basement/ Impoundment	Aqueous Solubility	Threshold Intake and Risk Calculations			
			Inhalation RfC	Adult Exposure Factor (threshold)	Adult Exposure Adjusted Air Concentration (threshold)	Hazard Index (Adult)
	mg/m ³	(mg/L)	(mg/m3)	(L/m3)	(mg/m3)	(unitless)
Acenaphthene	4.11E-04	3.90E+00	5.04E-01	2.19E-01	9.01E-05	1.79E-04
Acenaphthylene	3.47E-03	1.61E+01	-	2.19E-01	7.61E-04	-
Ammonia	1.61E-02	4.82E+05	1.80E+01	2.19E-01	3.53E-03	1.96E-04
Aniline	1.02E-06	3.60E+04	4.19E+00	2.19E-01	2.24E-07	5.35E-08
Anthracene	8.35E-04	4.34E-02	-	2.19E-01	1.83E-04	-
Arsenic, Inorganic	-	0.00E+00	-	-	-	-
Barium	-	0.00E+00	-	-	-	-
Benz(a)anthracene	-	9.40E-03	-	-	-	-
Benzene	4.88E-03	1.79E+03	1.09E+02	2.19E-01	1.07E-03	9.81E-06
Benzo(a)pyrene	-	1.62E-03	-	-	-	-
Benzo(b)fluoranthene	-	1.50E-03	-	-	-	-
Benzo(g,h,i)perylene	-	2.60E-04	-	-	-	-
Benzo(k)fluoranthene	-	8.00E-04	-	-	-	-
Bis(2-ethylhexyl)phalate	-	2.70E-01	-	-	-	-
Cadmium (Water)	-	0.00E+00	-	-	-	-
Chromium(III), Insoluble Salts	-	0.00E+00	-	-	-	-
Chromium(VI)	-	1.69E+06	-	-	-	-
Chrysene	-	2.00E-03	-	-	-	-
Cobalt	-	0.00E+00	-	-	-	-
Cresol, m-&p-	8.81E-04	2.27E+04	1.24E-03	2.19E-01	1.93E-04	1.56E-01
Cresol, o-	-	2.59E+04	-	-	-	-
Dibenz(a,h)anthracene	-	2.49E-03	-	-	-	-
Dibenzofuran	9.53E-04	3.10E+00	1.00E+00	2.19E-01	2.09E-04	2.09E-04
Dimethylphenol, 2,4-	8.25E-05	7.87E+03	-	2.19E-01	1.81E-05	-
Ethylbenzene	3.66E-04	1.69E+02	2.00E+00	2.19E-01	8.02E-05	4.01E-05
Fluoranthene	-	2.60E-01	-	-	-	-
Fluorene	1.54E-03	1.69E+00	-	2.19E-01	3.38E-04	-
Indeno(1,2,3-cd)pyrene	-	1.90E-04	-	-	-	-
Iron	-	0.00E+00	-	-	-	-
Lead and Compounds	-	0.00E+00	-	-	-	-
Manganese	-	0.00E+00	-	-	-	-
Methylnaphthalene, 2-	1.15E-02	2.46E+01	5.81E-02	2.19E-01	2.53E-03	4.35E-02
Naphthalene	3.07E-02	3.10E+01	4.40E-01	2.19E-01	6.74E-03	1.53E-02
Nickel Soluble Salts	-	0.00E+00	-	-	-	-
Phenanthrene	3.46E-03	1.15E+00	-	2.19E-01	7.59E-04	-
Phenol	2.03E-04	8.28E+04	1.54E-01	2.19E-01	4.44E-05	2.88E-04
Pyrene	4.29E-04	1.35E-01	-	2.19E-01	9.40E-05	-
Styrene	2.32E-05	3.10E+02	1.36E+00	2.19E-01	5.10E-06	3.75E-06
Toluene	2.13E-03	5.26E+02	3.01E+01	2.19E-01	4.68E-04	1.55E-05
TPH C06-C09 aliphatic	7.44E-04	1.18E+01	-	2.19E-01	1.63E-04	-
TPH C10-C14 aliphatic	2.12E-01	9.99E-02	-	2.19E-01	2.19E-02	-
TPH C10-C14 aromatic	2.09E-01	2.53E+01	-	2.19E-01	4.58E-02	-
TPH C15-C28 aliphatic	-	1.11E-04	-	-	-	-
TPH C15-C28 aromatic	-	1.06E+00	-	-	-	-
TPH C29-C36 aliphatic	-	2.50E-06	-	-	-	-
TPH C29-C36 aromatic	-	6.60E-03	-	-	-	-
Trimethylbenzene, 1,2,4-	1.11E-04	5.70E+01	1.96E+00	2.19E-01	2.43E-05	1.24E-05
Vanadium and compounds	-	-	-	-	-	-
Xylenes (total)	8.12E-04	1.06E+02	4.34E+00	2.19E-01	1.78E-04	4.11E-05

TOTAL

2.16E-01

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Soil RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

Chemical	Csoil	Csat	Risk at Input Soil Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity) (kg/mg)			RBSL (assumes no sat limit)	Risk at RBSL (with sat)	Vapour Only Risk at Csat (if necessary)	Adopted RBSL	Pathway Contributions to Total Estimated Risk at RBSL	
			Vapours from Subsurface Soil Indoors	TOTAL (All Pathways)	Vapours from Subsurface Soil Indoors	Total Vapour Pathways	TOTAL (All Pathways)					Vapours from Subsurface Soil Indoors	TOTAL
	mg/kg	mg/kg	unitless	unitless	kg/mg	kg/mg	kg/mg	mg/kg			mg/kg	%	%
Acenaphthene	511	3.94E+01	3.63E-05	3.63E-05	9.22E-07	9.22E-07	9.22E-07	2.17E+05	3.63E-05	3.63E-05	2.17E+05	0.00%	0.00%
Acenaphthylene	1700	1.63E+02	-	-	-	-	-	-	-	-	-	-	-
Ammonia	-	-	-	-	-	-	-	-	-	-	-	-	-
Aniline	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	2150	1.42E+00	-	-	-	-	-	-	-	-	-	-	-
Arsenic, Inorganic	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	1470	3.33E+00	-	-	-	-	-	-	-	-	-	-	-
Benzene	1510	6.59E+02	2.33E-03	2.33E-03	3.53E-06	3.53E-06	3.53E-06	7.09E+04	2.33E-03	2.33E-03	7.09E+04	0.23%	0.23%
Benzo(a)pyrene	652	1.90E+00	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	587	1.80E+00	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	305	1.01E+00	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	231	9.39E-01	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	210	-	-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	2.3	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	771	7.24E-01	-	-	-	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	2290	1.44E+04	6.38E-02	6.38E-02	2.79E-05	2.79E-05	2.79E-05	3.59E+04	4.00E-01	4.00E-01	3.59E+04	40.02%	40.02%
Cresol, o-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	71.4	9.51E+00	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	277	5.69E+01	1.68E-05	1.68E-05	2.96E-07	2.96E-07	2.96E-07	3.38E+06	1.68E-05	1.68E-05	3.38E+06	0.00%	0.00%
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	261	1.67E+02	1.70E-02	1.70E-02	1.02E-04	1.02E-04	1.02E-04	2.46E+03	1.70E-02	1.70E-02	2.46E+03	1.70%	1.70%
Fluoranthene	2440	2.89E+01	-	-	-	-	-	-	-	-	-	-	-
Fluorene	2100	3.10E+01	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	247	7.41E-01	-	-	-	-	-	-	-	-	-	-	-
Iron	60600	-	-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	13600	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	7650	1.23E+02	5.60E-03	5.60E-03	4.56E-05	4.56E-05	4.56E-05	4.39E+03	5.60E-03	5.60E-03	4.39E+03	0.56%	0.56%
Naphthalene	10200	9.66E+01	7.91E-04	7.91E-04	8.19E-06	8.19E-06	8.19E-06	2.44E+04	7.91E-04	7.91E-04	2.44E+04	0.08%	0.08%
Nickel Soluble Salts	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	5180	3.84E+01	-	-	-	-	-	-	-	-	-	-	-
Phenol	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	2640	1.47E+01	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	2650	2.91E+02	2.95E-03	2.95E-03	1.01E-05	1.01E-05	1.01E-05	2.46E+04	2.95E-03	2.95E-03	2.46E+04	0.30%	0.30%
TPH C06-C09 aliphatic	593	2.21E+02	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aliphatic	69400	1.11E+02	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aromatic	69400	1.54E+02	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aliphatic	93200	7.02E+01	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	93200	8.04E+01	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	20600	3.16E+00	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	20600	1.66E+00	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	220	7.46E+01	4.56E-03	4.56E-03	6.12E-05	6.12E-05	6.12E-05	1.64E+04	4.56E-03	4.56E-03	1.64E+04	0.46%	0.46%
Vanadium and compounds	248	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	2576	8.90E+01	3.23E-04	3.23E-04	3.63E-06	3.63E-06	3.63E-06	6.88E+04	3.23E-04	3.23E-04	6.88E+04	0.03%	0.03%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Groundwater RBSL Derivation - Adult Threshold Health Effects
Barangaroo
Wharf 8, Hickson Road (Sussex Street), Barangaroo, NSW 2000
Scenario 2 - Upper Basement (Odour Based Calculations) Scenario

Chemical	Cgw mg/L	Solubility mg/L	Risk at Input Groundwater Concentration (Hazard Index)		Risk/Soil Concentration (i.e., pathway specific factor for exposure and toxicity)			RBSL (assumes no sol limit) mg/L	Risk at RBSL (with sol)	Vapour Only Risk at Sol (if necessary)	Adopted RBSL mg/L	Pathway Contributions to Total Estimated Risk at RBSL	
			GW vapours from flowing water unitless	TOTAL (All Pathways) unitless	GW vapours from flowing water unitless	Total Vapour Pathways L/mg	TOTAL (All Pathways) L/mg					GW vapours from flowing water %	TOTAL %
Acenaphthene	4.48	3.90E+00	1.79E-04	1.79E-04	4.59E-05	4.59E-05	4.59E-05	4.36E+03	1.79E-04	1.79E-04	4.36E+03	0.1%	0.09%
Acenaphthylene	43.2	1.61E+01	-	-	-	-	-	-	-	-	-	-	-
Ammonia	348	4.82E+05	1.96E-04	1.96E-04	5.64E-07	5.64E-07	5.64E-07	1.77E+06	2.72E-01	2.72E-01	1.77E+06	27.2%	27.20%
Aniline	0.212	3.60E+04	5.35E-08	5.35E-08	2.52E-07	2.52E-07	2.52E-07	3.96E+06	9.08E-03	9.08E-03	3.96E+06	0.9%	0.91%
Anthracene	15.4	4.34E-02	-	-	-	-	-	-	-	-	-	-	-
Arsenic, Inorganic	0.024		-	-	-	-	-	-	-	-	-	-	-
Barium	2.23		-	-	-	-	-	-	-	-	-	-	-
Benz(a)anthracene	12.6	9.40E-03	-	-	-	-	-	-	-	-	-	-	-
Benzene	40.2	1.79E+03	9.81E-06	9.81E-06	2.44E-07	2.44E-07	2.44E-07	1.02E+06	4.37E-04	4.37E-04	1.02E+06	0.2%	0.17%
Benzo(a)pyrene	9.26	1.62E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	8.33	1.50E-03	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	4.22	2.60E-04	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	2.93	8.00E-04	-	-	-	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	0.03	2.70E-01	-	-	-	-	-	-	-	-	-	-	-
Cadmium (Water)	0.108		-	-	-	-	-	-	-	-	-	-	-
Chromium(III), Insoluble Salts	0.102		-	-	-	-	-	-	-	-	-	-	-
Chromium(VI)	0.102	1.69E+06	-	-	-	-	-	-	-	-	-	-	-
Chrysene	9.78	2.00E-03	-	-	-	-	-	-	-	-	-	-	-
Cobalt	0.057		-	-	-	-	-	-	-	-	-	-	-
Cresol, m-&p-	436	2.27E+04	1.56E-01	1.56E-01	3.58E-04	3.58E-04	3.58E-04	2.80E+03	1.00E+00	-	2.80E+03	100.0%	100.00%
Cresol, o-	182	2.59E+04	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	0.822	2.49E-03	-	-	-	-	-	-	-	-	-	-	-
Dibenzofuran	10.2	3.10E+00	2.09E-04	2.09E-04	6.74E-05	6.74E-05	6.74E-05	1.48E+04	2.09E-04	2.09E-04	1.48E+04	0.0%	0.02%
Dimethylphenol, 2,4-	38	7.87E+03	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	3.02	1.69E+02	4.01E-05	4.01E-05	1.33E-05	1.33E-05	1.33E-05	1.88E+04	2.24E-03	2.24E-03	1.88E+04	0.9%	0.90%
Fluoranthene	25.9	2.60E-01	-	-	-	-	-	-	-	-	-	-	-
Fluorene	21.1	1.69E+00	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	3.05	1.90E-04	-	-	-	-	-	-	-	-	-	-	-
Iron	187		-	-	-	-	-	-	-	-	-	-	-
Lead and Compounds	0.555		-	-	-	-	-	-	-	-	-	-	-
Manganese	4.89		-	-	-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	105	2.46E+01	4.35E-02	4.35E-02	1.77E-03	1.77E-03	1.77E-03	1.13E+02	4.35E-02	4.35E-02	1.13E+02	21.7%	21.74%
Naphthalene	283	3.10E+01	1.53E-02	1.53E-02	4.94E-04	4.94E-04	4.94E-04	4.05E+02	1.53E-02	1.53E-02	4.05E+02	7.7%	7.66%
Nickel Soluble Salts	0.303		-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	74.1	1.15E+00	-	-	-	-	-	-	-	-	-	-	-
Phenol	249	8.28E+04	2.88E-04	2.88E-04	1.16E-06	1.16E-06	1.16E-06	8.63E+05	9.59E-02	9.59E-02	8.63E+05	9.6%	9.59%
Pyrene	27.9	1.35E-01	-	-	-	-	-	-	-	-	-	-	-
Styrene	0.194	3.10E+02	3.75E-06	3.75E-06	1.93E-05	1.93E-05	1.93E-05	5.18E+04	5.99E-03	5.99E-03	5.18E+04	0.6%	0.60%
Toluene	17.6	5.26E+02	1.55E-05	1.55E-05	8.82E-07	8.82E-07	8.82E-07	2.83E+05	4.64E-04	4.64E-04	2.83E+05	0.2%	0.19%
TPH C06-C09 aliphatic	6.08	1.18E+01	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aliphatic	1730	9.99E-02	-	-	-	-	-	-	-	-	-	-	-
TPH C10-C14 aromatic	1730	2.53E+01	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aliphatic	1520	1.11E-04	-	-	-	-	-	-	-	-	-	-	-
TPH C15-C28 aromatic	1520	1.06E+00	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aliphatic	332	2.50E-06	-	-	-	-	-	-	-	-	-	-	-
TPH C29-C36 aromatic	332	6.60E-03	-	-	-	-	-	-	-	-	-	-	-
Trimethylbenzene, 1,2,4-	0.92	5.70E+01	1.24E-05	1.24E-05	1.35E-05	1.35E-05	1.35E-05	7.42E+04	7.68E-04	7.68E-04	7.42E+04	0.1%	0.08%
Vanadium and compounds	0.0228	-	-	-	-	-	-	-	-	-	-	-	-
Xylenes (total)	6.7	1.06E+02	4.11E-05	4.11E-05	6.13E-06	6.13E-06	6.13E-06	4.08E+04	6.50E-04	6.50E-04	4.08E+04	0.3%	0.26%

Bold denotes soil/ groundwater SSTC has been proposed for human health and/or odour (see text for details)

Appendix D

Compliance with SEPP 55 (1998) and NSW EPA (2011)

Appendix D Compliance with SEPP 55 (1998) and NSW EPA (2011)

The following summary provides an assessment of compliance with the SEPP 55 (1998) *Managing Land Contamination (Remediation of Land)* and the NSW EPA (2011) *Consultants Reporting on Contaminated Sites*:

Table 21 Assessment of Compliance with SEPP 55 (1998) and NSW EPA (2011)

Legislative Requirement	Relevant Works and RAP Section
SEPP 55 (1998)	
Can the site be appropriately remediated? Consider the RAP and any statement by the proponent's consultant certifying that remediation is practical.	Refer to Section 8.0 to Section 11.0, and Table T19.
Are the proposed clean-up criteria appropriate for the future use of the site, considering possible human health and environmental impacts?	Refer to Section 7.0.
Are the proposed plans for remediation work acceptable? For example, do they include an occupational health and safety plan, community relations plan, contingency plan?	Refer to references listed against the NSW EPA (2011) criteria below
Is a site audit of the RAP necessary?	This RAP will be submitted to the NSW EPA Accredited Site Auditor, Graeme Nyland, for approval before implementation.
NSW EPA (2011)	
<i>Environmental Summary</i> including background; objectives; scope of works; summary of sampling results; summary of conclusions and recommendations	Refer to the Executive Summary Section
<i>Scope of Work</i>	Refer to Section 1.3
<i>Site Identification</i> including a. street number, street name and suburb; b. lot and deposited plan number; co-ordinates; locality map; c. site layout plan	Refer to: a. & b. in Table 1; c. Figure F1 and F2
<i>Site History</i> including a. past, present and proposed zoning; b. past, present and proposed land-use; c. summary of council rezoning, relevant development and building approvals; d. chronological list of site uses; e. aerial photograph review; f. site photographs; g. inventory and locations of waste and chemicals; h. contaminant sources and potential off-site effects; i. site layout plans showing past and present industrial processes; j. sewer and service plans; k. manufacturing processes; l. USTs and ASTs; m. product spill and loss history; n. discharges to land, water and air; o. disposal locations; p. complaint history; q. local knowledge; r. permits, licences, approvals, trade waste agreements; s. adjacent site history; t. local literature; u. local usage of ground and surface water; v. integrity assessment;	Refer to: a. Table 1; b. Section 3.2, Table 1, Section 5.0, Section 6.1, Section 6.2; c. Section 2.2, Section 3.3; d. Section 3.2; e. Section 3.2 and 6.4.1; f. Section 3.2; g. Table 2, Section 3.2; Section 3.3, Figure F2; h. Figure F2, Section 3.2; Section 3.3, Section 5.0, Section 6.6 and Section 6.7; i. Figure F2; j. Figure F9; k. Section 3.2; l. Table 2, Section 3.2, Section 5.0, Figure F2; m. to q. N/A; r. Section 3.2.3; s. Section 3.2; t. Section 3.2; u. to v. N/A.

Legislative Requirement	Relevant Works and RAP Section
<i>Site Condition and Surrounding Environment</i> including a. topography; b. site boundary conditions; c. visible signs of contamination; d. signs of plant stress; e. drums, wastes and fill; f. odours; g. surface water quality; h. flood potential; i. sensitive local environments	Refer to: a. Section 6.3; b. to d. N/A e. Section 3.2.3 and 6.4.2; f. Section 5.0; g. Section 5.0 and 6.3; h. N/A; i. Section 6.7.
<i>Geology and Hydrogeology</i> including a. soil stratigraphy; b. location and extent of fill material; c. soil bore logs; d. monitoring wells; e. springs; f. groundwater depth; g. groundwater flow rate and direction; h. surface water run-off direction; i. background water quality; j. preferential water courses; k. meteorology	Refer to: a. Section 5.0, 6.4.1 and 6.4.2; b. Section 5.0, 6.4.2 and 7.2 c. Section 5.0; d. Section 5.0, Figure F3; e. N/A; f. Section 6.5; g. Section 5.12, 6.5 7.2 and 11.5; h. Section 6.3; i. Section 6.4.1; j. Section 6.3 and 6.5; k. N/A
<i>Basis for Assessment Criteria</i> including a. selected assessment criteria and references; b. rationale for appropriateness of the criteria; c. assumptions of limitations of criteria	Refer to: a. Table T1 and T2; b. Section 7.0 c. Section 7.0
<i>Results</i> including a. summary of previous results; b summary of results in a table that show sample numbers and sampling depths, assessment criteria and highlights results exceeding the assessment criteria; c. site plan showing sampling locations, identification numbers and depths; d; site plan showing extent of soil and groundwater contamination	Refer to: a. Section 5.0; b. Table 3, Figure F4 to Figure F5, Table T3 to T16; c. Figure F3; d. Figure F4 to Figure F8
<i>Site Characterisation</i> including a. assessment of type of contamination; b. assessment of extent of contamination including offsite; c. assessment of chemical degradation products; d. assessment of routes of exposure	Refer to: a. Section 6.6; b. Section 7.2; c. VMP HHERA (AECOM, 2012b) Section 5.16; d. Section 6.7 and VMP HHERA (AECOM, 2012b)
<i>Remedial Action Plan</i> including a. remediation goal; b. extent of remediation required; c. remedial options appraisal; d. rational for selected remedial option; e. validation testing; f. contingency plan; g. interim site management plan; h. operational management plan including stormwater, soil, noise, dust, odour and OH&S plan; i. remediation schedule; j. operation hours; k. contingency plans to respond to emergencies; l. regulatory compliance requirements; m. appropriate personnel contact details; n. community relation plans; o. stages progress reporting; p. long-term site management plan	Refer to: a. Section 7.0; b. Section 7.2; c. Section 10.0 and 11.0; d. Section 11.0; e. Section 19.0; f. Section 20; g. Section 20.5; h. Section 14.0 to 17.0, 20.0 and 21.0; i. Section 12.2; j. Section 13.4.2; k. Section 1.7, 13.1 and 20; l. Section 2.0 and this Appendix; m. Section 24.0; n. Section 22.0; o. Section 19.12; p. Section 20.5;

Legislative Requirement	Relevant Works and RAP Section
<i>Conclusions and Recommendations</i> including a. brief summary of all findings; b. assumptions in reaching conclusions; c. extent of uncertainties in the results; d. list summarising activities and physical changes to site where remedial action has been undertaken; e. suitability of site statement; f. statement of limitations and constraints of the site use; g. recommendations	Refer to a. Section 25.0

Based on the above table, AECOM concludes that this RAP has been appropriately prepared to comply with the overall aims and principles of the SEPP 55 (1998) and the NSW EPA (2011) guidelines.

Appendix E

Environmental Protection Licence 13336

Licence Variation

Licence - 13336



Office of
Environment
& Heritage

BARANGAROO DELIVERY AUTHORITY (BDA)

ABN 94 567 807 277

LEVEL 21 201 KENT STREET

SYDNEY NSW 2000

Attention:

Notice Number 1500535
File Number LIC10/940
Date 13-Dec-2011

NOTICE OF VARIATION OF LICENCE NO. 13336

BACKGROUND

- A. BARANGAROO DELIVERY AUTHORITY (BDA) ("the licensee") is the holder of Environment Protection Licence No. 13336 ("the licence") issued under the *Protection of the Environment Operations Act 1997* ("the Act"). The licence authorises the carrying out of activities at and a portion of Hickson Rd (near to 30-38 Hickson Rd), MILLERS POINT, NSW, 2000.
 - B. On 31 May 2011 the EPA received an email transmission from the licensee's contractors requesting a variation to the licence to add relevant conditions associated with the SISCO and SEPR Pilot Trials at block 5 (Works Approved by Project Approval MP10_0087).
 - C. On 31 May 2011 the EPA received an application from the licensee requesting a variation to the licence to add the category of 'scheduled development works' and relevant conditions associated with the relocation of a sewer on the premises and along Towns Place and Hickson Road.
 - D. On 16 May 2011 the EPA received an application from the licensee requesting a variation to the licence to add the Scheduled Activities of Crushing Grinding or Separating and Extractive Industries and relevant conditions associated with works at Headland Park.
 - E. The EPA has sought and considered additional information from the licensee to support its applications.
1. The EPA has considered the above applications and has decided to vary the licence by:
 - Adding a scheduled development works description at condition A1;
 - Adding new scheduled activities at condition A1;
 - Varying the premises description at A2;
 - Adding air discharge points at P1;
 - Adding concentration limits at L2;

Licence Variation



Office of
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- Varying condition L4;
- Adding Monitoring conditions at M2;
- Adding an Operating conditions at O5;
- Varying Monitoring conditions at M2 and M8; and
- Renumbering Special conditions and adding conditions at E2, E3, E4, E5, E6 and E7.

VARIATION OF LICENCE NO. 13336

2. By this notice the EPA varies licence No. 13336. The attached licence document contains all variations that are made to the licence by this notice.
3. The following variation have been made to the licence:
 -

Greg Sheehy
Manager
Metropolitan - Sydney Industry
(by Delegation)

INFORMATION ABOUT THIS NOTICE

- This notice is issued under section 58(5) of the Act.
- Details provided in this notice, along with an updated version of the licence, will be available on the EPA's Public Register (<http://www.environment.nsw.gov.au/prpoeo/index.htm>) in accordance with section 308 of the Act.

Appeals against this decision

- You can appeal to the Land and Environment Court against this decision. The deadline for lodging the appeal is 21 days after you were given notice of this decision.

When this notice begins to operate

- The variations to the licence specified in this notice begin to operate immediately from the date of this notice, unless another date is specified in this notice.
- If an appeal is made against this decision to vary the licence and the Land and Environment Court directs that the decision is stayed the decision does not operate until the stay ceases to have effect or the Land and Environment Court confirms the decision or the appeal is withdrawn (whichever occurs first).

Environment Protection Licence

Licence - 13336



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Licence Details

Number: 13336
Anniversary Date: 25-October

Licensee

BARANGAROO DELIVERY AUTHORITY (BDA)

LEVEL 21 201 KENT STREET

SYDNEY NSW 2000

Premises

BARANGAROO
AND A PORTION OF HICKSON RD (NEAR TO 30-38
HICKSON RD)
MILLERS POINT NSW 2000

Scheduled Activity

Contaminated Groundwater Treatment
Crushing, Grinding or Separating
Extractive Activities

Fee Based Activity

Contaminated groundwater treatment
Crushing, grinding or separating
Land-based extractive activity

Scale

Any handling capacity
> 100000-500000 T processed
> 100000-500000 T extracted, processed or
stored

Region

Metropolitan - Sydney Industry
Level 3, NSW Govt Offices, 84 Crown Street
WOLLONGONG NSW 2500
Phone: (02) 9995 5000
Fax: (02) 9995 6900

PO Box 513 WOLLONGONG EAST
NSW 2520

Environment Protection Licence

Licence - 13336



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INFORMATION ABOUT THIS LICENCE	4
Dictionary	4
Responsibilities of licensee	4
Duration of licence	4
Licence review	4
Fees and annual return to be sent to the EPA	4
Transfer of licence	5
Public register and access to monitoring data	5
1 ADMINISTRATIVE CONDITIONS	6
A1 What the licence authorises and regulates	6
A2 Premises or plant to which this licence applies	6
A3 Other activities	7
A4 Information supplied to the EPA	7
2 DISCHARGES TO AIR AND WATER AND APPLICATIONS TO LAND	7
P1 Location of monitoring/discharge points and areas	7
3 LIMIT CONDITIONS	9
L1 Pollution of waters	9
L2 Concentration limits	9
L3 Volume and mass limits	12
L4 Hours of operation	12
L5 Potentially offensive odour	13
4 OPERATING CONDITIONS	14
O1 Activities must be carried out in a competent manner	14
O2 Maintenance of plant and equipment	14
O3 Dust	14
O4 Waste management	14
O5 Other operating conditions	14
5 MONITORING AND RECORDING CONDITIONS	15
M1 Monitoring records	15
M2 Requirement to monitor concentration of pollutants discharged	15
M3 Testing methods - concentration limits	19
M4 Environmental monitoring	19
M5 Recording of pollution complaints	20
M6 Telephone complaints line	20
M7 Requirement to monitor volume or mass	20

Environment Protection Licence

Licence - 13336



Office of
Environment
& Heritage

M8	Other monitoring and recording conditions	21
6	REPORTING CONDITIONS	21
R1	Annual return documents	21
R2	Notification of environmental harm	22
R3	Written report	23
7	GENERAL CONDITIONS	23
G1	Copy of licence kept at the premises or plant	23
G2	Signage	23
8	SPECIAL CONDITIONS	24
E1	Site Wide Air Emissions Reporting	24
E2	Barangaroo South Water Treatment Plant	24
E3	Headland Park - Early Works	25
E4	SISCO and SEPR Trial	28
E5	Ambient Water Quality	29
E6	Completed PRPs	30
E7	Special Dictionary	30
DICTIONARY		32
	General Dictionary	32

Environment Protection Licence

Licence - 13336



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Information about this licence

Dictionary

A definition of terms used in the licence can be found in the dictionary at the end of this licence.

Responsibilities of licensee

Separate to the requirements of this licence, general obligations of licensees are set out in the Protection of the Environment Operations Act 1997 ("the Act") and the Regulations made under the Act. These include obligations to:

- ensure persons associated with you comply with this licence, as set out in section 64 of the Act;
- control the pollution of waters and the pollution of air (see for example sections 120 - 132 of the Act); and
- report incidents causing or threatening material environmental harm to the environment, as set out in Part 5.7 of the Act.

Variation of licence conditions

The licence holder can apply to vary the conditions of this licence. An application form for this purpose is available from the EPA.

The EPA may also vary the conditions of the licence at any time by written notice without an application being made.

Where a licence has been granted in relation to development which was assessed under the Environmental Planning and Assessment Act 1979 in accordance with the procedures applying to integrated development, the EPA may not impose conditions which are inconsistent with the development consent conditions until the licence is first reviewed under Part 3.6 of the Act.

Duration of licence

This licence will remain in force until the licence is surrendered by the licence holder or until it is suspended or revoked by the EPA or the Minister. A licence may only be surrendered with the written approval of the EPA.

Licence review

The Act requires that the EPA review your licence at least every 5 years after the issue of the licence, as set out in Part 3.6 and Schedule 5 of the Act. You will receive advance notice of the licence review.

Fees and annual return to be sent to the EPA

For each licence fee period you must pay:

- an administrative fee; and
- a load-based fee (if applicable).

Environment Protection Licence

Licence - 13336



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The EPA publication "A Guide to Licensing" contains information about how to calculate your licence fees. The licence requires that an Annual Return, comprising a Statement of Compliance and a summary of any monitoring required by the licence (including the recording of complaints), be submitted to the EPA. The Annual Return must be submitted within 60 days after the end of each reporting period. See condition R1 regarding the Annual Return reporting requirements.

Usually the licence fee period is the same as the reporting period.

Transfer of licence

The licence holder can apply to transfer the licence to another person. An application form for this purpose is available from the EPA.

Public register and access to monitoring data

Part 9.5 of the Act requires the EPA to keep a public register of details and decisions of the EPA in relation to, for example:

- licence applications;
- licence conditions and variations;
- statements of compliance;
- load based licensing information; and
- load reduction agreements.

Under s320 of the Act application can be made to the EPA for access to monitoring data which has been submitted to the EPA by licensees.

This licence is issued to:

BARANGAROO DELIVERY AUTHORITY (BDA)

LEVEL 21 201 KENT STREET

SYDNEY NSW 2000

subject to the conditions which follow.

Environment Protection Licence

Licence - 13336



Office of
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1 Administrative Conditions

A1 What the licence authorises and regulates

A1.1 This licence authorises the carrying out of the scheduled development work listed below at the premises listed in A2:

Preparation for scheduled activities, other activities; and.

A1.2 This licence authorises the carrying out of the scheduled activities listed below at the premises specified in A2. The activities are listed according to their scheduled activity classification, fee-based activity classification and the scale of the operation.

Unless otherwise further restricted by a condition of this licence, the scale at which the activity is carried out must not exceed the maximum scale specified in this condition.

Scheduled Activity	Fee Based Activity	Scale
Contaminated Groundwater Treatment	Contaminated groundwater treatment	Any handling capacity
Crushing, Grinding or Separating	Crushing, grinding or separating	> 100000 - 500000 T processed
Extractive Activities	Land-based extractive activity	> 100000 - 500000 T extracted, processed or stored

A1.3 The licensee must not carry on any scheduled activities until the scheduled development works are completed, except as elsewhere provided in this licence.

A1.4 To further clarify condition A1.1 above, "other activities" means preparation for the scheduled activities to be undertaken at the premises once planning permission is granted, namely:

Preparation for Chemical storage;

Preparation for Contaminated soil treatment;

Preparation for Sewage Treatment Systems (relocation of sewer).

Other activities also means the activities associated with the SISCO and SEPR Pilot Trials.

Activities permitted by Project Approval including those approved by:

1. MP10_0023 (Bulk Excavation and Basement Car Park);

2. MP10_0025 (Commercial Building C4)

3. MP10_0047 (Headland Park Early Works); and

3. MP10_0087 (SISCO and SEPR Pilot Trials).

A2 Premises or plant to which this licence applies

A2.1 The licence applies to the following premises:

Premises Details

BARANGAROO

AND A PORTION OF HICKSON RD (NEAR TO 30-38 HICKSON RD)

MILLERS POINT

Environment Protection Licence

Licence - 13336



Office of
Environment
& Heritage

NSW 2000

LOT 1 DP 876514, LOT 3 DP 876514, LOT 4 DP 876514, LOT 5 DP 876514,
LOT 6 DP 876514

BARANGAROO SOUTH, CENTRAL AND HEADLAND PARK AND
NORTHERN COVE INCLUDING STP 162 [HICKSON ROAD DECLARATION
AREA 3221] BEING THE PART OF HICKSON ROAD ADJACENT TO
NUMBERS: 30-34 HICKSON ROAD (LOT 11 IN DP 1065410); 36 HICKSON
ROAD (BEING LOT 6 IN DP 873158 AND LOT 12 IN DP 1065410); AND 38
HICKSON ROAD (SP72797) MILLERS POINT. THE PREMISES ALSO
INCLUDES THE WORK AREA AT TOWNS PLACE AND HICKSON ROAD AS
SHADED AND LABELLED AS "AREA OF SEWER WORKS" IN MAP TITLED
"BARANGAROO ENVIRONMENT PROTECTION LICENCE VARIATION 003
FIGURE 2.1" SUBMITTED WITH LICENCE VARIATION APPLICATION
DATED 31 MAY 2011.

A3 Other activities

A3.1 This licence applies to all other activities carried on at the premises, including:

Ancillary Activity

SISCO and SEPR Pilot Trials

A4 Information supplied to the EPA

A4.1 Works and activities must be carried out in accordance with the proposal contained in the licence application, except as expressly provided by a condition of this licence.

In this condition the reference to "the licence application" includes a reference to:

- a) the applications for any licences (including former pollution control approvals) which this licence replaces under the Protection of the Environment Operations (Savings and Transitional) Regulation 1998; and
- b) the licence information form provided by the licensee to the EPA to assist the EPA in connection with the issuing of this licence.

2 Discharges to Air and Water and Applications to Land

P1 Location of monitoring/discharge points and areas

P1.1 The following points referred to in the table below are identified in this licence for the purposes of monitoring and/or the setting of limits for the emission of pollutants to the air from the point.

Air			
EPA identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description

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Licence - 13336



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5	Ambient air monitoring		Location 1 as depicted on Figure 5.6, page 28 of the report supporting LVA supplied to the EPA on 10 Dec 2010.
8	Ambient air monitoring		Location 4 as depicted on Figure 5.6, page 28 of the report supporting LVA supplied to the EPA on 10 Dec 2010.
13	Ambient air monitoring		Location 9 as depicted on Figure 5.6, page 28 of the report supporting LVA supplied to the EPA on 10 Dec 2010.
14	Discharge to air - Air quality monitoring	Discharge to air - Air quality monitoring	Stack serving the MPE/SVE System titled SVE 1 as depicted in drawing titled "Block 5 and Hickson Road Pilot Trial - Block 5 System Set-up area" supplied to the EPA on 31 May 2011.
15	Discharge to air - Air quality monitoring	Discharge to air - Air quality monitoring	Stack serving the MPE/SVE System titled SVE 2 as depicted in drawing titled "Block 5 and Hickson Road Pilot Trial - Block 5 System Set-up area" supplied to the EPA on 31 May 2011.
16	Discharge to air - Air quality monitoring	Discharge to air - Air quality monitoring	Stack serving the MPE/SVE System titled SVE 3 as depicted in drawing titled "Block 5 and Hickson Road Pilot Trial - Block 5 System Set-up area" supplied to the EPA on 31 May 2011.
17	Discharge to air - Air quality monitoring.	Discharge to air - Air quality monitoring.	Vent serving the air strippers on the Wastewater Treatment Plant as depicted on drawing No EN-10 in the document titled Air Quality Impact Assessment: Water Treatment Plant supplied to the EPA on 28 July 2011.
18	Discharge to air - Air quality monitoring	Discharge to air - Air quality monitoring	Vent serving the displacement tank on the Wastewater Treatment Plant as depicted on drawing No EN-10 in the document titled Air Quality Impact Assessment: Water Treatment Plant supplied to the EPA on 28 July 2011.

P1.2 The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.

P1.3 The following utilisation areas referred to in the table below are identified in this licence for the purposes of the monitoring and/or the setting of limits for any application of solids or liquids to the utilisation area.

Water and land

EPA Identification no.	Type of Monitoring Point	Type of Discharge Point	Location Description
1	Discharge to waters Water quality monitoring	Discharge to waters Water quality monitoring	Discharge pipe installed through existing slab as described in document titled Barangaroo South S.1 Bulk Exc & Basement Carpark EPL variation Appl. 10 Dec 2010.
2	Ambient water quality monitoring North Near Field Turbidity Monitoring		Site NF1 as generally described in Fig 5.3 in LVA supporting information supplied to the EPA on 10 Dec 2010. Final location to be agreed in writing by the EPA.

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Licence - 13336



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3	Ambient water quality monitoring South Near Field Turbidity Monitoring	Site NF2 as generally described in Fig 5.3 in LVA supporting information supplied to the EPA on 10 Dec 2010. Final location to be agreed in writing by the EPA.
4	Ambient water quality monitoring Reference Turbidity Monitoring Point	Site BG1 as described in Fig 5.3 in LVA supporting information supplied to the EPA on 10 Dec 2010.

3 Limit Conditions

L1 Pollution of waters

L1.1 Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the Protection of the Environment Operations Act 1997.

L2. Concentration limits

L2.1 For each monitoring/discharge point or utilisation area specified in the table\>s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.

L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges.

L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table\>s.

L2.4 Air Concentration Limits

POINT 14,15,16

Pollutant	Units of measure	100 percentile concentration limit	Reference conditions	Oxygen correction	Averaging period
volatile organic compounds as n-propane equivalent	milligrams per cubic metre	20	Dry, 273K 101.3kPa		

POINT 17,18

Pollutant	Units of measure	100 percentile concentration limit	Reference conditions	Oxygen correction	Averaging period
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Licence - 13336



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volatile organic compounds as n-propane equivalent	milligrams per cubic metre	20	Dry, 273K 101.3kPa
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L2.5 Water and/or Land Concentration Limits

POINT 1

Pollutant	Units of Measure	50 percentile concentration limit	90 percentile concentration limit	3DGM concentration limit	100 percentile concentration limit
Acenaphthene	micrograms per litre				2
Acenaphthylene	micrograms per litre				2
Ammonia	micrograms per litre				910
Anthracene	micrograms per litre				2
Arsenic	micrograms per litre				2.3
Benzene	micrograms per litre				500
Benzo(a)anthracene	micrograms per litre				2
Benzo(a)pyrene	micrograms per litre				2
Benzo(b)fluoranthene	micrograms per litre				2
Benzo(k)fluoranthene	micrograms per litre				2
Benzo[ghi]perylene	micrograms per litre				2
Cadmium	micrograms per litre				0.7
Chromium (trivalent)	micrograms per litre				27
Chromium (VI) Compounds	micrograms per litre				4.4

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Licence - 13336



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Chrysene	micrograms per litre	2
Copper	micrograms per litre	1.3
Cyanide	micrograms per litre	4
Dibenz[a,h]anthracene	micrograms per litre	2
Ethyl benzene	micrograms per litre	80
Fluoranthene	micrograms per litre	2
Fluorene	micrograms per litre	2
Indeno(1,2,3-cd)pyrene	micrograms per litre	2
Lead	micrograms per litre	4.4
m+p-Xylene	micrograms per litre	75
Mercury	micrograms per litre	0.1
Naphthalene	micrograms per litre	50
Nickel	micrograms per litre	7
Oil and Grease	milligrams per litre	10
o-Xylene	micrograms per litre	350
pH	pH	6.5-8.5
Phenanthrene	micrograms per litre	2
Phenol	micrograms per litre	400
Pyrene	micrograms per litre	2
Toluene	micrograms per litre	180

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Licence - 13336



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Total Petroleum Hydrocarbons C10-C14 Fraction	micrograms per litre	50
Total Petroleum Hydrocarbons C15-C28 Fraction	micrograms per litre	100
Total Petroleum Hydrocarbons C29-C36 Fraction	micrograms per litre	50
Total Petroleum Hydrocarbons C6-C9 Fraction	micrograms per litre	20
TSS	milligrams per litre	50
Zinc	micrograms per litre	15

L3 Volume and mass limits

- L3.1 For each discharge point or utilisation area specified below (by a point number), the volume/mass of:
- a) liquids discharged to water; or;
 - b) solids or liquids applied to the area;
- must not exceed the volume/mass limit specified for that discharge point or area.

Point	Unit of Measure	Volume/Mass Limit
1	kilolitres per day	6480

L4 Hours of operation

L4.1

Bulk Excavation and Basement Car Park

For the purposes of construction permitted by project Approval MP10_0023, work at the premises must be conducted between 7am and 6pm Monday to Friday and between 7am and 5pm Saturdays and at no time on Sundays and public holidays, unless inaudible at any residential premises.

Building C4

For the purposes of construction permitted by project Approval MP10_0025, work at the premises

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Licence - 13336



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must be conducted between 7am and 7pm Monday to Friday and between 7am and 5pm Saturdays and at no time on Sundays and public holidays, unless inaudible at any residential premises.

SISCO and SEPR Trial

For the purposes of construction permitted by project Approval MP10_0087, work at the premises must be conducted between 7am and 7pm Monday to Friday and between 7am and 6pm Saturdays and at no time on Sundays and public holidays, unless inaudible at any residential premises.

Works outside these hours are not permitted except as explicitly specified below or in other conditions and include:

- (a) the delivery of materials which is required outside these hours as requested by Police or other authorities for safety reasons;
- (b) emergency work to avoid the loss of lives, damage to property and/or to prevent environmental harm; or
- (c) Approved out of standard hours works identified in a CNVMP.

Headland Park Early Works

For the purposes of works and activities permitted by project Approval MP10_0047, work at the premises must be conducted between 7am and 6pm Monday to Friday and between 8am and 3pm Saturdays and at no time on Sundays and public holidays, unless inaudible at any residential premises.

Works outside these hours are not permitted except as explicitly specified below or in other conditions and include:

- (a) the delivery of materials which is required outside these hours as requested by Police or other authorities for safety reasons;
- (b) emergency work to avoid the loss of lives, damage to property and/or to prevent environmental harm; or
- (c) Approved out of standard hours works identified in a CNVMP.

L5 · Potentially offensive odour

Note: Section 129 of the Protection of the Environment Operations Act 1997, provides that the licensee must not cause or permit the emission of any offensive odour from the premises but provides a defence if the emission is identified in the relevant environment protection licence as a potentially offensive odour and the odour was emitted in accordance with the conditions of a licence directed at minimising odour.

- L5.1 The licensee must not cause or permit the emission of offensive odour beyond the boundary of the premises.

4 Operating Conditions

Environment Protection Licence

Licence - 13336



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O1 Activities must be carried out in a competent manner

O1.1 Licensed activities must be carried out in a competent manner.

This includes:

- a) the processing, handling, movement and storage of materials and substances used to carry out the activity; and
- b) the treatment, storage, processing, reprocessing, transport and disposal of waste generated by the activity.

O2 Maintenance of plant and equipment

O2.1 All plant and equipment installed at the premises or used in connection with the licensed activity:

- a) must be maintained in a proper and efficient condition; and
- b) must be operated in a proper and efficient manner.

O3 Dust

O3.1 All activities on the site must be undertaken with the objective of preventing visible emissions of dust beyond the boundary of the premises. Should such visible dust emissions occur at any time, the licensee must identify and implement all practicable dust mitigation measures, including cessation of relevant works, as appropriate, such that emissions of visible dust cease.

O4 Waste management

O4.1 The licensee must not cause, permit or allow any waste generated:

- a) Outside the premises to be received at the premises; and
 - b) On-site to be disposed of outside of the premises except as permitted by c) and d) below.
- c) The licensee must assess, classify and manage any waste generated at the premises in accordance with the Waste Classification Guidelines 2009 prior to transporting the waste off site.
- d) If waste is transported from the premises, the licensee must ensure that the waste is transported by a waste transporter authorised to transport such waste and is transported to a place that can lawfully accept that waste.

O5 Other operating conditions

O5.1 Sewer Relocation

For the purposes of the sheduled development works described as "Preparation for Sewage Treatment Systems" as authorised in condition A1, the licensee must not undertake any sewer relocation works within the Declared Area being the area defined by Declaration Number 21122 untill written permission from the EPA is sought and granted.

O5.2 SISCO and SEPR Trial

This condition relates to discharge points 14, 15 and 16. The stacks must be installed and maintained at a height of not less than 2 metres above ground level. When operating the

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Licence - 13336



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minimum stack discharge velocity must be maintained at 15m/s.

O5.3 Water Treatment Plant

The discharge point height of stacks at Points 17 and 18 must be maintained at least 2.77 m above ground level.

By 16 December 2011 the licensee must provide a report to the EPA which demonstrates the air impacts under the actual discharge velocities for points 17 & 18 will not result in any exceedence of the EPA's assessment criteria.

5 Monitoring and Recording Conditions

M1 Monitoring records

- M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.
- M1.2 All records required to be kept by this licence must be:
- a) in a legible form, or in a form that can readily be reduced to a legible form;
 - b) kept for at least 4 years after the monitoring or event to which they relate took place; and
 - c) produced in a legible form to any authorised officer of the EPA who asks to see them.
- M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence:
- a) the date(s) on which the sample was taken;
 - b) the time(s) at which the sample was collected;
 - c) the point at which the sample was taken; and
 - d) the name of the person who collected the sample.

M2 Requirement to monitor concentration of pollutants discharged

- M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:

M2.2 Air Monitoring Requirements

POINT 13,8,5

Pollutant	Units of measure	Frequency	Sampling Method
Lead	micrograms per cubic metre	Special Frequency 3	Other Approved Method 1
Metallic Compounds	micrograms per cubic metre	Special Frequency 3	AM-15
PM10	micrograms per cubic metre	Continuous	AM-22

Environment Protection Licence

Licence - 13336



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Polycyclic aromatic hydrocarbons	milligrams per cubic metre	Special Frequency 3	AM-15
Total Solid Particles	micrograms per cubic metre	Special Frequency 3	AM-15
Volatile organic compounds	milligrams per cubic metre	Continuous	Special Method 1

POINT 14,15,16

Pollutant	Units of measure	Frequency	Sampling Method
volatile organic compounds as n-propane equivalent	milligrams per cubic metre	Continuous	CEM-9
Volumetric flowrate	normalised cubic metres per second	Continuous during discharge	No method specified

POINT 17,18

Pollutant	Units of measure	Frequency	Sampling Method
Dry gas density	kilograms per cubic metre	Special Frequency 6	TM-23
Oxygen (O2)	percent	Special Frequency 6	TM-25
Temperature	degrees Celsius	Special Frequency 6	TM-2

POINT 17

Pollutant	Units of measure	Frequency	Sampling Method
volatile organic compounds as n-propane equivalent	milligrams per cubic metre	Special Frequency 5	Method approved in writing by the Authority

POINT 17,18

Pollutant	Units of measure	Frequency	Sampling Method
Volumetric flowrate	cubic metres per second	Special Frequency 6	TM-2

POINT 18

Pollutant	Units of measure	Frequency	Sampling Method
volatile organic compounds as n-propane equivalent	milligrams per cubic metre	Special Frequency 6	Method approved in writing by the Authority

M2.3 Water and/ or Land Monitoring Requirements

Environment Protection Licence

Licence - 13336



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POINT 1

Pollutant	Units of measure	Frequency	Sampling Method
Acenaphthene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Acenaphthylene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Ammonia	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Anthracene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Arsenic	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo(a)anthracene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo(a)pyrene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo(b)fluoranthene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo(k)fluoranthene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Benzo[ghi]perylene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Cadmium	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Chromium (trivalent)	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Chromium (VI)	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Compounds	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Chrysene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Conductivity	millisiemens per centimetre	Special Frequency 1	Method approved in writing by the Authority
Copper	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Cyanide	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Dibenz[a,h]anthracene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Dissolved Oxygen	milligrams per litre	Special Frequency 1	Method approved in writing by the Authority
Ethyl benzene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Fluoranthene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Fluorene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Indeno(1,2,3-cd)pyrene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Lead	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority

Environment Protection Licence

Licence - 13336



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m+p-Xylene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Mercury	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Naphthalene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Nickel	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Oil and Grease	milligrams per litre	Special Frequency 1	Method approved in writing by the Authority
o-Xylene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
PCBs	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
pH	pH	Special Frequency 1	Method approved in writing by the Authority
Phenanthrene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Phenol	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Pyrene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Toluene	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total Petroleum Hydrocarbons C10-C14 Fraction	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total Petroleum Hydrocarbons C15-C28 Fraction	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total Petroleum Hydrocarbons C29-C36 Fraction	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total Petroleum Hydrocarbons C6-C9 Fraction	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority
Total suspended solids	milligrams per litre	Special Frequency 1	Method approved in writing by the Authority
Turbidity	nephelometric turbidity units	Special Frequency 1	Method approved in writing by the Authority
Zinc	micrograms per litre	Special Frequency 1	Method approved in writing by the Authority

POINT 2

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	millisiemens per centimetre	Special Frequency 2	Method approved in writing by the Authority
pH	pH	Special Frequency 2	Method approved in writing by the Authority
Temperature	degrees Celsius	Special Frequency 2	Method approved in writing by the Authority
Turbidity	nephelometric turbidity units	Special Frequency 2	Method approved in writing by the Authority

Environment Protection Licence

Licence - 13336



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POINT 3

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	millisiemens per centimetre	Special Frequency 2	Method approved in writing by the Authority
pH	pH	Special Frequency 2	Method approved in writing by the Authority
Temperature	degrees Celsius	Special Frequency 2	Method approved in writing by the Authority
Turbidity	nephelometric turbidity units	Special Frequency 2	Method approved in writing by the Authority

POINT 4

Pollutant	Units of measure	Frequency	Sampling Method
Conductivity	millisiemens per centimetre	Special Frequency 2	Method approved in writing by the Authority
pH	pH	Special Frequency 2	Method approved in writing by the Authority
Temperature	degrees Celsius	Special Frequency 2	Method approved in writing by the Authority
Turbidity	nephelometric turbidity units	Special Frequency 2	Method approved in writing by the Authority

M3 Testing methods - concentration limits

M3.1 Monitoring for the concentration of a pollutant emitted to the air required to be conducted by this licence must be done in accordance with:

- any methodology which is required by or under the Act to be used for the testing of the concentration of the pollutant; or
- if no such requirement is imposed by or under the Act, any methodology which a condition of this licence requires to be used for that testing; or
- if no such requirement is imposed by or under the Act or by a condition of this licence, any methodology approved in writing by the EPA for the purposes of that testing prior to the testing taking place.

M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.

Note: The *Protection of the Environment Operations (Clean Air) Regulation 2010* requires testing for certain purposes to be conducted in accordance with test methods contained in the publication "Approved Methods for the Sampling and Analysis of Air Pollutants in NSW".

M4 Environmental monitoring

Environment Protection Licence

Licence - 13336



- M4.1 All noise and vibration monitoring must be done in accordance with the relevant Construction Noise and Vibration Management Plan unless otherwise required in writing by the EPA.

M5 Recording of pollution complaints

- M5.1 The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.
- M5.2 The record must include details of the following:
- a) the date and time of the complaint;
 - b) the method by which the complaint was made;
 - c) any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect;
 - d) the nature of the complaint;
 - e) the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and
 - f) if no action was taken by the licensee, the reasons why no action was taken.
- M5.3 The record of a complaint must be kept for at least 4 years after the complaint was made.
- M5.4 The record must be produced to any authorised officer of the EPA who asks to see them.

M6 Telephone complaints line

- M6.1 The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.
- M6.2 The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.
- M6.3 The preceding two conditions do not apply until 3 months after:
- a) the date of the issue of this licence or
 - b) if this licence is a replacement licence within the meaning of the Protection of the Environment Operations (Savings and Transitional) Regulation 1998, the date on which a copy of the licence was served on the licensee under clause 10 of that regulation.

M7 Requirement to monitor volume or mass

- M7.1 For each discharge point or utilisation area specified below, the licensee must monitor:
- a) the volume of liquids discharged to water or applied to the area;
 - b) the mass of solids applied to the area;
 - c) the mass of pollutants emitted to the air;
- at the frequency and using the method and units of measure, specified below.

Environment Protection Licence

Licence - 13336



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POINT 1

Frequency	Unit of Measure	Sampling Method
Daily	kilolitres per day	No method specified

M8 Other monitoring and recording conditions

M8.1 For the purposes of the tables above:

Discharges to Waters - Water Quality Monitoring - WTP (point 1)

Special Frequency 1 means: Once daily for the first fourteen days then weekly.

Ambient Water Quality - Water Quality Monitoring - (points 2, 3 and 4)

Special Frequency 2 means: Every 15 Minutes.

Ambient Air Quality - (points 5, 8 and 13)

Special Frequency 3 means: 24 Hours every 6 days;

In relation to VOC monitoring - Special Method 1 means: As per table 5.7 in Licence Variation

Application dated 10 Dec 2010; and

In relation to Lead monitoring - Other Approved Method 1 means: Either AM-11 or an alternative method to AM-11 for interim use that has been approved in writing by EPA.

Discharges to Air - WTP air emission monitoring (point 17 - stripper)

Other method approved in writing by the Authority means: Stack Test as interim and then CEMS as described in the document titled "*Air Quality and Odour Management Sub-Plan - Document No: PLAN-EN-04- Revision D*".

Special Frequency 5 means: as agreed to in writing by EPA.

Discharges to Air - WTP air emission monitoring (point 18 - displacement tank)

Other method approved in writing by the Authority means: As described in the document titled "*Air Quality and Odour Management Sub-Plan - Document No: PLAN-EN-04- Revision D*".

Special Frequency 6 means: as agreed to in writing by EPA.

6 Reporting Conditions

R1 Annual return documents

R1.1 The licensee must complete and supply to the EPA an Annual Return in the approved form comprising:

- a) a Statement of Compliance; and
- b) a Monitoring and Complaints Summary.

At the end of each reporting period, the EPA will provide to the licensee a copy of the form that must be completed and returned to the EPA.

R1.2 An Annual Return must be prepared in respect of each reporting period, except as provided

Environment Protection Licence

Licence - 13336



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below.

- R1.3 Where this licence is transferred from the licensee to a new licensee:
- a) the transferring licensee must prepare an Annual Return for the period commencing on the first day of the reporting period and ending on the date the application for the transfer of the licence to the new licensee is granted; and
 - b) the new licensee must prepare an Annual Return for the period commencing on the date the application for the transfer of the licence is granted and ending on the last day of the reporting period.
- R1.4 Where this licence is surrendered by the licensee or revoked by the EPA or Minister, the licensee must prepare an Annual Return in respect of the period commencing on the first day of the reporting period and ending on:
- a) in relation to the surrender of a licence - the date when notice in writing of approval of the surrender is given; or
 - b) in relation to the revocation of the licence - the date from which notice revoking the licence operates.
- R1.5 The Annual Return for the reporting period must be supplied to the EPA by registered post not later than 60 days after the end of each reporting period or in the case of a transferring licence not later than 60 days after the date the transfer was granted (the 'due date').
- R1.6 The licensee must retain a copy of the Annual Return supplied to the EPA for a period of at least 4 years after the Annual Return was due to be supplied to the EPA.
- R1.7 Within the Annual Return, the Statement of Compliance must be certified and the Monitoring and Complaints Summary must be signed by:
- a) the licence holder; or
 - b) by a person approved in writing by the EPA to sign on behalf of the licence holder.
- R1.8 A person who has been given written approval to certify a certificate of compliance under a licence issued under the Pollution Control Act 1970 is taken to be approved for the purpose of this condition until the date of first review of this licence.

Note: The term "reporting period" is defined in the dictionary at the end of this licence. Do not complete the Annual Return until after the end of the reporting period.

Note: An application to transfer a licence must be made in the approved form for this purpose.

R2 Notification of environmental harm

- R2.1 Notifications must be made by telephoning the Environment Line service on 131 555.
- R2.2 The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred.

Note: The licensee or its employees must notify the EPA of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.

Environment Protection Licence

Licence - 13336



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R3 Written report

- R3.1 Where an authorised officer of the EPA suspects on reasonable grounds that:
- a) where this licence applies to premises, an event has occurred at the premises; or
 - b) where this licence applies to vehicles or mobile plant, an event has occurred in connection with the carrying out of the activities authorised by this licence,
- and the event has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies), the authorised officer may request a written report of the event.
- R3.2 The licensee must make all reasonable inquiries in relation to the event and supply the report to the EPA within such time as may be specified in the request.
- R3.3 The request may require a report which includes any or all of the following information:
- a) the cause, time and duration of the event;
 - b) the type, volume and concentration of every pollutant discharged as a result of the event;
 - c) the name, address and business hours telephone number of employees or agents of the licensee, or a specified class of them, who witnessed the event;
 - d) the name, address and business hours telephone number of every other person (of whom the licensee is aware) who witnessed the event, unless the licensee has been unable to obtain that information after making reasonable effort;
 - e) action taken by the licensee in relation to the event, including any follow-up contact with any complainants;
 - f) details of any measure taken or proposed to be taken to prevent or mitigate against a recurrence of such an event; and
 - g) any other relevant matters.
- R3.4 The EPA may make a written request for further details in relation to any of the above matters if it is not satisfied with the report provided by the licensee. The licensee must provide such further details to the EPA within the time specified in the request.

7 General Conditions

G1 Copy of licence kept at the premises or plant

- G1.1 A copy of this licence must be kept at the premises to which the licence applies.
- G1.2 The licence must be produced to any authorised officer of the EPA who asks to see it.
- G1.3 The licence must be available for inspection by any employee or agent of the licensee working at the premises.

G2 Signage

- G2.1 Each monitoring and discharge point must be clearly marked by a sign that indicates the EPA point identification number.

Environment Protection Licence

Licence - 13336



Office of
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8 Special Conditions

E1 Site Wide Air Emissions Reporting

- E1.1 30 days after commencement of works and monthly thereafter unless otherwise agreed in writing by the EPA, the licensee must submit to the Manager Sydney Industry, Environment Protection Authority, PO Box 668 Parramatta NSW 2124, a monthly air emissions monitoring report. The report must review all air monitoring data collected in compliance with the conditions of this licence and any Air Quality Management Plan and provide an interpretation of those results and any relevant site management responses.

E2 Barangaroo South Water Treatment Plant

E2.1 WTP Performance Report

Commencing one month from the first day of operations of the WTP and monthly thereafter or unless otherwise agreed in writing by the EPA, the licensee must submit to the Manager Sydney Industry, Environment Protection Authority, PO Box 668 Parramatta NSW 2124, a monthly WTP Performance Report. The report must review and compare the performance of the WTP against the requirements of this EPL, including Discharge Point 1 concentration limits, discharge volumes, recycled water quantities and quality as well as ambient monitoring results. The report must outline the circumstances which will trigger additional monitoring arrangements and include details about incidents and responses. The report must include the results of the visual inspections of water quality controls including silt curtains and any remedial action undertaken to ensure compliance with licence conditions including O1 and O2.

E2.2 WTP Commissioning Report

Within 60 days from the date of commissioning of the Water Treatment Plant (WTP) the licensee must submit to the Manager Sydney Industry, Environment Protection Authority, PO Box 668 Parramatta NSW 2124, a WTP commissioning report ("the report"). The report must include but not be limited to details about plant performance when treating a representative range of influents encountered during the initial stage of the works, namely, establishment works and installation of the perimeter retaining wall. The report must be updated ("the updated report") as works progress and as other influents are encountered at the site and directed to the WTP for treatment (for example contaminated groundwater, clean storm-water/surface water; contaminated storm-water/surface water; stockpile leachate etc). The updated report must be made available to an Authorised EPA officer on request.

E2.3 Air Quality Management Plan

The licensee must develop and implement an air quality management plan (AQMP) including an air quality monitoring program and VOC breakthrough action plan that will ensure WTP emissions will be controlled by best practice techniques and not cause any adverse environmental or health impact.

The AQMP must be submitted for OEH's review prior to WTP commissioning.