

16 December 2014

Commercial-in-Confidence

Mark Burns  
Environment Manager  
Barangaroo South | Lend Lease  
30 The Bond, 30 Hickson Road, Millers Point, NSW

Dear Mark

**Addendum to VMP Remediation Extent report (AECOM, 2013a), Barangaroo, Hickson Road, Millers Point, NSW**

## 1.0 Introduction

AECOM Australia Pty Limited (AECOM) was commissioned by Lend Lease (Millers Point) Pty Ltd (Lend Lease) to prepare the *VMP Remediation Extent, VMP Remediation Works Area, (Parts of Barangaroo and Hickson Road), Millers Point, NSW*. 23 July 2013 (hereafter referred to as the *VMP Remediation Extent* report, [AECOM, 2013a]). The *Remedial Action Plan (RAP), NSW EPA Declared Remediation Site 21122 and Block 4 (Stage 1b) Development Works, Barangaroo, Millers Point, NSW*. 24 July 2013 (hereafter referred to as the *VMP / Block 4 RAP* [AECOM, 2013b]) is based, in part, on the *VMP Remediation Extent* (AECOM, 2013a) report.

The key objective of the *VMP Remediation Extent* report (AECOM, 2013a) is to determine the extent of remediation that will enable the NSW EPA Declaration to be revoked. The NSW EPA Declaration Area (also known as the "Voluntary Management Proposal" [VMP] Remediation Works Area") ("the Site") comprises (refer to **Figure 1, Attachment 1** taken from the Figure 15 of the *VMP Remediation Extent* report [AECOM, 2013a]):

- a section of Hickson Road;
- part of Barangaroo Block 4 (within Barangaroo South); and
- part of Barangaroo Block 5 (within Barangaroo Central).

This Addendum to the *VMP Remediation Extent* report (AECOM, 2013a) updates some of the estimated remediation volumes that were referenced by the original document. The volumes, which were presented for the purpose of demonstrating the reduction in contaminant mass that would be realised from the proposed remediation extent, did not include the volume of material contained in the two hotspots in Block 5 that were otherwise included as part of the remediation extent.

### 1.1 Objectives

The purpose of this letter is to:

- a) update the remediation volumes estimated by the *VMP Remediation Extent Report* (AECOM, 2013) for the purpose of determining the recommended extent of remediation; and
- b) demonstrate that the updated volumes do not impact on the conclusions of either the *VMP Remediation Extent* report (AECOM, 2013a) or the *VMP/Block 4 RAP* (AECOM, 2013b).

As described by Section 6.4 of the *VMP Remediation Extent* report (AECOM, 2013a), remediation volumes were estimated for the purpose of calculating the reduction in contaminant mass that would be realised by the proposed extent of remediation. The estimated contaminant mass reduction was one of several lines of evidence presented by the *VMP Remediation Extent* report (AECOM, 2013a) to demonstrate that proposed extent of remediation would be protective of the environment to the extent practicable.

## 1.2 Zone 1 to 4 Areas

For the purposes of calculating estimated contaminant mass at the Site and in offsite areas to the west of the Site, the following Zone 1 to 4 definitions were adopted in the *VMP Remediation Extent* report (AECOM, 2013a) (as illustrated in the attached **Figure 1, Attachment 1**):

- **Zone 1 (human health remediation extent)** – includes all soil analytical results from the materials across Block 4 and Block 5 and Hickson Road (within the Site) that are within the extent of remediation for the protection of human health (including off Site locations BH70 and MW541D);
- **Zone 2 (western Declaration Area)** – includes all soil analytical results from the materials across Block 4 and Block 5 and Hickson Road (within the Site) outside Zone 1 - that is, generally west of the extent of remediation for the protection of human health;
- **Zone 3 (off Site within 20m of the Declaration Area)** - includes all soil analytical results from the materials located off Site, within the corridor 20 m west of the western Site boundary (i.e. down hydraulic gradient of the Site within the ORWN and Barangaroo Central areas); and
- **Zone 4 (off Site beyond 20m of the Declaration Area)** – includes all soil analytical results from the materials located off Site, beyond or west of the corridor 20m west of the western Site boundary (i.e. down hydraulic gradient of the Site within the ORWN and Barangaroo Central areas).

## 2.0 Scope of Work

The scope described by this letter is:

- update of the 'Zone 1' remediation volumes estimated by the *VMP Remediation Extent* report (AECOM, 2013a) for Block 5. Zone 1 is defined as the extent of remediation required to 'ensure the remediated Site is protective of human health in the context of its current form and land use';
- update of the Zone 1 contaminant mass estimates for Block 5, which are based on the estimated remediation volumes; and
- assess whether the updated Block 5 Zone 1 contaminant mass estimates have an impact on the conclusions of the *VMP Remediation Extent* report (AECOM, 2013a) and *VMP/Block 4 RAP* (AECOM, 2013b).

## 3.0 Updated Block 5 Zone 1 Estimated Remediation Volumes and Contaminant Mass Calculations

### 3.1 Zone 1 Estimated Remediation Volumes

As illustrated in **Figure 1**, the extent of remediation for the protection of human health included two hot spot locations located offsite (directly to the west of the Block 5 portion of the Site). The updated estimated remediation volume for the Block 5 portion of Zone 1 is calculated to be 27,800 m<sup>3</sup>. This updated volume affects Table 12 to 16 and Table F1 to F4 (Appendix F) of the *VMP Remediation Extent* report (AECOM, 2013a). The updated tables are provided as **Attachment 2**.

### 3.2 Zone 1 Contaminant Mass Calculations

The contaminant mass calculations presented in Table 12 to 16 and Table F1 to F4 (Appendix F) of the *VMP Remediation Extent* report (AECOM, 2013a) have been updated to reflect the updated estimated remediation volume from **Section 3.1**. The amended tables are provided in **Attachment 2**.

Comparison of the updated contaminant mass calculations presented in **Attachment 1** to those presented in the *VMP Remediation Extent* report (AECOM, 2013a), indicate that the updated estimated Zone 1 Block 5 remediation volume results in:

- a negligible change (between 0% for naphthalene and 0.1% for Total Petroleum Hydrocarbon [TPH] C<sub>10</sub>-C<sub>36</sub>) in the estimated Zone 1 contaminant mass, based on pre-remediation conditions, as a percentage of the total estimated contaminant mass (refer to Table 14, **Attachment 2**);
- a negligible increase (0.2% for TPH C<sub>10</sub>-C<sub>36</sub> and naphthalene) in the estimated Zone 1 contaminant mass that will remain on Site following remediation, as a percentage of the total estimated post-remediation contaminant mass (refer to Table 15, **Attachment 2**);
- a negligible increase (between 0% for TPH C<sub>10</sub>-C<sub>36</sub> or 0.1% for naphthalene) in the estimated contaminant mass reduction within the Zone 1 to 4 fill material and marine sediments) that will be realised by the proposed remediation extent (refer to Table 16, **Attachment 2**); and

- a negligible increase (0.1% for TPH C<sub>10</sub>-C<sub>36</sub> and naphthalene) in the estimated contaminant mass reduction within the Zone 1 to 4 fill materials (only) that will be realised by the proposed remediation extent (refer to Table 16, **Attachment 2**).

In summary, the updated estimated Zone 1 Block 5 remediation volume and resultant contaminant mass calculations indicate that the contaminant mass reduction achieved by the proposed VMP Remediation Works will be greater than currently indicated in the *VMP Remediation Extent* report (AECOM, 2013a).

#### 4.0 Conclusions

Based on the information presented herein, AECOM considers that the updated estimated Zone 1 Block 5 remediation volume does not:

- have a significant impact on the contaminant mass calculations currently presented in the *VMP Remediation Extent* report (AECOM, 2013a);
- affect the conclusions of the *VMP Remediation Extent* report (AECOM, 2013a); and
- affect the conclusions of the *VMP/Block 4 RAP* (AECOM, 2013b).

#### 5.0 References

AECOM Australia, 2013a. *VMP Remediation Extent, VMP Remediation Works Area, (Parts of Barangaroo and Hickson Road), Millers Point, NSW*. 23 July 2013

AECOM Australia, 2013b. *Remedial Action Plan, NSW EPA Declared Remediation Site 21122 and Block 4 (Stage 1b) Development Works, Barangaroo, Millers Point, NSW*. 24 July 2013

Kind regards



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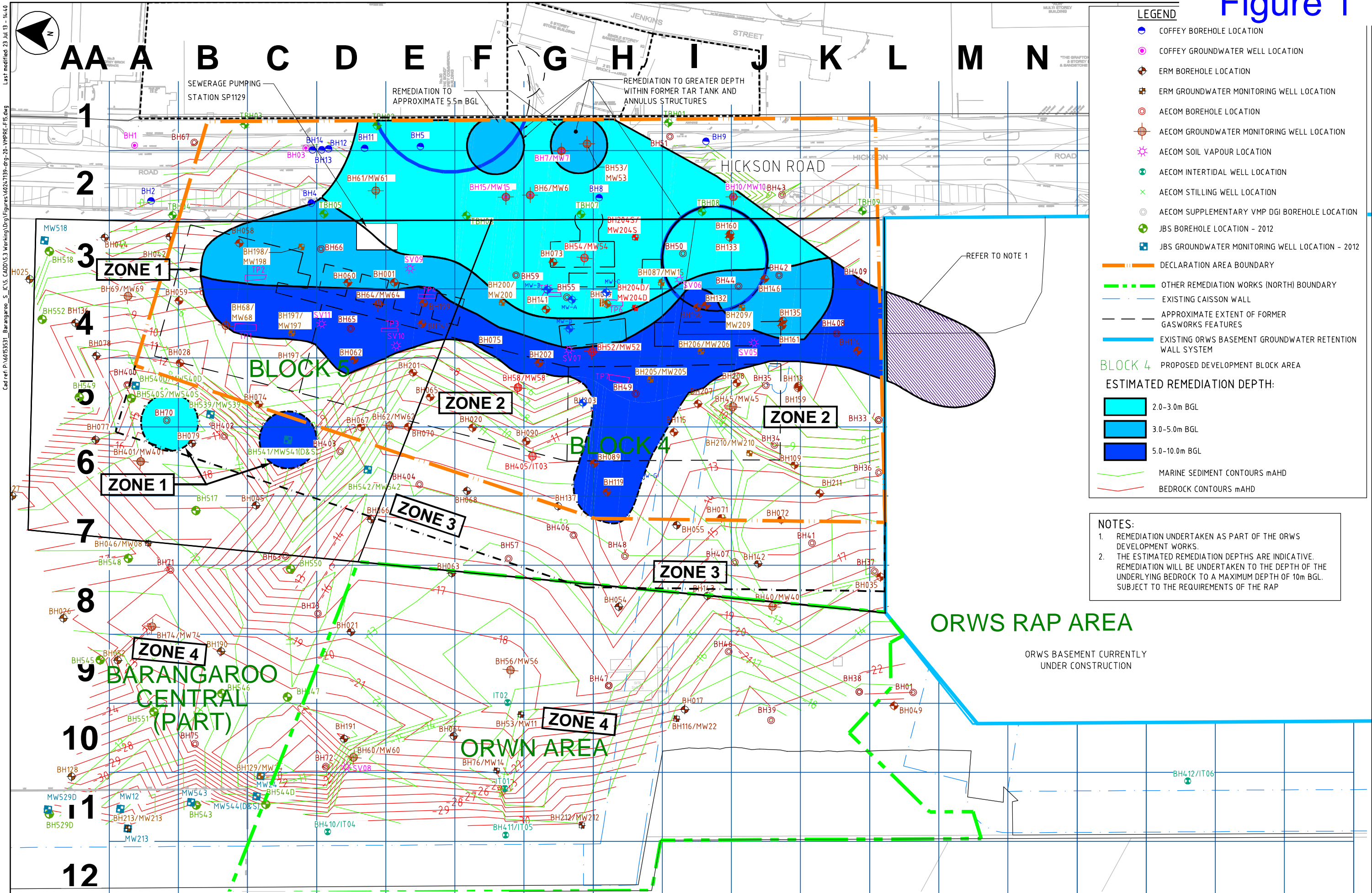
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encl: Attachment 1 - Figure 1 (from VMP Remediation Extent report [AECOM, 2013a])  
Attachment 2 - Table 12-16 and Table F1-F4 (from the VMP Remediation Extent report (AECOM, 2013a))

**Attachment 1: Site Figure**

# Figure 1



**LEGEND**

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- ✱ AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- ✱ AECOM STILLING WELL LOCATION
- AECOM SUPPLEMENTARY VMP DGI BOREHOLE LOCATION
- JBS BOREHOLE LOCATION - 2012
- JBS GROUNDWATER MONITORING WELL LOCATION - 2012

DECLARATION AREA BOUNDARY  
 OTHER REMEDIATION WORKS (NORTH) BOUNDARY  
 EXISTING CAISSON WALL  
 APPROXIMATE EXTENT OF FORMER GASWORKS FEATURES  
 EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM  
BLOCK 4 PROPOSED DEVELOPMENT BLOCK AREA

**ESTIMATED REMEDIATION DEPTH:**

- 2.0-3.0m BGL
- 3.0-5.0m BGL
- 5.0-10.0m BGL

— MARINE SEDIMENT CONTOURS mAHD  
— BEDROCK CONTOURS mAHD

**NOTES:**

- REMEDATION UNDERTAKEN AS PART OF THE ORWS DEVELOPMENT WORKS.
- THE ESTIMATED REMEDIATION DEPTHS ARE INDICATIVE. REMEDIATION WILL BE UNDERTAKEN TO THE DEPTH OF THE UNDERLYING BEDROCK TO A MAXIMUM DEPTH OF 10m BGL. SUBJECT TO THE REQUIREMENTS OF THE RAP

This drawing is confidential and shall only be used for the purposes of this project.

REVISIONS	No.	BY	DATE	DESCRIPTION	APPD
	04	PAS	23.07.13	FINAL ISSUE	AR
	04	PAS	20.06.13	DRAFT ISSUE	AR
	02	PAS	12.03.13	DRAFT ISSUE	AR
	01	PAS	06.03.13	DRAFT ISSUE	DM

**SCALES:**

1:1000

5 0 5 10 15m

A3

THE SIGNING OF THIS TITLE BLOCK CONFIRMS THE DESIGN AND DRAFTING OF THIS PROJECT HAVE BEEN PREPARED AND CHECKED IN ACCORDANCE WITH THE AECOM QUALITY ASSURANCE SYSTEM TO ISO 9001-2000

DESIGNED	KM	CHECKED	AR
DRAWN	TR	CHECKED	PAS
APPROVED	AR	DATE	23.07.13

CONTRACTOR:

DESIGNER:

**AECOM**

AECOM Australia Pty Ltd A.B.N. 20 093 846 925

CLIENT:

**VMP REMEDIATION EXTENT, BARANGAROO**

FIGURE F15:  
EXTENT OF REMEDIATION (SATURATED)

STATUS: FINAL

DRAWING NO: 60247139-DRG-20-VMPRE-F15

REV: 04

REVISIONS

04 PAS 23.07.13 FINAL ISSUE AR

04 PAS 20.06.13 DRAFT ISSUE AR

02 PAS 12.03.13 DRAFT ISSUE AR

01 PAS 06.03.13 DRAFT ISSUE DM

**Attachment 2: Amended Tables 12 to 16 and Table F1 to F4  
(Appendix F) from the *VMP Remediation Extent*  
report (AECOM, 2013a)**

Table 12 Zone 1 to 4 Material Volume Estimates (m<sup>3</sup>)

Area	Upper Fill Material	Lower Fill Material	Marine Sediments
Zone 1 (total):	82,000	86,600	-
- Block 4	(43,000)		-
- Block 5	<del>(23,200)</del>	(27,800)	-
- Hickson Road		(15,800)	-
Zone 2	51,600	11,200	10,100
Zone 3	53,900	8,800	10,000
Zone 4	309,900	50,400	99,400

NOTE: 99,000 – denotes amended volume estimate

Table 13 Zone 1 and 2 Estimated Mass Balance Calculations (Current Site Conditions)

CoPC	Zone 1 (Current Conditions)		Zone 2 (Current Conditions)	
	Average (mg/kg)	Contaminant Mass (kg)	Average (mg/kg)	Contaminant Mass (kg)
Acenaphthene	26	4,264	0.33	41
Acenaphthylene	145	23,780	0.83	104
Anthracene	109	17,876	0.99	124
Fluorene	127	20,828	0.52	65
<b>Naphthalene<sup>1</sup></b>	<b>801</b>	<b><del>131,364</del> 138,733</b>	<b>0.82</b>	<b>103</b>
Phenanthrene	357	58,548	2.6	327
<b>TPH C10 - C14<sup>1</sup></b>	<b>3,163</b>	<b><del>518,732</del> 547,831</b>	<b>27</b>	<b>3,391</b>
TPH C6 - C9	327	53,628	3.4	427
Total Xylene	87	14,268	0.37	46
Benzene	66	10,824	0.1	13
Ethylbenzene	11	1,804	0.19	24
Toluene	81	13,284	0.19	24

NOTE: 99,000 – denotes amended volume estimate

Naphthalene and TPH C<sub>10</sub>-C<sub>14</sub> average concentrations for Zone 1 are based on the analytical data across the entire Zone 1 fill material (i.e. individual averages have not been calculated for Block 4, Block 5 and Hickson Road). This has been undertaken to facilitate comparison of the Zone 1 average concentration to the Zone 2 average concentrations for the purpose of identifying key gasworks related CoPC. It is noted that the average concentrations adopted for Zone 1 in the following **Table 14** (overpage) are based on the individual data sets for those parts of Block 4, Block 5 and Hickson Road that fall within Zone 1.

Table 14 Zone 1 to 4 Current Contaminant Mass Calculations (refer to attached Table F3)

Zone Area	CoPC	Ave conc (mg/kg)	Estimated volume (m <sup>3</sup> )	Total contaminant mass (kg)	% of Total mass (Zone 1 to 4)
<b>Zone 1 - Onsite within Remediation Area</b>					
Block 4	Naphthalene	809	43,000	69,574	53.5%
	TPH C <sub>10</sub> - C <sub>14</sub>	2,621	43,000	225,406	42.6%
Block 5	Naphthalene	64	<del>23,200</del> 27,800	<del>2,970</del> 3,558	<del>2.3%</del> 2.7%
	TPH C <sub>10</sub> - C <sub>14</sub>	262	<del>23,200</del> 27,800	<del>42,157</del> 14,567	<del>2.3%</del> 2.7%
Hickson Road	Naphthalene	1,190	15,800	37,604	28.9%
	TPH C <sub>10</sub> - C <sub>14</sub>	5,956	15,800	188,210	35.6%
<b>Zone 1 total</b>	<b>Naphthalene</b>	-	<del>82,000</del> 86,600	<del>110,148</del> 110,736	<b>84.8%</b>
	<b>TPH C<sub>10</sub> - C<sub>14</sub></b>	-	<del>82,000</del> 86,600	<del>425,772</del> 428,183	<b>80.5% 80.6%</b>
<b>Zone 2 - Onsite within upper fill outside Remediation Area</b>					
	Naphthalene	0.8	51,600	83	0.1%
	TPH C <sub>10</sub> - C <sub>14</sub>	26	51,600	2,683	0.5%
<b>Zone 2 – Onsite within lower fill outside Remediation Area</b>					
	Naphthalene	9.3	11,200	208	0.2%
	TPH C <sub>10</sub> - C <sub>14</sub>	79	11,200	1,770	0.3%
<b>Zone 2 - Onsite within marine sediments outside Remediation Area</b>					
	Naphthalene	120	10,120	2,429	1.9%
	TPH C <sub>10</sub> - C <sub>14</sub>	394	10,120	7,975	1.5%
<b>Zone 3 - Off Site upper fill within 20m of Declaration Area</b>					
	Naphthalene	5.5	53,920	593	0.5%
	TPH C <sub>10</sub> - C <sub>14</sub>	61	53,920	6,578	1.2%
<b>Zone 3 - Off Site lower fill within 20m of Declaration Area</b>					
	Naphthalene	41	8,800	722	0.6%
	TPH C <sub>10</sub> - C <sub>14</sub>	38	8,800	669	0.1%
<b>Zone 3 - Off Site marine sediments within 20m of Declaration Area</b>					
	Naphthalene	474	9,960	9,442	7.3%
	TPH C <sub>10</sub> - C <sub>14</sub>	2,502	9,960	49,840	9.4%
<b>Zone 4 - Off Site upper fill outside 20m of Declaration Area</b>					
	Naphthalene	1.2	309,920	744	0.6%
	TPH C <sub>10</sub> - C <sub>14</sub>	30	309,920	18,595	3.5%
<b>Zone 4 - Off Site lower fill outside 20m of Declaration Area</b>					
	Naphthalene	22	50,400	2,218	1.7%
	TPH C <sub>10</sub> - C <sub>14</sub>	25	50,400	2,520	0.5%
<b>Zone 4 - Off Site marine sediments outside 20m of Declaration Area</b>					
	Naphthalene	17.0	99,400	3,380	2.6%
	TPH C <sub>10</sub> - C <sub>14</sub>	64.0	99,400	12,723	2.4%

NOTE: 99,000 – denotes amended volume estimate

Table 15 Zone 1 and 4 Estimated Mass Balance Calculations (Post-Remediation) (refer to attached Table F4)

Zone Area	CoPC	Ave conc (mg/kg)	Estimated volume (m <sup>3</sup> )	Total contaminant mass (kg)	% of Residual Mass (post remediation) (Zone 1 to 4)
<b>Zone 1 - Onsite within Remediation Area</b>					
Block 4	Naphthalene	-	-	-	-
	TPH C <sub>10</sub> - C <sub>14</sub>	-	-	-	-
Block 5	Naphthalene	6.4	<del>23,200</del> 27,800	<del>297</del> 356	<del>4.2%</del> 1.5%
	TPH C <sub>10</sub> - C <sub>14</sub>	26.2	<del>23,200</del> 27,800	<del>4,216</del> 1,457	<del>4.0%</del> 1.2%
Hickson Road	Naphthalene	119.0	15,800	3,760	15.8%
	TPH C <sub>10</sub> - C <sub>14</sub>	595.6	15,800	18,821	15.3%
<b>Zone 1 total</b>	<b>Naphthalene</b>	-	<del>39,000</del> 43,600	<del>4,057</del> 4,116	<del>47.0%</del> 17.2%
	<b>TPH C<sub>10</sub> - C<sub>14</sub></b>	-	<del>39,000</del> 43,600	<del>20,037</del> 20,278	<del>46.2%</del> 16.4%
<b>Zone 2 - Onsite within upper fill outside Remediation Area</b>					
	Naphthalene	0.8	51,600	83	0.3%
	TPH C <sub>10</sub> - C <sub>14</sub>	26	51,600	2,683	2.2%
<b>Zone 2 – Onsite within lower fill outside Remediation Area</b>					
	Naphthalene	9.3	11,200	208	0.9%
	TPH C <sub>10</sub> - C <sub>14</sub>	79	11,200	1,770	1.4%
<b>Zone 2 - Onsite within marine sediments outside Remediation Area</b>					
	Naphthalene	120	10,120	2,429	<del>40.2%</del> 10.1%
	TPH C <sub>10</sub> - C <sub>14</sub>	394	10,120	7,975	6.5%
<b>Zone 3 - Off Site upper fill within 20m of Declaration Area</b>					
	Naphthalene	5.5	53,920	593	2.5%
	TPH C <sub>10</sub> - C <sub>14</sub>	61	53,920	6,578	5.3%
<b>Zone 3 - Off Site lower fill within 20m of Declaration Area</b>					
	Naphthalene	41	8,800	722	3.0%
	TPH C <sub>10</sub> - C <sub>14</sub>	38	8,800	669	0.5%
<b>Zone 3 - Off Site marine sediments within 20m of Declaration Area</b>					
	Naphthalene	474	9,960	9,442	39.5%
	TPH C <sub>10</sub> - C <sub>14</sub>	2,502	9,960	49,840	<del>40.4%</del> 40.3%
<b>Zone 4 - Off Site upper fill outside 20m of Declaration Area</b>					
	Naphthalene	1.2	309,920	744	3.1%
	TPH C <sub>10</sub> - C <sub>14</sub>	30	309,920	18,595	<del>45.1%</del> 15.0%
<b>Zone 4 - Off Site lower fill outside 20m of Declaration Area</b>					
	Naphthalene	22	50,400	2,218	9.3%
	TPH C <sub>10</sub> - C <sub>14</sub>	25	50,400	2,520	2.0%
<b>Zone 4 - Off Site marine sediments outside 20m of Declaration Area</b>					
	Naphthalene	17.0	99,400	3,380	<del>44.2%</del> 14.1%
	TPH C <sub>10</sub> - C <sub>14</sub>	64.0	99,400	12,723	10.3%

NOTE: 99,000 – denotes amended volume estimate

Table 16 Zone 1 to 4 - Comparison of Estimated Current and Post-Remediation Contaminant Masses (Zone 1 to 4)

	Zone 1 to 4 (Current Conditions)	Zone 1 to 4 (Post Remediation)	
CoPC	Estimated Contaminant Mass (kg)	Estimated Contaminant Mass (kg)	Zone 1 to 4 % contaminant reduction
<b>Within fill material and marine sediments</b>			
Naphthalene	429,965 130,554	23,875 23,934	81.6% 81.7%
TPH C10 - C14	529,125 531,535	123,389 123,630	76.7%
<b>Within fill material only</b>			
Naphthalene	414,715 115,303	8,666 8,683	92.4% 92.5%
TPH C10 - C14	458,587 460,998	53,044 53,093	88.4% 88.5%

NOTE: 99,000 – denotes amended volume estimate