Last modified: 11 Jul 13 - 13:38

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HICKSON ROAD

BLOCK 5

BLOCK 4

BARANGAROO CENTRAL (PART)

ORWN AREA

ORWS RAP AREA

ORWS BASEMENT CURRENTLY UNDER CONSTRUCTION

BH001_1	1/05/2006
CPAH (TEF)	67.0

BH64_1-1.2	1/03/2010
CPAH (TEF)	108.0

BH200_1	7/04/2008
CPAH (TEF)	166.0

BH073_1.5-1.95	2/05/2006
CPAH (TEF)	140.1

BH54_1-1.4	23/02/2010
CPAH (TEF)	842.6

BH204S_1	18/03/2008
CPAH (TEF)	119.4

BH087_1.5-1.95	8/06/2006
CPAH (TEF)	114.5

BH55_1-1.2	25/02/2010
CPAH (TEF)	372.1

BH145_0.3-0.5	1/05/2006
CPAH (TEF)	110.0

BH204D_1.5	7/04/2008
TPH C10-C14	54200.0
TPH C15-C28	72400.0
CPAH (TEF)	921.6

LEGEND

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- AECOM STILLING WELL LOCATION
- DECLARATION AREA BOUNDARY
- OTHER REMEDIATION WORKS (NORTH) BOUNDARY
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- BLOCK 4 AND 5 BOUNDARIES
- EXISTING CAISSON WALL

NOTE:

LOCATION OF COFFEY GROUNDWATER WELLS ARE APPROXIMATE ONLY.

TPH C10-C14 EXCEEDS SITE SPECIFIC CRITERIA

TPH C15-C28 EXCEEDS SITE SPECIFIC CRITERIA

CPAHs EXCEEDS SITE SPECIFIC CRITERIA

REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
04	PAS	11.07.13	FINAL DRAFT ISSUE	AR
03	PAS	20.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

SCALES:

10 0 10 20 30 40m

1 : 1000 FULL SIZE A3

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APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER:

AECOM

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

CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F7:
VMP REMEDIATION WORKS -
UNSATURATED SOILS SSTC^{VMP} EXCEEDANCES

STATUS: FINAL DRAFT

DRAWING NO: 60247139-DRG-20-RAPC-F7

REV: 04

Last modified: 11 Jul 13 - 13:37

Cad ref: P:\60153531_Barangaroo_S_ICIS_CADD\5.3 Working\Drg\Figures\60247139-drg-20-RAPC-F8.dwg

30-34 HICKSON ROAD
LOT 2 DP 873158

36 HICKSON ROAD
LOT 3 DP 873158

38 HICKSON ROAD
LOT 3 DP 873158

HICKSON ROAD

BLOCK 5

BLOCK 4

BARANGAROO CENTRAL (PART)

ORWN AREA

ORWS RAP AREA

ORWS BASEMENT CURRENTLY UNDER CONSTRUCTION

MW7/BH7	26/03/2008
TPH C10-C14	830000
Benzene	25200
Ammonia as N	294
Naphthalene	4800

MW15/BH15	1/05/2008
TPH C10-C14	494000
TPH C15-C28	754000
Naphthalene	192000
Benzene	40200
CPAH (TEF)	11162

MW10/BH10	26/03/2008
CPAH (TEF)	1054.69
TPH C10-C14	528000
Benzene	5450
Ammonia as N	348
Naphthalene	15800

MW204S/BH204S	25/02/2011
Naphthalene	8580

MW15/BH087A	15/03/2010
TPH C10-C14	41000
Benzene	13100
Naphthalene	7800

MW54/BH54	19/03/2012
TPH C10-C14	28000
Naphthalene	8640

MW69/BH69	19/03/2010
Naphthalene	1920

MW206/BH206	19/03/2010
TPH C10-C14	68000
Benzene	5450
Naphthalene	10600

MW200/BH200	28/02/2011
TPH C10-C14	47400
Benzene	17900
Naphthalene	5450

IT03D/BH405	25/02/2011
Naphthalene	2560

MW205/BH205	17/03/2010
CPAH (TEF)	11556
Naphthalene	283000
TPH C10-C14	1730000
TPH C15-C28	1520000
TPH C29-C36	332000

MW541D	25/05/2012
Benzene	4300
Naphthalene	1900

MW60/BH60	18/03/2010
TPH C10-C14	18500
Naphthalene	1500

LEGEND

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- AECOM STILLING WELL LOCATION
- JBS BOREHOLE LOCATION - 2012
- JBS GROUNDWATER MONITORING WELL LOCATION - 2012
- DECLARATION AREA BOUNDARY
- OTHER REMEDIATION WORKS (NORTH) BOUNDARY
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- BLOCK 4 AND 5 BOUNDARIES
- EXISTING CAISSON WALL

BLOCK 4 PROPOSED DEVELOPMENT BLOCK AREA

NOTE:
LOCATION OF COFFEY GROUNDWATER WELLS ARE APPROXIMATE ONLY.

BENZENE EXCEEDS SITE SPECIFIC CRITERIA
NAPHTHALENE EXCEEDS SITE SPECIFIC CRITERIA
AMMONIA AS N EXCEEDS SITE SPECIFIC CRITERIA
TPH C_{10}-C_{14} EXCEEDS SITE SPECIFIC CRITERIA
TPH C_{29}-C_{36} EXCEEDS SITE SPECIFIC CRITERIA
TPH C_{15}-C_{28} EXCEEDS SITE SPECIFIC CRITERIA
CPAHs EXCEEDS SITE SPECIFIC CRITERIA

No.	BY	DATE	DESCRIPTION	APPD
04	PAS	11.07.13	FINAL DRAFT ISSUE	AR
03	PAS	20.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

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SCALES: 5 0 5 10 15m — 1:1000 A3

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APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER: AECOM

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

CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F8:
VMP REMEDIATION WORKS -
GROUNDWATER SSTC VMP EXCEEDANCES

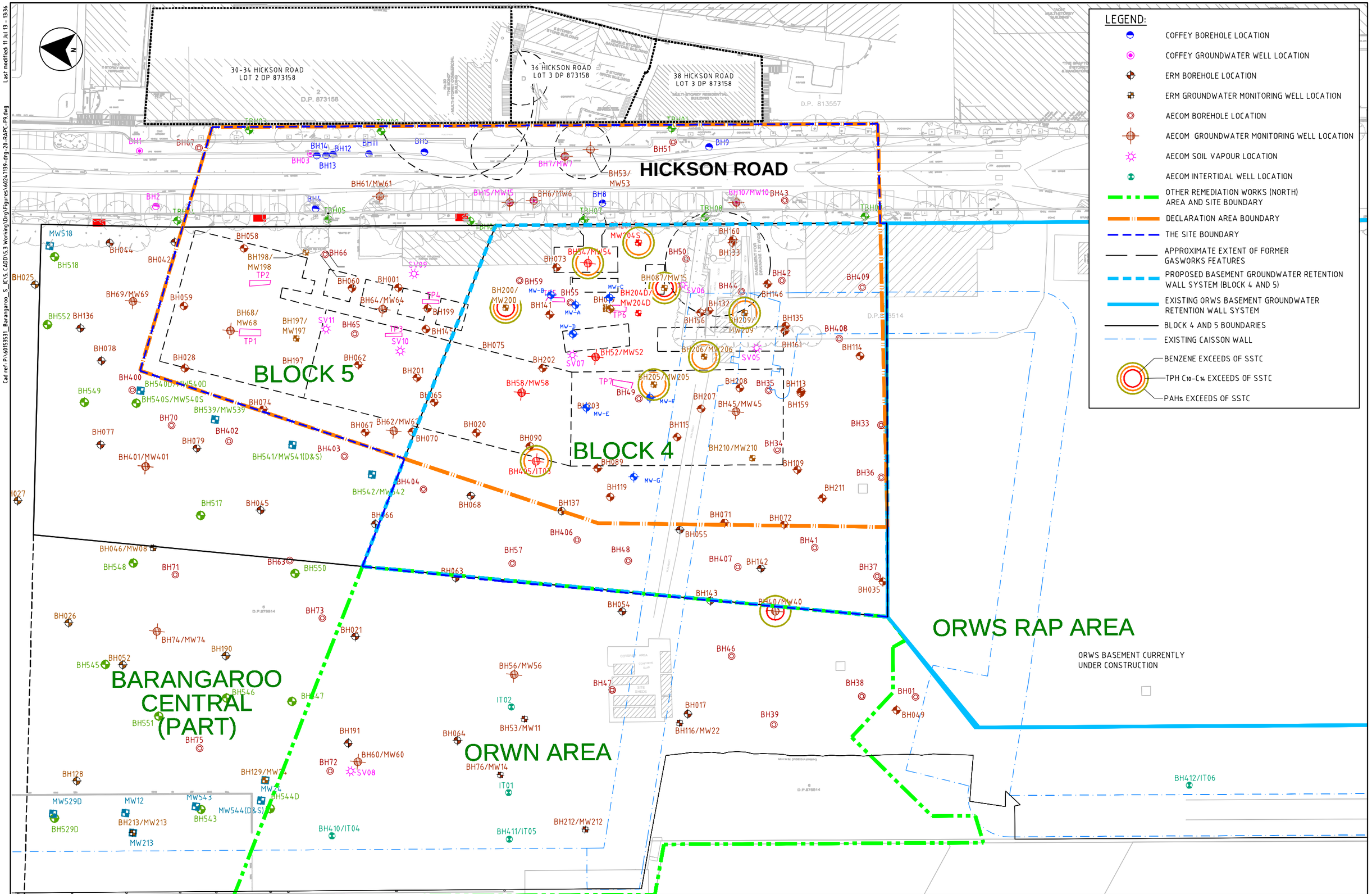
STATUS: FINAL DRAFT

DRAWING NO: 60247139-DRG-20-RAPC-F8

REV: 04

Last modified: 11 Jul 13 - 13:36

Cad ref: P:\60153531_Barangaroo_S_ICLS_CADD\5.3 Working\Drg\Figures\60247139-drg-20-RAPC-F9.dwg



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

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No.	BY	DATE	DESCRIPTION	APPD
04	PAS	11.07.13	FINAL DRAFT ISSUE	AR
03	PAS	20.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

SCALES:

5000 0 5000 10000 15000mm

1 : 500 FULL SIZE A1

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DRAWN	TT	CHECKED	JA
APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER:

AECOM

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

CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F9:
BLOCK 4 DEVELOPMENT REMEDIATION WORKS
GROUNDWATER SSTC DEV EXCEEDANCES

STATUS:	DRAWING NO:	REV:
FINAL DRAFT	60247139-DRG-20-RAPC-F9	04

Last modified: 11 Jul 13 - 13:42

Cad ref: P:\60153531_Barangaroo_S_(CIS_CADD\S3 Working\Drg\Figures\60247139-drg-28-RAPC-F10.dwg

30-34 HICKSON ROAD
LOT 2 DP 873158

36 HICKSON ROAD
LOT 3 DP 873158

38 HICKSON ROAD
LOT 3 DP 873158

SEWERAGE PUMPING STATION SP1129 (TO BE RETAINED)

HICKSON ROAD

BLOCK 5

BLOCK 4

BARANGAROO CENTRAL (PART)

ORWN AREA

ORWS RAP AREA

ORWS BASEMENT CURRENTLY UNDER CONSTRUCTION

LEGEND

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- AECOM STILLING WELL LOCATION
- DECLARATION AREA BOUNDARY
- THE SITE BOUNDARY
- OTHER REMEDIATION WORKS (NORTH) BOUNDARY
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- BLOCK 4 AND 5 BOUNDARIES
- EXISTING CAISSON WALL
- BLOCK 4 PROPOSED DEVELOPMENT BLOCK AREA
- ESTIMATED REMEDIATION DEPTH (0-2m bgl)

NOTE:
LOCATION OF COFFEY GROUNDWATER WELLS ARE APPROXIMATE ONLY.

REVISIONS					
04	PAS	11.07.13	FINAL DRAFT ISSUE		AR
03	PAS	20.06.13	DRAFT ISSUE		AR
02	PAS	18.03.13	DRAFT ISSUE		AR
01	TT	12.09.12	DRAFT ISSUED		DM
No.	BY	DATE	DESCRIPTION		APPD

SCALES:
5 0 5 10 15m
1:1000 A3

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DRAWN	TT	CHECKED	JA
APPROVED	AR	DATE	18.03.13

CONTRACTOR:

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

CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F10:
VMP EXTENT OF REMEDIATION (UNSATURATED)

STATUS: FINAL DRAFT

DRAWING NO: 60247139-DRG-20-RAPC-F10

REV: 04

Last modified: 11 Jul 13 - 13:41

Cad ref: P:\60153531_Barangaroo_S_JCIS_CAD\S3.3 Working\Drg\Figures\60247139-drg-28-RAPC-F11.dwg

AA A B C D E F G H I J K L M N

1 2 3 4 5 6 7 8 9 10 11 12

SEWERAGE PUMPING STATION SP1129 (TO BE RETAINED)

REMEDIATION TO APPROXIMATE 5.5m BGL

REMEDIATION TO GREATER DEPTH WITHIN FORMER TAR TANK AND ANNULUS STRUCTURES

HICKSON ROAD

JENKINS STREET

BLOCK 5

BLOCK 4

BARANGAROO CENTRAL (PART)

ORWN AREA

ORWS RAP AREA

ORWS BASEMENT CURRENTLY UNDER CONSTRUCTION

REFER TO NOTE 1

LEGEND

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- AECOM STILLING WELL LOCATION
- AECOM SUPPLEMENTARY VMP DGI BOREHOLE LOCATION
- JBS BOREHOLE LOCATION - 2012
- JBS GROUNDWATER MONITORING WELL LOCATION - 2012
- DECLARATION AREA BOUNDARY
- THE SITE BOUNDARY
- OTHER REMEDIATION WORKS (NORTH) BOUNDARY
- EXISTING CAISSON WALL
- APPROXIMATE EXTENT OF FORMER GASWORKS FEATURES
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- BLOCK 4 AND 5 BOUNDARIES

BLOCK 4 PROPOSED DEVELOPMENT BLOCK AREA

ESTIMATED REMEDIATION DEPTH:

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

- MARINE SEDIMENT CONTOURS mAHD
- BEDROCK CONTOURS mAHD

NOTES:

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

REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
05	PAS	11.07.13	FINAL DRAFT ISSUE	AR
04	PAS	20.06.13	DRAFT ISSUE	AR
03	PAS	12.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

SCALES: 5 0 5 10 15m — 1:1000 A3

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APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER: AECOM

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

CLIENT:

VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F11:
VMP EXTENT OF REMEDIATION (SATURATED)

STATUS: FINAL DRAFT

DRAWING NO: 60247139-DRG-20-RAPC-F11

REV: 05

Last modified: 11 Jul 13 - 13:41

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HICKSON ROAD

SEWERAGE PUMPING STATION SP1129 (TO BE RETAINED)

BLOCK 5

BLOCK 4

BARANGAROO CENTRAL (PART)

ORWN AREA

ORWS RAP AREA

ORWS BASEMENT CURRENTLY UNDER CONSTRUCTION

HYDROCARBON ODOUR AND BLACK STAINING FROM AT 7.5 - 8.5m BGL

MODERATE TAR ODOUR FROM 4.2 - 9.4m BGL

HYDROCARBON ODOUR AND SHEEN FROM 7.0 - 8.0m BGL

MODERATE HYDROCARBON ODOUR AT 3.0m BGL

LEGEND:

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- OTHER REMEDIATION WORKS (NORTH) AREA AND SITE BOUNDARY
- DECLARATION AREA BOUNDARY
- THE SITE BOUNDARY
- APPROXIMATE EXTENT OF FORMER GASWORKS FEATURES
- ESTIMATED EXTENT OF REMEDIATION
- PROPOSED BASEMENT GROUNDWATER RETENTION WALL SYSTEM (BLOCK 4)
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- EXISTING CAISSON WALL
- BLOCK 4 AND 5 BOUNDARIES

ESTIMATED REMEDIATION DEPTH

- 0.0-3.0m BGL
- 3.0-5.0m BGL
- 5.0-10.0m BGL
- MATERIAL TO BE EXCAVATED FOR BASEMENT, WHICH MAY REQUIRE MANAGEMENT PER THIS RAP
- BEDROCK CONTOURS mAHD
- ODOROUS MATERIAL OBSERVED IN BOREHOLE WITHIN PROPOSED BASEMENT EXCAVATION DEPTH (APPROX. 8m BGL)

NOTES:

1. IT HAS BEEN ASSUMED, FOR THE PURPOSES OF ASSESSING THE EXTENT OF REMEDIATION, THAT THE BASEMENT WILL BE CONSTRUCTED TO A DEPTH BELOW THE GROUNDWATER TABLE. THAT IS, THE EXTENT OF REMEDIATION IS BASED ON CONSIDERATION OF RISK BASED CRITERIA FOR GROUNDWATER.
2. THE ESTIMATED REMEDIATION DEPTHS ARE INDICATIVE. REMEDIATION WILL BE UNDERTAKEN TO THE DEPTH OF THE UNDERLYING BEDROCK TO A MAXIMUM DEPTH OF 10m BGL, SUBJECT TO THE REQUIREMENTS OF THE RAP.

REVISIONS

No.	BY	DATE	DESCRIPTION	APPD
04	PAS	11.07.13	FINAL DRAFT ISSUE	AR
03	PAS	20.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

SCALES: 5 0 5 10 15m — 1:1000 A3

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DRAWN	TT	CHECKED	JA
APPROVED	AR	DATE	18.03.13

CONTRACTOR:

DESIGNER: AECOM

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

CLIENT:

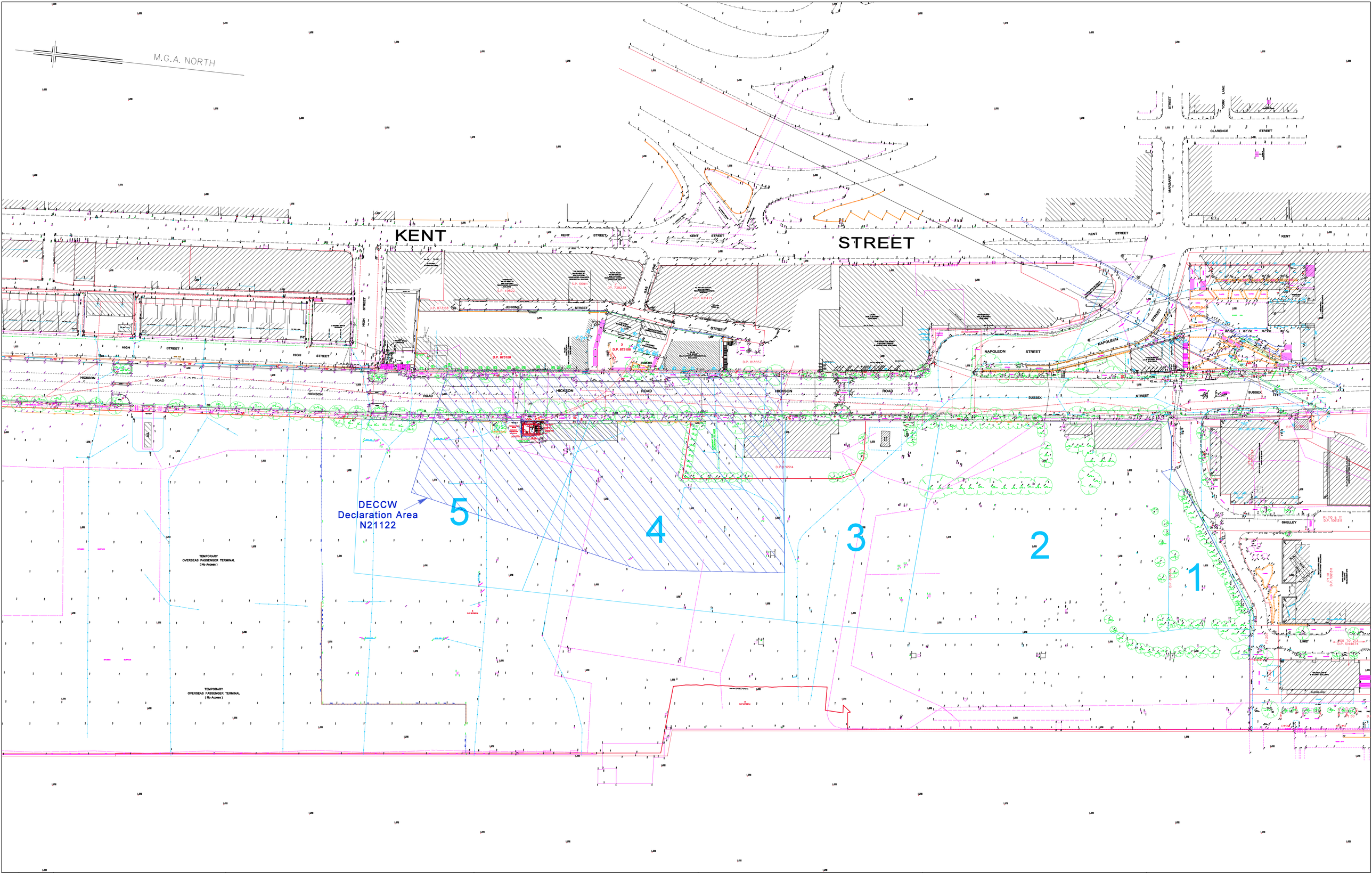
VMP / BLOCK 4 RAP, BARANGAROO

FIGURE F12:
BLOCK 4 DEVELOPMENT EXTENT OF REMEDIATION (SATURATED)

STATUS: FINAL DRAFT

DRAWING NO: 60247139-DRG-20-RAPC-F12

REV: 04



REV.	DATE	AMENDMENTS

0 100
REDUCTION RATIO 1: 1000 @ A1

THIS TITLE BLOCK AND NOTES FORM AN INTEGRAL PART OF THE PLAN AND MUST BE REPRODUCED IN ANY USE, DUPLICATION OR AMENDMENT.

DATUM : AUSTRALIAN HEIGHT DATUM
CONTOUR INTERVAL : N/A
ORIGIN OF LEVELS : S.S.M. 46693
R.L. 2.454 A.H.D.

RYGATE & COMPANY PTY. LIMITED
REGISTERED LAND SURVEYORS
81 YORK STREET, SYDNEY 2000
MEMBER OF ASSOCIATION OF CONSULTING SURVEYORS
PHONE 9262 6800
FAX 9262 6843
ABN 61 001 204897
www.rygate.com.au
Email: surveyors@rygate.com.au

SURVEYOR	DRAWN	CHECKED	APPROVED
SG	GD		

CLIENT: LEND LEASE (Millers Point) PTY. LTD.

LOCALITY: BARANGAROO

L.G.A.: CITY OF SYDNEY

PLAN

SHOWING DETAIL, LEVELS & SERVICES
LOTS 3 & 5 DP 876514
AND ALONG HICKSON ROAD

REFERENCE No.	PLAN No.	DATE	SHEET No. 1
74479	74479-1	18/10/2010	OF 1 SHEETS

Appendix C

Declaration Site HHERA Letter (AECOM, 2012d)

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PO Box Q410
QVB Post Office NSW 1230
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ABN 20 093 846 925

3 July 2012

Mark Burns
Environment Manager
Lend Lease (Millers Point) Pty Ltd
Level 4, 30 Hickson Road

Millers Point, NSW, 2000

Dear Mark

Human Health and Ecological Risk Assessment - Declaration Site, Barangaroo. Assessment of the Implications of the Revised Basement Design.

1.0 Introduction

AECOM Australia Pty Ltd (AECOM) previously prepared the *Human Health and Ecological Risk Assessment, Declaration Site (Development Works) Remediation Works Area - Barangaroo* (June 2011) (*HHERA Declaration Site*) (AECOM, 2011a). The objective of the *HHERA Declaration Site* (AECOM, 2011a) was to develop human health based site-specific target criteria (SSTC) and site-specific ecological screening criteria (SSESC) that would be applicable during the remediation and validation works associated with the redevelopment of the Declaration Site Area. The SSTC and SSESC were developed to be protective of the identified receptors associated with the proposed future land use.

The *HHERA Declaration Site* (AECOM, 2011a) utilised conceptual development plans available at the time the document was produced. In particular, the *HHERA Declaration Site* (AECOM, 2011a) identified that two basement areas (an upper and lower basement) would potentially be constructed at the Declaration Site. The development of the human health SSTC presented within the *HHERA Declaration Site* (AECOM, 2011a) made use of proposed design considerations associated with the lower and upper basement (Scenario 1 and Scenario 2 respectively). Design considerations adopted included:

- the smallest area within the proposed basement that would be accessible to the public was proposed to have dimensions of 25 meters by 25 meters;
- the basement ventilation rate would be maintained at an average air exchange rate of 4 per hour; and
- the lower basement would be used for car parking only (with no attendant or loading dock).

The *HHERA Declaration Site* (AECOM, 2011a) was accepted by the NSW EPA accredited Site Auditor as part of his Site Audit Report (SAR, ENVIRON Australia Pty Limited, 14 July 2011). The NSW EPA (then NSW OEH) granted approval of the *HHERA Declaration Site* (AECOM, 2011a) on the 11 July 2011 (Document reference: MP10_0023-MOD CBMK; Ref DOC11/30983). As a condition of the EPA approval, it was noted that if the basis of design, construction and operational parameters detailed in the *HHERA Declaration Site* (2011a) were not met, then the HHERA would require revision.

Subsequent to completion of the *HHERA Declaration Site* (AECOM, 2011a), the proposed design and use of the lower and upper basements has been revised. This design development has included optimising the layout and proposed uses of the basement, and consideration of likely ventilation rates required to optimise building energy use. Based on this, the following design modifications are proposed in relation to the HHERA assumptions:

a) Amending the proposed basement ventilation rates to be more consistent with strict environmental requirements for future building ratings (e.g. Greenstar / NABERS)

b) Amending the size (area and height) of the smallest area within the proposed basement that would be accessible to the public based on the revised basement layout.

c) Amending the usage of the lower basement level to include a loading dock utilised by full time workers.

This letter presents an assessment of changes to the SSTCs that will result from the proposed design modifications, and provides a comparison of the revised SSTCs with the previously approved SSTCs presented within the *HHERA Declaration Site* (AECOM, 2011a).

As detailed in the *HHERA Declaration Site* (AECOM, 2011a), the proposed design for the Declaration Site includes encapsulation of the entire Site (excepting Hickson Road), by a basement groundwater retention wall

system that will extend to and be keyed into bedrock. The development of SSESCs for the areas of Site within the retention wall system is therefore not required for ecological protection. Furthermore, the basement groundwater retention wall system will effectively cut off direct groundwater migration from Hickson Road to Darling Harbour, requiring groundwater from Hickson Road to migrate to the north or south around the perimeter of the Stage 1 Development. Therefore, in consideration of the distance between Hickson Road and Darling Harbour, the development of SSESCs for Hickson Road is not considered to be required for ecological protection.

2.0 Objective

The objective of this letter is to demonstrate whether the revised basement design and ventilation rates and inclusion of loading dock workers within the lower basement level within the *Declaration Site* basement will result in SSTCs which are equivalent to, greater (i.e. less conservative) or less (i.e. more conservative) than those presented within the *HHERA Declaration Site* (AECOM, 2011a).

3.0 Scope of Work

The following scope of works was undertaken.

1) Re modelling of the relevant soil and groundwater SSTCs (Scenario 1 and 2 which are representative of the proposed lower and upper basement) to reflect:

   - The revised layout for the lower and upper basement areas (both area and height).
   - A reduction in the average air exchange rate associated with ventilation of the lower and upper basement areas.

   Information pertaining to the proposed basement dimensions and the corresponding air exchange rates were provided to AECOM during meetings with Lend Lease. Additionally information provided by Lend Lease (Fitzpatrick, 2012), which reflects minimum average ventilation rates within proposed basement areas within the ORWS have been considered as being representative of the ventilation rates that will be provided within the basement constructed in the Declaration Area. This information is presented in **Enclosure A** of this letter report.

2) Re-modelling of groundwater (Scenario 1 which is representative of the lower basement levels) SSTCs to reflect use of the lower basement level as a loading dock with a full time worker.

3) Comparison of the revised SSTCs for soil and groundwater (based on revised layout, ventilation rate and worker exposures) with those presented within the *HHERA Declaration Site* (AECOM, 2011a) to assess whether the re-modelled SSTC are less (i.e. more conservative) or greater (i.e. less conservative) than those presented within *HHERA Declaration Site* (AECOM, 2011a);

4) Preparation of this letter report including:

   - Description of vapour modelling assumptions and input parameters which differ from those presented within the *HHERA Declaration Site* (AECOM, 2011a);
   - Justification for the application of revised input parameters, including Lend Lease calculated ventilation rates and revised basement layout areas;
   - Tables comparing the re-modelled SSTC with those presented within the *HHERA Declaration Site* (AECOM, 2011a).

4.0 Revised Vapour Modelling Assumptions

Based on the information provided by Lend Lease (**Enclosure A**) the assumptions made in the *HHERA Declaration Site* (AECOM, 2011a), have been revised to assess the effect on the derived SSTC with respect to:

- a reduction in the anticipated ventilation rates within the proposed lower and upper basements;
- the revised dimensions of the basement car park areas (to which the public and commercial workers will have access); and
- the use of the lower basement level as a loading dock where workers will be present.

AECOM considers that the revision of the SSTCs based on the revised design dimensions and potentially reduced air exchange rates and usage is more representative than the previously presented calculations and

resulting SSTC (which were based on a default of 25m by 25m basement area with four air exchanges per hour and no workers on the lower basement level).

Lend Lease (Fitzpatrick, 2012) provided AECOM average daily air exchange rates based on the proposed basement design configuration for the Barangaroo Area known as the Other Remediation Works South (ORWS Area) based on:

- 100% fan operation/ ventilation;
- 25% minimum fan operation/ ventilation; and
- 0% fan operation/ ventilation.

Where ventilation rates are likely to be reduced (i.e. less than four air exchanges per hour, based on the daily average) a revision of a number of assumptions related to the development of the SSTC is considered appropriate. The assumptions adopted for the revised SSTCs are based on the worst case scenario, considered to be in areas where daily average ventilation rates are lower than the previously modelled four air exchanges per hour. The reduction in the daily average ventilation rates is understood to occur as a result of energy saving controls which will be implemented within the proposed ORWS development. These controls include turning off ventilation systems during off-peak times.

For the purpose of assessing the potential impact of reduced ventilation rates within the lower and upper basements to be constructed in the Declaration Area, AECOM has considered the lowest ventilation rates calculated for the ORWS basement areas (identified within the lower basement B2 Residential car park). This ventilation rate is 3.17 air exchanges per hour (when periods of 0% fan/ventilation occurs throughout out the day).

Additional information presented to AECOM from Lend Lease also indicates that a loading dock may be present in the lower basement car park where a full time worker will be present. The revised modelling has therefore considered a commercial worker exposure of an eight hour day, 5 days per week for 48 weeks per year (to account for vacation time) for 30 years.

Table 1 and **Table 2** present the revised model assumptions for Scenario 1 (lower basement level) and Scenario 2 (upper basement level), respectively. AECOM notes that only those assumptions which have been revised are presented within this letter report.

Table 1 Revised Scenario 1 Model Assumptions

Model Input	Original HHERA Declaration Site Model Input	Revised Model Input	Comment
Scenario 1 – Lower Basement			
Water with Flow Model			
Dimensions of Basement - Height (m)	2.5	4.5	Provided by Lend Lease.
Dimensions of Basement - Width (m)	30	50	Based on information provided by Lend Lease.
Dimensions of Basement - Depth (m)	30	50	
Dimensions of Basement - Volume total basement (m^3)	2,250	11,250	Calculated from information provided by Lend Lease.
Dimensions of Wet Section of Basement – Length (m)	35	59	Two walls measuring 4.5 m in height plus the width of the floor (50 m).
Dimensions of Wet Section of Basement – Width (m)	15	25	Based on 50% of the total 50 m length of surface area, considered to have water flowing across it in the basement.

Model Input	Original HHERA Declaration Site Model Input	Revised Model Input	Comment
Fetch/ Depth (m) ratio of Wet Basement Section	1,500	2,500	Calculated.
Volume of wet basement (m^3)	5.3	14.8	Equivalent to the length and width of wet basement areas multiplied by a water thickness of 0.01 m.
Area covered in water (m2)	525	2,250	Based on 50% of the total 50 m length of surface area, considered to have water flowing down two walls and across the floor of the basement carpark.
Effective diameter of basement (m)	25.9	43.3	Calculated.
Volume of water entering basement (m^3/sec)	$5.25x\ 10^{-6}$	1.48×10^{-5}	Calculated by the volume of the wet basement multiplied by the permeability rate of the concrete basement walls.
Air exchange rate (exchanges/day)	96	76.1	Provided by Lend Lease. Based on an average daily air exchange rate of 3.17, which includes periods of 0% ventilation.
Exposure Time (years)	64	30	30 years based on a worker exposure.
Exposure Duration	1	8	Based on a worker exposure over a day (assumed to be 8 hours per day).
Exposure Frequency	350	240	Based on a worker working 5 days per week, 48 weeks per year (minus 4 weeks annual holidays).

Table 2 Revised Scenario 2 Model Assumptions

Model Input	Original HHERA Declaration Site Model Input	Revised Model Input	Comment
Scenario 2 – Upper Basement			
Soil to Air Model			
Enclosed-space volume/infiltration area (ratio) (cm)	1,875	5,625	Assumes 50 m by 50 m by 2 m high basement section adjacent to soil impacts, with soil vapour infiltration through upper 2m of 2 of 4 walls only. Therefore, volume = 11250 m^3 and infiltration area = 200 m^2.
Enclosed-space air exchange rate (1/s)	0.00111	0.0008806	Provided by Lend Lease. Based on an average daily air exchange rate of 3.17, which includes periods of 0% ventilation.
Slab Area (cm^2)	$7.25x\ 10^6$	2.7×10^7	Area through which vapours may enter (conservatively includes floor and all walls). Basement dimensions 50 m width x 50 m length x 2 m height.
Slab perimeter (cm)	10,000	20,000	Perimeter of basement footprint. Based on 50m x 50m basement.
Water with Flow Model			
Dimensions of Basement - Height (m)	3	4.5	Provided by Lend Lease.
Dimensions of Basement - Width (m)	25	50	Based on information provided by Lend Lease.

Model Input	Original HHERA Declaration Site Model Input	Revised Model Input	Comment
Dimensions of Basement - Depth (m)	25	50	
Dimensions of Basement - Volume total basement (m^3)	1,875	11,250	Calculated.
Dimensions of Wet Section of Basement – Length (m)	5	25	Based on the assumption 50% of the total wall length will have water flowing across it.
Dimensions of Wet Section of Basement – Width (m)	5	5	Assuming groundwater will be encountered across the face of 2.5 m of 2 walls. The upper 2 meters of the wall is considered to be unsaturated soils. No water is considered to flow across the floor, as this would not be in contact with saturated material.
Fetch/ Depth (m) ratio of Wet Basement Section	500	500	Calculated.
Volume of wet basement (m^3)	0.25	1.25	Equivalent to the length and width of wet basement areas multiplied by a water thickness of 0.01 m.
Area covered in water (m^2)	25	125	Equivalent to the length multiplied by the width of the wet area.
Effective diameter of basement (m)	5.6	12.6	Calculated.
Volume of water entering basement (m^3/sec)	2.5×10^{-7}	1.25×10^{-6}	Calculated by the volume of the wet basement multiplied by the permeability rate of the concrete basement walls.
Air exchange rate (exchanges/day)	96	76	Based on information provided by Lend Lease, where minimum average daily air exchange rates have been calculated at 3.17per hour, which includes periods of 0% ventilation.

5.0 Development of SSTCs

For the purpose of deriving SSTCs, AECOM has considered the lowest air exchange rate provided by Lend Lease (3.17 per hour) to be representative of the most conservative exposure scenario for inhalation of volatile contaminants within the lower basement (Scenario 1) and upper basement (Scenario 2) .

AECOM has also revised the exposure assumptions for frequency and duration for Scenario 1 to account for a worker within the loading dock of the lower basement level.

SSTCs have been derived using the approach and methodology detailed in both the *HHERA Declaration Site* (AECOM, 2011a).

Based on the revised model inputs provided in **Table 1** and **Table 2**, revised soil and groundwater SSTC have been developed for the two modelled exposure scenarios (Scenario 1- Lower Basement and Scenario 2- Upper Basement), which are representative of the proposed basement dimensions, ventilation rates and exposure parameters. The results of the model are presented within **Enclosure B** of this letter report.

Note no changes have been made to Scenarios 3 to Scenario 8 inclusive as these scenarios do not consider the inclusion of a basement. The only exception is Scenario 7, which considers a multi storey residential building constructed above a basement car park. Scenario 7 has not been considered further in this letter because it adopts a 10 fold dilution between the basement and the upper floors where residents may reside. Therefore, it is not representative of the most conservative SSTCs derived.

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5.1 Revised Groundwater SSTC (mg/L)

Based on the revised model inputs (presented in **Section 4.0**) the results of the risk assessment models (including the odour models) are presented in **Enclosure B** of this letter report. **Table 3** below provides a comparison of the previously derived SSTC for groundwater as presented within the *HHERA Declaration Site* (AECOM 2011a), with the revised SSTC for groundwater presented in **Enclosure B**.

Table 3 Groundwater Scenario 1 and Scenario 2 SSTC

Chemical	Previous SSTC		Revised SSTC		Previous SSTC		Revised SSTC	
	Derived	Proposed	Derived	Proposed	Derived	Proposed	Derived	Proposed
Scenario	**Scenario 1 – Lower Basement mg/L**				**Scenario 2 – Upper Basement mg/L**			
Acenaphthene	610	##	180	##	1,900	##	1800	##
Acenaphthylene	300	##	80	80	910	##	890	##
Ammonia	2,400	2,400	630	630	6,800	6,800	6,800	6,800
Aniline	**1,400,000**	##	***180,000***	***180,000***	***3,800,000***	**##**	**4,000,000**	##
Anthracene	17	##	4.6	##	50	##	50	##
Arsenic, Inorganic	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-
Benz(a)anthracene	-	-	-	-	-	-	-	-
Benzene	21	21	7.7	7.7	95	95	90	90
Benzo(a)pyrene	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-	-	-	-	-
Bis(2-ethylhexyl)phalate	-	-	-	-	-	-	-	-

Chemical	Previous SSTC		Revised SSTC		Previous SSTC		Revised SSTC	
	Derived	Proposed	Derived	Proposed	Derived	Proposed	Derived	Proposed
Scenario	Scenario 1 – Lower Basement mg/L				Scenario 2 – Upper Basement mg/L			
Cadmium	-	-	-	-	-	-	-	-
Chromium(III)	-	-	-	-	-	-	-	-
Chromium(VI)	-	-	-	-	-	-	-	-
Chrysene	-	-	-	-	-	-	-	-
Cobalt	-	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-	-	-	-	-
Dibenzofuran	1,100	##	270	##	3,200	##	3100	##
Dimethylphenol, 2,4-	-	-	-	-	-	-	-	-
Ethylbenzene	4,000	##	***750***	750	13,000	##	12,000	##
Fluoranthene	-	-	-	-	-	-	-	-
Fluorene	48	##	13	13	140	##	140	##
Indeno(1,2,3-cd)pyrene	-	-	-	-	-	-	-	-
Lead and Compounds	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-
Methylphenol, 2-	-	-	-	-	-	-	-	-
Methylnaphthalene, 2-	***38***	***38***	***4.5***	***4.5***	**120**	**120**	**110**	**110**

Chemical	Previous SSTC		Revised SSTC		Previous SSTC		Revised SSTC	
	Derived	Proposed	Derived	Proposed	Derived	Proposed	Derived	Proposed
Scenario	Scenario 1 – Lower Basement mg/L				Scenario 2 – Upper Basement mg/L			
Methylphenol, 3&4	***1,000***	***1,000***	***130***	***130***	***2,700***	***2,700***	**2,800**	**2,800**
Naphthalene	0.92	0.92	0.24	0.24	2.9	2.9	2.8	2.8
Nickel	-	-	-	-	-	-	-	-
Phenanthrene	22	##	5.8	5.8	64	##	64	##
Phenol	***310,000***	***310,000***	***39,000***	***39,000***	***830,000***	***830,000***	**860,000**	##
Pyrene	11	##	2.8	##	*29*	##	30	##
Styrene	3,300	##	840	840	10,000	##	9,900	##
Toluene	160,000	##	4000	4000	49,500	##	47,000	##
TPH C_6-C_9 aliphatic ($)	28,000	28,000	7300	7300	90,000	90,000	86,000	86,000
TPH C_{10}-C_{14} aliphatic ($)	7.7	7.7	1.8	1.8	14.5	15	14	14
TPH C_{10}-C_{14} aromatic ($)								
TPH C_{15}-C_{28} aliphatic	-	-	-	-	-	-	-	-
TPH C_{15}-C_{28} aromatic								
TPH C_{29}-C_{36} aliphatic	-	-	-	-	-	-	-	-
TPH C_{29}-C_{36} aromatic								
Trimethylbenzene, 1,2,4-	87	87	22	22	278	280	270	270
Vanadium	-	-	-	-	-	-		
Xylenes (total) ($)	650	##	176	176	2,200	##	2,070	##

Chemical	Previous SSTC		Revised SSTC		Previous SSTC		Revised SSTC	
	Derived	Proposed	Derived	Proposed	Derived	Proposed	Derived	Proposed
Scenario	Scenario 1 – Lower Basement mg/L				Scenario 2 – Upper Basement mg/L			
CPAH#[1]	-	-	-	-	-	-		

Shading = SSTC exceeds aqueous solubility limit however the derived SSTC is within 10 times the solubility limit.
= an SSTC has not been determined for remediation purposes as the derived level is at least 10 times greater than solubility limits
# [1]= the solubility limits for individual carcinogenic PAHs are in the order of 10^{-3} to 10^{-4} mg/L and are assumed to represent the solubility of the CPAH group. The derived SSTC for CPAH is 0.01 mg/L and is considered to be well over the solubility limits and has therefore not been adopted.
CPAH = carcinogenic PAHs and includes: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h) anthracene and indeno (1,2,3-cd)pyrene (see text for details)
Italics= odour SSTC (were lower than human health SSTC)
$ = SSTC is greater than 10 times the saturation/ solubility limit and has been adopted on the following basis: **TPH fractions:** SSTC has been adopted as it is not considered appropriate to exclude this complex and chemically diverse group of chemicals based on the solubility/ saturation characteristics of an analytical surrogate.

Key Assumptions:

- The derivation of SSTCs has been based on plans and design assumptions provided by Lend Lease .
- The development of SSTCs has assumed that tar will be removed from the immediate vicinity of outer basement walls to the extent practicable, and basement design and engineering controls should ensure that tar seepage into basements does not occur.
- There are significant biodegradation processes occurring within sub-surface soils based on measured oxygen concentrations beneath the sub-surface. To account for these biodegradation processes, a 10 fold factor (Davis 2009) has been adopted for site specific target criteria for soil for the paved and unpaved areas of the Site, where biodegradation processes are considered to be significant.
- Risks associated with mixtures of chemicals have been modelled by applying proportional risks as follows: BTEX (HI 0.25 each), PAH (HI 0.2), TPH (HI 0.25 total for aliphatic and aromatic per fraction), all other chemicals HI = 1.
- The lower and upper basements have been modelled using a water seepage model adopted from Water 9 (USEPA, 1994).
- In the lower and upper basements a windspeed of 0.03 m/sec within the basements (Scenario 1 and Scenario 2) has been modelled
- Chemicals are assumed to be volatile if Henry's Law constant is greater than 1 x 10^{-5} atm-m^3/mole (USEPA,2004)
- In basement scenarios (Scenario 1 and Scenario 2) it has been assumed that no more than two walls will be in contact with contaminated soil / groundwater (with Scenario 1 also considering exposures to the floor). Based on building plans provided by LL, it has been assumed that basement areas will be compartmentalised with each compartment adjacent to basement areas leaving a maximum of 2 exposed walls.
- The basement groundwater retention wall system will comprise a diaphragm wall (or equivalent), extending to and keyed into bedrock, with a reinforced concrete basement wall, constructed on the inside. A sealed plenum constructed immediately inside the reinforced concrete basement wall will include: (a) passive ventilation to the atmosphere; and (b) dish drains that will drain any seepage.

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5.2 Revised Soil SSTC

Based on the revised model inputs (presented in **Section 4.0**) the results of the risk assessment models (including the odour models) are presented in **Enclosure B** of this letter report. **Table 4** below provides a comparison of the previously derived SSTC for soil, as presented within the *HHERA Declaration Site* (AECOM 2011a), with the revised SSTC for soil shown in **Enclosure B**.

As discussed in the *HHERA Declaration Site* (AECOM, 2011a), unsaturated soil impacts are not likely to exist adjacent to the lower basement wall. Therefore no soil SSTCs have been derived for Scenario 1 receptors.

Table 4 Soil SSTC Scenario 2 Upper Basement

Chemical	Previous SSTC (HHERA Declaration Site)		Revised SSTC	
	Derived	Proposed	Derived	Proposed
Scenario 2 – Upper Basement				
Acenaphthene	22,200	##	90,000	##
Acenaphthylene	35,800	##	146,000	##
Anthracene	1,190,000	##	4,900,000	##
Arsenic, Inorganic	-	-	-	-
Benz(a)anthracene	-	-	-	-
Benzene	15.3	15	62	62
Benzo(a)pyrene	-	-	-	-
Benzo(b)fluoranthene	-	-	-	-
Benzo(k)fluoranthene	-	-	-	-
Benzo(g,h,i)perylene	-	-	-	-
Chromium(III), Insol. Salts	-	-	-	-
Chromium(VI)	-	-	-	-
Chrysene	-	-	-	-
Copper	-	-	-	-
Dibenz(a,h)anthracene	-	-	-	-

Chemical	Previous SSTC (HHERA Declaration Site)		Revised SSTC	
	Derived	Proposed	Derived	Proposed
Scenario 2 – Upper Basement				
Dibenzofuran	174,000	##	709,000	##
Ethylbenzene	***602***	***600***	**2,500**	##
Fluoranthene	-	-	-	-
Fluorene	51,400	##	210,000	##
Indeno(1,2,3-cd)pyrene	-	-	-	-
Lead	-	-	-	-
Methylnaphthalene, 2-	***1,080***	***1,100***	**4,400**	##
Methylphenol, 3&4	***8,800***	***8,800***	***36,000***	***36,000***
Naphthalene	40.8	41	170	170
Phenanthrene	319,000	##	1,300,000	##
Pyrene	1,840,000	##	7,500,000	##
Toluene	***6,040***	**6,000**	***25,000***	##
TPH C06-C09 aliphatic ($)	3,360	3,400	14,000	14,000
TPH C10-C14 aliphatic ($)	13,000	13,000	53,000	53,000
TPH C10-C14 aromatic ($)				
TPH C15-C28 aliphatic	-	-	-	-
TPH C15-C28 aromatic				
TPH C29-C36 aliphatic	-	-	-	-
TPH C29-C36 aromatic				
Trimethylbenzene, 1,2,4-	14.3	14	58	58
Vanadium	-	-	-	-

Chemical	Previous SSTC (HHERA Declaration Site)		Revised SSTC	
	Derived	Proposed	Derived	Proposed
Scenario 2 – Upper Basement				
Xylenes (total)	856	##	3,500	##
Zinc	-	-	-	-
CPAH	-	-	-	-

Notes:

Shading = SSTC exceeds saturation limit however the derived SSTC is within 10 times the saturation limit.

= an SSTC has not been determined for remediation purposes as the derived level is at least 10 times greater than saturation/ solubility limits, therefore maximum vapour phase concentration of chemical cannot result in unacceptable risk level.

CPAH = carcinogenic PAHs and includes: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h) anthracene and indeno (1,2,3-cd)pyrene (see HHERA – Declaration Site (AECOM, 2011a) for details)

Italics= odour SSTC (where lower than human health SSTC)

$ = SSTC is greater than 10 times the saturation/ solubility limit and has been adopted on the following basis: **TPH fractions:** SSTC has been adopted as it is not considered appropriate to exclude this complex and chemically diverse group of chemicals based on the solubility/ saturation characteristics of an analytical surrogate up to the maximum observed concentrations on site of TPH C_6-C_9 7,500 mg/kg, C_{10}-C_{14} 70,000 mg/kg and C_{15+} 130,000 mg/kg.

5.3 Key Assumptions Relating to the Derivation of the SSTCs:

The following key assumptions have been made, in the process of deriving the revised SSTCs:

- The derivation of the revised SSTCs has been based on:
  - design assumptions provided by Lend Lease, as shown in **Enclosure A.**
  - the assumption that workers within a loading dock on the lower basement level will work on average an 8 hour day, 240 days per year for a maximum period of 30 years.
- The development of SSTCs has assumed that tar will be removed from the immediate vicinity of outer basement walls to the extent practicable, and basement design and engineering controls should ensure that tar seepage into basements does not occur.
- The current theoretical estimation of soil concentrations within indoor and outdoor air is based on partitioning modelling which has been demonstrated to overestimate concentrations between 10 -1,000 fold. To account for this conservatism, an adjustment factor of 10 has been applied. In all scenarios a soil partitioning factor of 10 has been applied to BTEX, TPH (fractions C_6-C_9 and C_{10}-C_{14} to account for the over-conservative nature of vapour modelling associated with these chemicals (CCME, 2008b and CRC Care, 2010)
- Risks associated with mixtures of chemicals have been modelled by applying proportional risks as follows: BTEX (HI 0.25 each), PAH (HI 0.2), TPH (HI 0.25 total for aliphatic and aromatic per fraction), all other chemicals HI = 1
- Chemicals are assumed to be volatile if Henry's Law constant is greater than 1×10^{-5} atm-m^3/mole (USEPA,2004)

6.0 Results of the Revised SSTCs

In accordance with the scope of this report, AECOM has developed revised SSTCs (for soil and groundwater) for the proposed lower and upper basement car park areas.

The revision of the SSTCs was undertaken to assess the impact of the potential reduction in the proposed air exchange (or ventilation) rates within selected areas of the proposed basement car park, revised basement dimensions and to account for workers within a loading dock on the lower basement level.

Original SSTCs were modelled on a predicted ventilation rate of 4 air exchanges per hour for a basement with dimensions of 25 m wide by 25m long. Based on the information provided by Lend Lease (**Enclosure A),** the revised SSTCs consider a reduced air exchange rate and larger basement dimensions within the upper and lower basement car park areas. Additionally, exposure assumptions within the lower basement now consider commercial workers within the lower basement working an 8 hour day, 240 days per year for 30 years.

The SSTCs for soil and groundwater presented in the *HHERA Declaration Site* (AECOM, 2011a) have been compared to the revised SSTCs (refer to **Table 3 and Table 4)**.

Comparison of the previous SSTC (as presented in the *HHERA Declaration Site* (AECOM, 2011a)) and the revised SSTC indicates:

Scenario 1 (Lower Basement)

- Revised groundwater SSTCs are lower than the Scenario 1 groundwater SSTCs originally presented in the *HHERA Declaration Site* (AECOM, 2011a).
- Unsaturated soil impacts are not considered to occur adjacent to the lower basement walls, therefore no soil SSTC are presented for Scenario 1.

Scenario 2 (Upper Basement)

- Revised groundwater SSTCs are lower than the Scenario 2 groundwater SSTCs originally presented in the *HHERA Declaration Site* (AECOM, 2011a).
- Revised soil SSTCs are greater than the soil SSTCs originally presented in the *HHERA Declaration Site* (AECOM, 2011a). Therefore the values originally presented within the *HHERA Declaration Site* (AECOM, 2011a) are more conservative and therefore considered to be protective of the receptors modelled within exposure Scenario 2 based on the revised basement dimensions provided by Lend Lease.

7.0 Conclusions

This letter report presents an assessment of the proposed design modifications, and provides a comparison of the revised SSTCs with the previously approved SSTCs presented within the *HHERA Declaration Site* (AECOM, 2011a). The conclusions provided within this letter are based on revisions to a number of assumptions, as presented in **Section 4.0**, to account for the modification to the lower and upper basement design and use. The proposed design modifications considered within this letter include:

- amending the proposed ventilation rates within the lower and upper basements (in particular, reducing the daily average ventilation rates to less than 4 air exchanges per hour, to reflect the likely basement and the ventilation system design and operation);
- amending the actual shape and size of the basement car park areas (to which the public will have access) (in particular revising them from an indicative area of 25 m x 25 m x 3 m height to an area of 50 m x 50 m x 4.5 m height based on the proposed basement design); and
- amending the use of the lower basement level to also include a loading dock utilised by full time workers in addition to a commercial/residential car park.

As a conservative approach, AECOM has adopted the lowest calculated ventilation rates provided by Lend Lease, as reduced ventilation rates (likely required to optimise building energy use) influence the potential risks associated with vapour inhalation at the Declaration Site. The adopted value is based on calculated ventilation rates for the basement designed for the Barangaroo ORWS.

The revised groundwater SSTCs for Scenario 1 and 2 are lower than those previously calculated. That is, the values originally presented within the *HHERA Declaration Site* (AECOM, 2011a) are less conservative; and based on the revised basement design and use, may not be protective of the Scenario 1 and 2 receptors. AECOM considers the revised groundwater SSTCs should be adopted in place of those in the *HHERA Declaration Site* (AECOM, 2011a) by the Remedial Action Plan (RAP) for the Declaration Area.

The revised soil SSTCs for Scenario 2 are greater than the SSTCs originally presented in the *HHERA Declaration Site* (AECOM, 2011a). That is, the values originally presented within the *HHERA Declaration Site* (AECOM, 2011a) are more conservative and therefore are considered to be protective of the receptors modelled within exposure Scenario 2 based on the revised basement plans provided by Lend Lease.

AECOM notes that the conclusions provided within this letter report are specific to the adopted assumptions, and should the proposed development deviate from these assumptions, the impact to derived SSTCs should be reviewed.

8.0 References

AECOM, 2011a. *Human Health and Ecological Risk Assessment -Declaration Site (Development Works) Remediation Works Area – Barangaroo (HHERA Declaration Site).* AECOM Australia Pty Ltd, 9 June 2011.

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9.0 Limitations

This document was prepared by AECOM Australia Pty Ltd (AECOM) for the sole use of Lend Lease (Millers Point) Pty Ltd, the only intended beneficiary of our work. Any advice, opinions or recommendations contained in this document should be read and relied upon only in the context of the document as a whole and are considered current to the date of this document. Any other party should satisfy themselves that the scope of work conducted and reported herein meets their specific needs before relying on this document. AECOM cannot be held liable for any third party reliance on this document, as AECOM is not aware of the specific needs of the third party. No other party should rely on the document without the prior written consent of AECOM, and AECOM undertakes no duty to, nor accepts any responsibility to, any third party who may rely upon this document.

This document was prepared for the specific purpose described in our proposal dated 14 October 2011 and as agreed to by Lend Lease (Millers Point) Pty Ltd. From a technical perspective, the subsurface environment at any site may present substantial uncertainty. It is a heterogeneous, complex environment, in which small subsurface features or changes in geologic conditions can have substantial impacts on water and chemical movement. Uncertainties may also affect source characterisation assessment of chemical fate and transport in the environment, assessment of exposure risks and health effects, and remedial action performance.

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

Kind regards,

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Enclosures

Enclosure A: Ventilation parameters provided by Lend Lease.

Enclosure B: Revised SSTC Calculations Scenario 1 and Scenario 2

Enclosure C: Comparison of Scenario 1 SSTC Groundwater to ORWS Groundwater Data

Enclosure A

Ventilation parameters provided by Lend Lease

Lend Lease BARANGAROO SOUTH

Lend Lease Project Management & Construction (Australia) Pty Limited ABN 97 000 098 162

Correspondence

No. 12013

Master Project Name:
Barangaroo Basement & Infrastructure

Project Address:
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Project Name:	Barangaroo - Basement
Project Number:	161804
Subject:	Basement Airchange Study
Area/Zone:	Basements & Infrastructure
Sub-Area/Sub-Zone:	GENERAL Basement & Infrastructure File
Category:	Mechanical Services
Date:	16 Apr 2012 09:13:00

Sender	Company	Phone	Fax
Cole Fitzpatrick	Lend Lease Project Management & Construction (Australia) Pty Limited	92375404	-

Author	Company	Phone	Fax
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To Recipient(s)	Company	Phone	Fax
Amanda Lee	AECOM	89340457	-

cc Recipient(s)	Company	Phone	Fax
No cc recipients selected.			

Message:

Amanda,

I have attached the corresponding zone drawings which accompany the table. I have also made a small amendment to the table since friday.

Thanks again.

Cole.

>Original No.: 11991
>From: Cole Fitzpatrick
>Date: 13 Apr 2012 05:55 PM
>Subject: Basement Airchange Study
>Attachments in email:
>120413 Airchanges Study.pdf
>==========
>Amanda,

I spoke with Joseph this afternoona dn he asked me to recut the airchange calcs.

here are my results, let me know if you have any questions.

have a good weekend.

Cole.

File Attachments:

Attachment Name	Size
120416 Airchanges Study.pdf	25 Kb
120416_Airchange_Study_Zones_B1.pdf	3794 Kb
120416_Airchange_Study_Zones_B2.pdf	3350 Kb

Related Correspondence:

No.	Date	Title	Author	Company
11991	13 Apr 2012	**Basement Airchange Study**	Cole Fitzpatrick	Lend Lease Project Man ...

Document Links:

No.	Module	Title	Author	Doclink Creator
No document links				

100% Air Quantity

Space	Area - m2	Height - m	Volume - m3	No of Cars	L/s per Car	Current Design - L/s	Arch/hr
B1 COMMERCIAL	11,567	3.75	43,346	402	250	100,500	8.35
B2 COMMERCIAL	5,052	2.68	13,539	158	250	39,500	10.50
B2 NORTH COMMERCIAL	2,369	2.67	6,325	82	250	20,500	11.67
B2 RESIDENTIAL	3,570	2.68	9,568	135	150	20,250	7.62
C3/C4 DOCK	3,220	6.03	19,401	28	1500	42,000	7.79
C4/C5 DOCK	2,460	5.08	12,487	37	750	27,750	8.00

Scenario 1 - 25% Min. Flow

Space	Area - m2	Height - m	Volume - m3	No of Cars	L/s per Car	Current Design - L/s	Arch/hr
B1 COMMERCIAL	11,567	3.75	43,346	402	250	50,041	4.16
B2 COMMERCIAL	5,052	2.68	13,539	158	250	19,668	5.23
B2 NORTH COMMERCIAL	2,369	2.67	6,325	82	250	10,207	5.81
B2 RESIDENTIAL	3,570	2.68	9,568	135	150	10,083	3.79
C3/C4 DOCK	3,220	6.03	19,401	28	1500	25,900	4.81
C4/C5 DOCK	2,460	5.08	12,487	32	1500	17,113	4.93

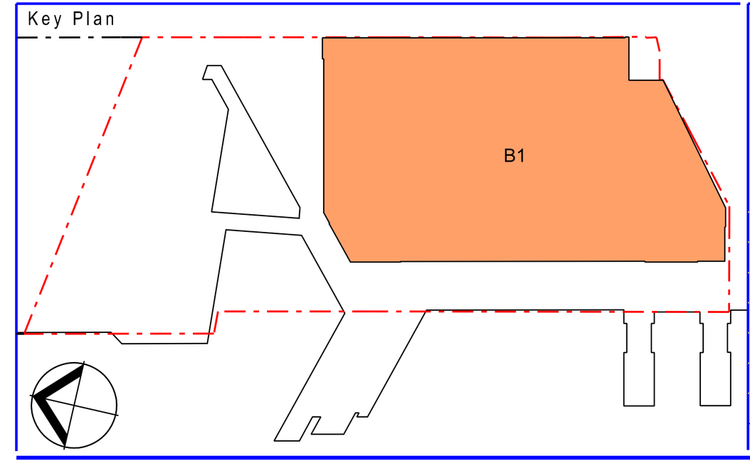
Scenario 2 - 0% Min. Flow

Space	Area - m2	Height - m	Volume - m3	No of Cars	L/s per Car	Current Design - L/s	Arch/hr
B1 COMMERCIAL	11,567	3.75	43,346	402	250	41,875	3.48
B2 COMMERCIAL	5,052	2.68	13,539	158	250	16,458	4.38
B2 NORTH COMMERCIAL	2,369	2.67	6,325	82	250	8,542	4.86
B2 RESIDENTIAL	3,570	2.68	9,568	135	150	8,438	3.17
C3/C4 DOCK	3,220	6.03	19,401	28	1500	22,400	4.16
C4/C5 DOCK	2,460	5.08	12,487	32	1500	14,800	4.27

PRELIMINARY

INDICATIVE LAYOUT ONLY

Key Plan



Rev.	Item	Revision Description	Date
07		ISSUED FOR REVIEW	20.03.12
06		ISSUED FOR SERVICES COORDINATION	03.02.12
05		ISSUED FOR REVIEW AND INFORMATION	13.01.12
04		ISSUED FOR REVIEW AND INFORMATION	30.11.11
03		ISSUED FOR REVIEW AND INFORMATION	
02		ISSUED FOR CONTRACT PRICE	25.07.11
01		ISSUED FOR CLIENT REVIEW	06.06.11

Rev.	Item	Revision Description	Date

Lead Architects: RSHP — RSHP Australia Pty Ltd, Ivan Harbour | Principal Architect, RAIA NSW ARB 8484, Sydney NSW 2000

Collaborating Architects: Lend Lease, Graham W Jones | Principal Architect, FRAIA NSW ARB 4005, ABN 97 000 098 162

Consultant

Principal: Lend Lease

Developer	Lend Lease
Project Management & Construction	Lend Lease
Design	Lend Lease

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Project: BARANGAROO SOUTH

Title: PLAN
FLOOR PLAN
BASEMENT LEVEL 1

Drawn By	Date	Purpose	Approved By	Date
	04/10/11	FOR INFO		

SCALE 1:500 @ B1 1:1250 @ A3 N/A

Project No.	Site No.	Drawing No.	Revision
161804	BB1	AD0000009	07

8:30:30 AM 16/04/2012 fitc448

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