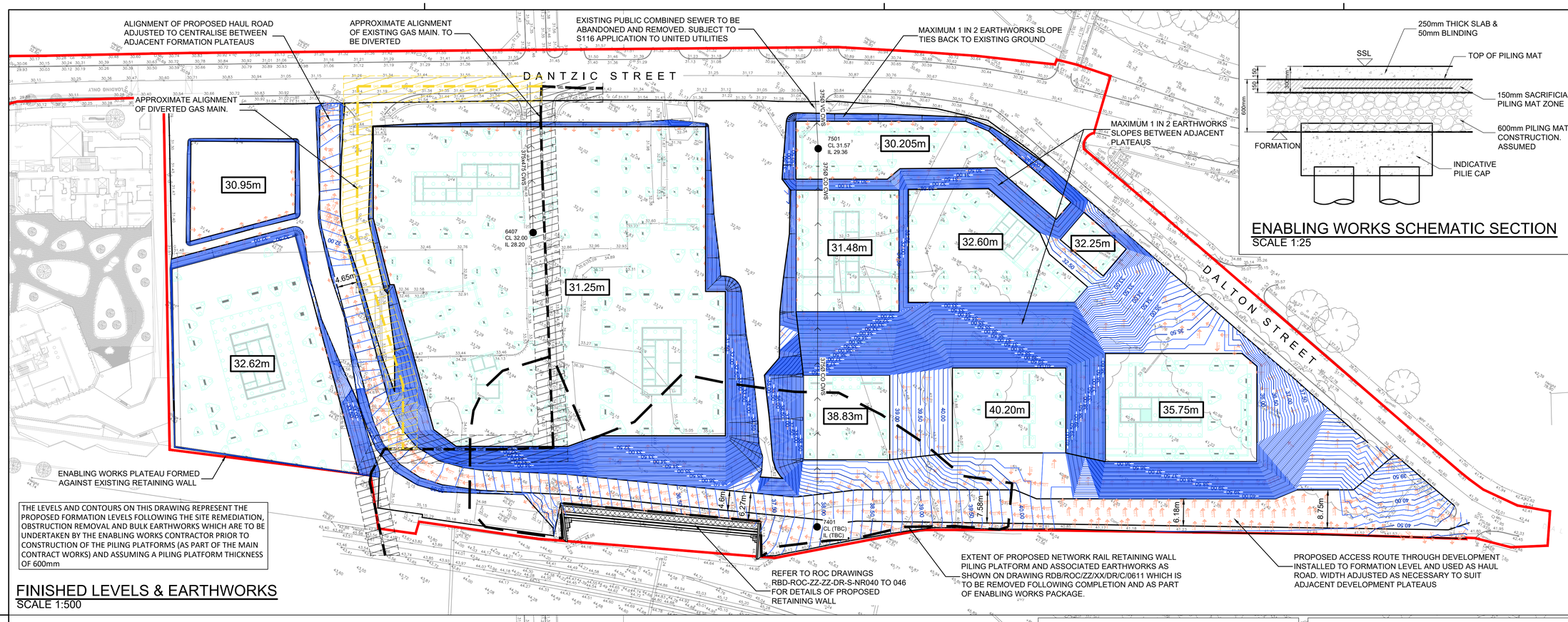


THE LEVELS AND CONTOURS ON THIS DRAWING REPRESENT THE PROPOSED FORMATION LEVELS FOLLOWING THE SITE REMEDIATION, OBSTRUCTION REMOVAL AND BULK EARTHWORKS WHICH ARE TO BE UNDERTAKEN BY THE ENABLING WORKS CONTRACTOR PRIOR TO CONSTRUCTION OF THE PILING PLATFORMS (AS PART OF THE MAIN CONTRACT WORKS) AND ASSUMING A PILING PLATFORM THICKNESS OF 600mm

FINISHED LEVELS & EARTHWORKS
SCALE 1:500

ENABLING WORKS SCHEMATIC SECTION
SCALE 1:25

THIS DRAWING IS THE PROPERTY OF RgCp. COPYRIGHT IS RESERVED BY THEM AND THE DRAWING IS ISSUED ON THE CONDITION THAT IT IS NOT COPIED, REPRODUCED, RETAINED OR DISCLOSED TO ANY UNAUTHORISED PERSON EITHER WHOLLY OR IN PART WITHOUT THE WRITTEN CONSENT OF RgCp

NOTES
1. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS.
3. ANY DISCREPANCIES SHOULD BE REPORTED TO THE ENGINEER IMMEDIATELY SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO THE COMMENCEMENT OF WORK.
4. THE PROPOSED SUBSTRUCTURE LAYOUT SHOWN ON THIS DRAWING IS FOR INFORMATION ONLY. REFER TO STRUCTURAL PLANS FOR PRECISE LOCATION SETTING OUT INFORMATION AND DETAILS.
5. THE PROPOSED FINISHED LEVELS SHOWN ON THIS DRAWING REPRESENT THE ENABLING WORKS FORMATION I.E. UNDERSIDE OF THE PROPOSED PILING PLATFORMS.

CUT / FILL BANDS

CUT		FILL	
	0.00 - 1.00m		0.00 - 1.00m
	1.00 - 2.00m		1.00 - 2.00m
	2.00 - 3.00m		2.00 - 3.00m
	3.00 - 4.00m		3.50 - 4.00m
	4.00 - 5.00m		4.00 - 4.60m
	5.00 - 6.00m		
	6.00 - 7.00m		
	7.00 - 8.00m		
	8.00 - 9.00m		
	9.00 - 9.30m		

BANDS INDICATE THE DEPTHS OF CUT & FILL BETWEEN THE PROPOSED FORMATION AND THE EXISTING SITE FOLLOWING SITE STRIP (100mm) AND CONSTRUCTION OF THE NETWORK RAIL ENABLING WORKS PLATFORM (RDB/ROC/ZZ/XX/DR/0611).

THE SITE STRIP MATERIAL IS NOT CONSIDERED SUITABLE FOR RE-USE WITHIN THE BULK EARTHWORKS AND IS TO BE REMOVED FROM SITE.

THE MATERIAL USED WITHIN THE NETWORK RAIL PLATFORM COMPRISE A MIXTURE OF SITE WON AND IMPORTED GRANULAR MATERIAL.

THE SUITABILITY OF SITE WON MATERIAL TO BE USED WITHIN THE BULK EARTHWORKS EXERCISE IS TO BE CONFIRMED.

ASSESSMENT OF SITE WON MATERIAL

GROSS CUT	MADE GROUND	NATURAL GROUND
37,537m³	31,762m³	5,775m³

SITE STRIP (100mm)

2D AREA	VOLUME
18,903m²	1,890m³

SITE STRIP ABOVE EXCLUDES AREA BENEATH NETWORK RAIL RAMP/PLATFORM FOOTPRINT AS QUANTIFIED ON ROC DRAWING RDB/ROC/ZZ/XX/DR/C/0611 AND DISPOSED OF SEPERATELY. IT IS ASSUMED THAT THE MATERIAL CANNOT BE RE-USED AND IS TO BE REMOVED OFF-SITE.

SITE WIDE CUT AND FILL SUMMARY
(EXCLUDING SITE STRIP VOLUME)

AREA	2D AREA	GROSS CUT	GROSS FILL	NET CUT/FILL
FULL	20,030m²	41,902m³	1,810m³	40,092m³ CUT
Adjustment for use of site won material to form Network Rail Platform to formation as shown on dwg. RDB/ROC/ZZ/XX/DR/0611		-2,555m³	-	37,537m³ CUT

CUT & FILL VOLUMES ABOVE ARE BASED ON A REDUCED LEVEL DIG BETWEEN PROPOSED FORMATION (USING THE FOLLOWING CONSTRUCTION BUILD UPS) AND THE EXISTING GROUND FOLLOWING SITE STRIP AND CONSTRUCTION OF THE NETWORK RAIL ENABLING WORKS PLATFORM (RDB/ROC/ZZ/XX/DR/C/0611)

BUILD UP DEPTHS

PLATEAU FOOTPRINT	600mm
HAUL ROAD	665mm

PLATEAU BUILD UP DEPTH IS INDICATIVE ONLY AND TO BE CONFIRMED BY PILING CONTRACTOR. DEPTH FOR HAUL ROAD BASED ON LANDSCAPE ARCHITECTS LEVELS AND PAVEMENT TYPES (RDB/OPN/00/ZZ/DR/LA/210000 P01 & 210100 P01)

ISOPACHYTE CONTOURS & VOLUMETRIC
SCALE 1:500

REV	DATE	DETAILS	DRN	CHK
P01	19.05.23	FIRST ISSUE	ARJ	MN

DRAWING STATUS
PRELIMINARY

RIBA STAGE
STAGE 3

RoC CONSULTING
Commercial Wharf
6 Commercial Street
Manchester M15 4PZ
T 0161 214 5390
W rocconsulting.com

DRAWN	DATE	SCALES
ARJ	MAY 23	1:500
CHECKED	DATE	THE ABOVE SCALES APPLY WHEN PLOTTED AT A1 SIZE --DO NOT SCALE--
MN	MAY 23	
APPRVD.	DATE	EMAIL FOR DRAWINGS
MN	MAY 23	info@rocconsulting.com

CLIENT
FAR EAST CONSORTIUM INTERNATIONAL LTD

PROJECT TITLE
PLOTS NT02, NT03 & NT04
NORTHERN GATEWAY

DRAWING TITLE
ENABLING WORKS
PLATEAU LEVELS &
CUT-FILL ANALYSIS

DRAWING No.	REV.
RDB/ROC/ZZ/XX/DR/C/0612	P01

4328 © RgCp Ltd.

WORK IN PROGRESS

THIS DESIGN IS BASED ON STAGE 3 INFORMATION AS OF 19.05.23. ALL INFORMATION ON THIS DRAWING IS SUBJECT TO CHANGE AS THE SCHEME IS DEVELOPED AS THE FOLLOWING INFORMATION IS EITHER YET TO BE FINALISED.

- LANDSCAPE/ EXTERNAL WORKS LEVELS
- LANDSCAPE/ EXTERNAL WORKS FINISHES

THIS DRAWING IS THE PROPERTY OF RgCp. COPYRIGHT IS RESERVED BY THEM AND THE DRAWING IS ISSUED ON THE CONDITION THAT IT IS NOT COPIED, REPRODUCED, RETAINED OR DISCLOSED TO ANY UNAUTHORISED PERSON EITHER WHOLLY OR IN PART WITHOUT THE WRITTEN CONSENT OF RgCp

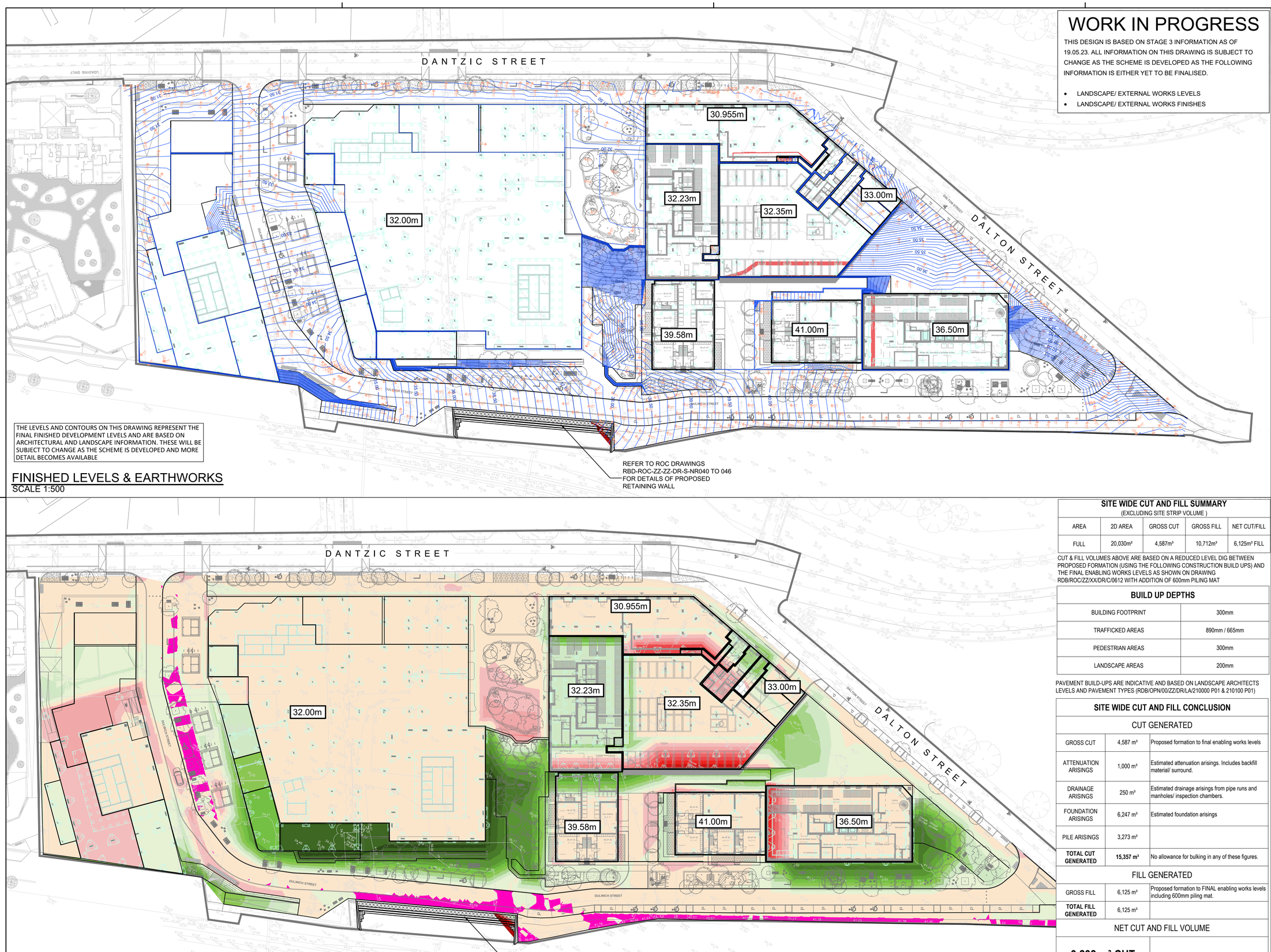
NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS, ENGINEERS AND SPECIALIST DRAWINGS AND SPECIFICATIONS.
3. ANY DISCREPANCIES SHOULD BE REPORTED TO THE ENGINEER IMMEDIATELY SO THAT CLARIFICATION CAN BE SOUGHT PRIOR TO THE COMMENCEMENT OF WORK.
4. THE PROPOSED SUBSTRUCTURE LAYOUT SHOWN ON THIS DRAWING IS FOR INFORMATION ONLY. REFER TO STRUCTURAL PLANS FOR PRECISE LOCATION SETTING OUT INFORMATION AND DETAILS.
5. THE PROPOSED FINISHED LEVELS SHOWN ON THIS DRAWING REPRESENT THE ENABLING WORKS FORMATION I.E. UNDERSIDE OF THE PROPOSED PILING PLATFORMS.

CUT / FILL BANDS

CUT		FILL	
	0.00		0.00 - 0.50m
	0.00 - 0.50m		0.50 - 1.00m
	0.50 - 1.00m		1.00 - 1.50m
	1.00 - 1.50m		1.50 - 2.00m
	1.50 - 2.00m		2.00 - 2.50m
	2.00 - 2.50m		2.50 - 3.00m
	2.50 - 3.00m		3.00 - 4.00m
	3.00 - 3.50m		4.00 - 5.00m
	3.50 - 4.00m		5.00 - 6.00m
	4.00 - 5.00m		6.00 - 7.00m
	5.00 - 6.00m		

BANDS INDICATE THE DEPTHS OF CUT & FILL BETWEEN THE PROPOSED FORMATION AND THE FINAL ENABLING WORKS LEVELS I.E. THOSE SHOWN ON DRAWING RDB/ROC/ZZ/XX/DR/C/0612 WITH THE ADDITION OF THE 600mm PILING MAT.



THE LEVELS AND CONTOURS ON THIS DRAWING REPRESENT THE FINAL FINISHED DEVELOPMENT LEVELS AND ARE BASED ON ARCHITECTURAL AND LANDSCAPE INFORMATION. THESE WILL BE SUBJECT TO CHANGE AS THE SCHEME IS DEVELOPED AND MORE DETAIL BECOMES AVAILABLE

REFER TO ROC DRAWINGS RBD-ROC-ZZ-ZZ-DR-S-NR040 TO 046 FOR DETAILS OF PROPOSED RETAINING WALL

FINISHED LEVELS & EARTHWORKS

SCALE 1:500

REFER TO ROC DRAWINGS RBD-ROC-ZZ-ZZ-DR-S-NR040 TO 046 FOR DETAILS OF PROPOSED RETAINING WALL

ISOPACHYTE CONTOURS & VOLUMETRIC

SCALE 1:500

SITE WIDE CUT AND FILL SUMMARY
(EXCLUDING SITE STRIP VOLUME)

AREA	2D AREA	GROSS CUT	GROSS FILL	NET CUT/FILL
FULL	20,030m²	4,587m³	10,712m³	6,125m³ FILL

CUT & FILL VOLUMES ABOVE ARE BASED ON A REDUCED LEVEL DIG BETWEEN PROPOSED FORMATION (USING THE FOLLOWING CONSTRUCTION BUILD UPS) AND THE FINAL ENABLING WORKS LEVELS AS SHOWN ON DRAWING RDB/ROC/ZZ/XX/DR/C/0612 WITH ADDITION OF 600mm PILING MAT

BUILD UP DEPTHS

BUILDING FOOTPRINT	300mm
TRAFFICKED AREAS	890mm / 665mm
PEDESTRIAN AREAS	300mm
LANDSCAPE AREAS	200mm

PAVEMENT BUILD-UPS ARE INDICATIVE AND BASED ON LANDSCAPE ARCHITECTS LEVELS AND PAVEMENT TYPES (RDB/OPN/00/ZZ/DR/LA/210000 P01 & 210100 P01)

SITE WIDE CUT AND FILL CONCLUSION

CUT GENERATED		
GROSS CUT	4,587 m³	Proposed formation to final enabling works levels
ATTENUATION ARISINGS	1,000 m³	Estimated attenuation arisings. Includes backfill material/ surround.
DRAINAGE ARISINGS	250 m³	Estimated drainage arisings from pipe runs and manholes/ inspection chambers.
FOUNDATION ARISINGS	6,247 m³	Estimated foundation arisings
PILE ARISINGS	3,273 m³	
TOTAL CUT GENERATED	**15,357 m³**	No allowance for bulking in any of these figures.
FILL GENERATED		
GROSS FILL	6,125 m³	Proposed formation to FINAL enabling works levels including 600mm piling mat.
TOTAL FILL GENERATED	6,125 m³	
NET CUT AND FILL VOLUME		
9,232 m³ CUT		

REV.	DATE	DETAILS	DRN.	CHK.
P01	19.05.23	FIRST ISSUE	ARJ	MN

DRAWING STATUS
PRELIMINARY

RIBA STAGE
STAGE 3

RoC CONSULTING
Commercial Wharf
6 Commercial Street
Manchester M15 4PZ
T 0161 214 5390
W rocconsulting.com

DRAWN ARJ	DATE MAY 23	SCALES 1:500
CHECKED MN	DATE MAY 23	THE ABOVE SCALES APPLY WHEN PLOTTED AT A1 SIZE --DO NOT SCALE--
APPRVD. MN	DATE MAY 23	EMAIL FOR DRAWINGS info@rocconsulting.com

CLIENT
FAR EAST CONSORTIUM INTERNATIONAL LTD

PROJECT TITLE
PLOTS NT02, NT03 & NT04
NORTHERN GATEWAY

DRAWING TITLE
DEVELOPMENT FINISHED LEVELS & CUT-FILL ANALYSIS

DRAWING No.	REV.
RDB/ROC/ZZ/XX/DR/C/0613	P01

4328 © RgCp Ltd.

APPENDIX E
GENERIC ASSESSMENT CRITERIA

Appendix E.1 Commercial Reuse Screening Values (for use beneath buildings & hardstanding)

Generic assessment criteria for human health: residential scenario without home-grown produce

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009[1]. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009[2]. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014, the publication of Category 4 Screening Levels (C4SL)[3,4], as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)[5] used in the generation of SGVs.

C4SL were initially published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010[3]). Further C4SL were published in 2021 for vinyl chloride, tetrachloroethene (PCE) and trichloroethene (TCE). Where a C4SL has been published, the RSK GAC duplicates the C4SL using all input parameters within the SP1010 final project report[3] and associated chemical specific reports[6], and adopts them as GAC for these substances. Due to the use of decimal places rather than significant figures applied to the Contaminated Land Exposure Assessment (CLEA) tool outputs, the GAC presented may be marginally differently to the C4SL values, however any differences between the values are minimal and would not equate to an unacceptable risk.

For all other substances the C4SL exposure modifications relevant for residential without home-grown produce end use have been applied to the current RSK GAC. These include alterations to daily inhalation rates for residential and commercial scenarios, reducing soil adherence factors in children (age classes 1 to 12 only) and reducing exposure frequency for dermal contact outdoors.

The RSK GAC have also been revised with updated toxicology published by LQM/CIEH in 2015[7] or by the USEPA[14], where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the CLEA tool v1.071, supporting EA guidance[5,8,9] and revised exposure scenarios published for the C4SL[3]. The SAC are also termed GAC.

Conceptual model

In accordance with SR3[5], the residential without home-grown produce scenario considers risks to a female child between the ages of 0 and 6 years old as the highest risk scenario. In

accordance with Box 3.1 of SR3[5], the pathways considered for production of the SAC in the residential without home-grown produce scenario are

- direct soil and dust ingestion in areas of soft landscaping
- dermal contact with soil and indoor dust
- inhalation of indoor and outdoor dust and vapours.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium[1], the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh}, are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase[9]. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached[9]. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required[9]:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway contribution is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances, the vapour pathway exposure should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook[9], this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook[9], which explains how to calculate an effective assessment criterion manually.

SR3[5] states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface to indoor air correction factor of 10 into the CLEA model chemical database for all petroleum hydrocarbon fractions (including BTEX, trimethylbenzenes and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7[10], the EA TOX[1] reports, the C4SL SP1010 project report and associated chemical specific reports[3,6], the 2015 LQM/CIEH report[7] or the USEPA IRIS database[14]. Where a LLTC[3,6] has been published for a substance, RSK has used these input parameters to derive the RSK GAC. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene, barium and methyl tertiary-butyl ether (MTBE) were obtained from the CL:AIRE Soil Generic Assessment Criteria report[11].

For TPH, aromatic hydrocarbons C_5–C_8 were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the residential without home-grown produce scenario, the CLEA default building is a small, two-storey terrace house with a concrete ground-bearing slab. SR3[5] notes this residential building type to be the most conservative in terms of potential for vapour intrusion. The building parameters used in the production of the RSK GACs are the default CLEA v1.06 inputs presented in Table 3.3 of SR3[3], with a dust loading factor detailed in Section 9.3 of SR3[5]. The parameters for a sandy loam soil type were used in line with Table 4.4 of SR3[5]. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for this SOM, RSK has produced an additional set of GAC for SOM of 1% and 2.5% for all substances using the CLEA tool.

Summary of modifications to the default CLEA SR3[5] input parameters for residential without home-grown produce

In summary, the RSK GAC were produced using the default input parameters for soil properties, the air dispersion model, building properties and the vapour model detailed in SR3[5]. Modifications to the default SR3[5] exposure scenarios based on the C4SL exposure scenarios[3] are presented in Table 2 below.

The final selected GAC are presented by pathway in Table 3 and the combined GAC in Table 4.

Figure 1: Conceptual model for CLEA residential scenario without home-grown produce

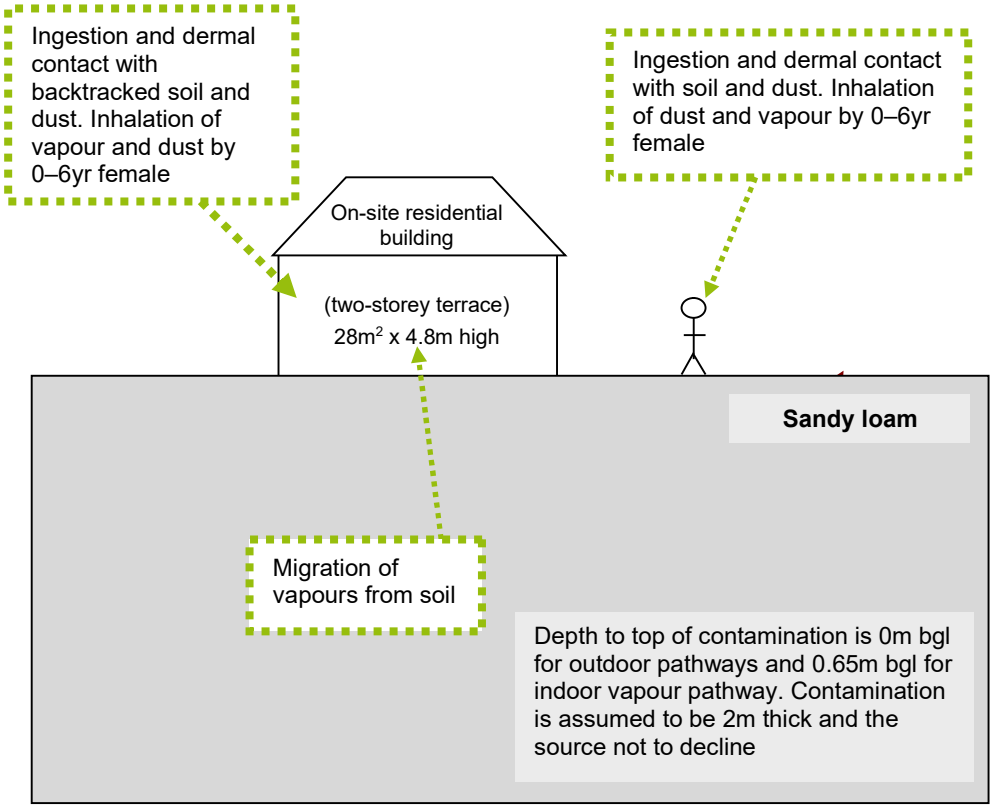


Table 1: Exposure assessment parameters for residential scenario without home-grown produce – inputs for CLEA model

Parameter	Value	Justification
Land use	Residential without home-grown produce	Chosen land use
Receptor	Female child	Key generic assumption given in Box 3.1, SR3[5]
Building	Small terraced house	Key generic assumption given in Box 3.1, SR3[5]. Small, two-storey terraced house chosen, as it is the most conservative residential building type in terms of protection from vapor intrusion (Section 3.4.6, SR3)[5]
Soil type	Sandy loam	Most common UK soil type (Section 4.3.1, from Table 3.1, SR3)[5]
Start age class (AC)	1	Range of age classes corresponding to key generic assumption that the critical receptor is a young female child aged 0–6. From Box 3.1, SR3[5]
End AC	6	
SOM (%)	6	Representative of sandy loamy soil according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents'[13]
	1	To provide SAC for sites where SOM <6% as often observed by RSK
	2.5	
pH	7	Model default

Table 2: Residential without home-grown produce – modified receptor data

Parameter	Unit	Age class					
		1	2	3	4	5	6
Soil to skin adherence factor – (outdoor)	mg soil/cm^2 skin	0.1	0.1	0.1	0.1	0.1	0.1
Justification		Table 3.5, SP1010[3]					
Inhalation rate	m^3 day^{-1}	5.4	8.0	8.9	10.1	10.1	10.1
Justification		Mean value USEPA, 2011[12]; Table 3.2, SP1010[3]					
Notes: For **cadmium**, the exposure assessment for a residential land use is based on estimates representative of lifetime exposure AC1-18. This is because the TDI_{oral} and TDI_{inh} are based on considerations of the kidney burden accumulated over 50 years. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period. See the Environment Agency Science Report SC05002/ TOX 3[1], Science Report SC050021/Cadmium SGV[1] and the project report SP1010[3] for more information.							

References

1. Environment Agency (2009), 'Science Reports SC050021 - SGV and TOX reports for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'; 'Supplementary information for the derivation of SGV for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs', and 'Contaminants in soil: updated collation of toxicological data and intake values for humans: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'. Available at: https://www.gov.uk/government/publications/contaminants-in-soil-updated-collation-of-toxicological-data-and-intake-values-for-humans and https://www.gov.uk/government/publications/land-contamination-soil-guideline-values-sgvs (accessed 4 February 2015)

2. Nathanial, C. P., McCaffrey, C., Ashmore, M., Cheng, Y., Gillet, A. G., Ogden, R. C. and Scott, D. (2009), *LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment*, second edition (Nottingham: Land Quality Press).

3. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination', Revision 2, DEFRA research project SP1010.

4. Department for Environment, Food and Rural Affairs (Defra) (2014), 'SP1010: Development of Category 4 Screening Levels for assessment of land affected by contamination – Policy Companion Document', Revision 2.

5. Environment Agency (2009), *Science Report – SC050021/SR3. Updated technical background to the CLEA model* (Bristol: Environment Agency).

6. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Appendices C to H). DEFRA research project SP1010'. CL:AIRE (2021). Category 4 Screening Levels: Trichloroethene (TCE). CL:AIRE, London. ISBN 978-1-905046-38-6. CL:AIRE (2021). Category 4 Screening Levels: Vinyl Chloride. CL:AIRE, London. ISBN 978-1-905046-36-2. CL:AIRE (2021). Category 4 Screening Levels: Tetrachloroethene (PCE). CL:AIRE, London. ISBN 978-1-905046-37-9.

7. Nathanial, C. P., McCaffrey, C., Gillet, A. G., Ogden, R. C. and Nathanial, J. F. (2015), *The LQM/CIEH S4ULs for Human Health Risk Assessment* (Nottingham: Land Quality Press).

8. Environment Agency (2009), *Human health toxicological assessment of contaminants in soil. Science Report – Final SC050021/SR2* (Bristol: Environment Agency).

9. Environment Agency (2009), *Science Report – SC050021/SR4 CLEA Software (version 1.05) Handbook* (Bristol: Environment Agency).

10. Environment Agency (2008), *Science Report SC050021/SR7. Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values* (Bristol: Environment Agency).

11. CL:AIRE (2010), *Soil Generic Assessment Criteria for Human Health Risk Assessment* (London: CL:AIRE).

12. USEPA (2011), *Exposure factors handbook*, EPA/600/R-090/052F (Washington, DC: Office of Research and Development).

13. Environment Agency (2009), 'Changes made to the CLEA framework documents after the three-month evaluation period in 2008', released January 2009.

14. USEPA (2010). Hydrogen cyanide and cyanide salts. Integrated Risk Information Systems (IRIS) Chemical Assessment Summary. September 2010. https://www.epa.gov/iris (accessed 9 December 2015)

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITHOUT HOME-GROWN PRODUCE

Table 3

Human Health Generic Assessment Criteria by Pathway for Residential Scenario Without Home-Grown Produce

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Metals													
Arsenic	(a,b)	3.99E+01	5.26E+02	NR	NR	3.99E+01	5.26E+02	NR	NR	3.99E+01	5.26E+02	NR	NR
Barium	(b)	1.35E+03	NR	NR	NR	1.35E+03	NR	NR	NR	1.35E+03	NR	NR	NR
Beryllium		1.56E+02	1.72E+00	NR	NR	1.56E+02	1.72E+00	NR	NR	1.56E+02	1.72E+00	NR	NR
Boron		1.08E+04	5.20E+06	NR	NR	1.08E+04	5.20E+06	NR	NR	1.08E+04	5.20E+06	NR	NR
Cadmium	(a)	1.95E+02	4.88E+02	1.49E+02	NR	1.95E+02	4.88E+02	1.49E+02	NR	1.95E+02	4.88E+02	1.49E+02	NR
Chromium (III) - trivalent	(c)	1.98E+04	9.07E+02	NR	NR	1.98E+04	9.07E+02	NR	NR	1.98E+04	9.07E+02	NR	NR
Chromium (VI) - hexavalent	(a,d)	5.91E+01	2.06E+01	NR	NR	5.91E+01	2.06E+01	NR	NR	5.91E+01	2.06E+01	NR	NR
Copper		1.08E+04	1.41E+04	7.13E+03	NR	1.08E+04	1.41E+04	7.13E+03	NR	1.08E+04	1.41E+04	7.13E+03	NR
Lead	(a)	3.14E+02	NR	NR	NR	3.14E+02	NR	NR	NR	3.14E+02	NR	NR	NR
Elemental Mercury (Hg^0)	(d)	NR	2.41E-01	NR	4.31E+00	NR	5.74E-01	NR	1.07E+01	NR	1.25E+00	NR	2.58E+01
Inorganic Mercury (Hg^{2+})		5.71E+01	3.63E+03	5.62E+01	NR	5.71E+01	3.63E+03	5.62E+01	NR	5.71E+01	3.63E+03	5.62E+01	NR
Methyl Mercury (Hg^{4+})		1.80E+01	1.87E+01	9.16E+00	7.33E+01	1.80E+01	3.62E+01	1.20E+01	1.42E+02	1.80E+01	7.68E+01	1.46E+01	3.04E+02
Nickel	(d)	1.88E+02	1.81E+02	NR	NR	1.88E+02	1.81E+02	NR	NR	1.88E+02	1.81E+02	NR	NR
Selenium	(b)	4.31E+02	NR	NR	NR	4.31E+02	NR	NR	NR	4.31E+02	NR	NR	NR
Vanadium		1.17E+03	1.46E+03	NR	NR	1.17E+03	1.46E+03	NR	NR	1.17E+03	1.46E+03	NR	NR
Zinc	(b)	4.05E+04	3.63E+07	NR	NR	4.05E+04	3.63E+07	NR	NR	4.05E+04	3.63E+07	NR	NR
Cyanide (free)		4.03E+01	1.37E+04	4.02E+01	NR	4.03E+01	1.37E+04	4.02E+01	NR	4.03E+01	1.37E+04	4.02E+01	NR
Volatile Organic Compounds													
Benzene	(a)	7.36E+01	9.01E-01	8.90E-01	1.22E+03	7.36E+01	1.68E+00	1.64E+00	2.26E+03	7.36E+01	3.48E+00	3.33E+00	4.71E+03
Toluene		2.87E+04	9.08E+02	8.80E+02	8.69E+02	2.87E+04	2.00E+03	1.87E+03	1.92E+03	2.87E+04	4.55E+03	3.93E+03	4.36E+03
Ethylbenzene		1.29E+04	8.34E+01	8.29E+01	5.18E+02	1.29E+04	1.96E+02	1.93E+02	1.22E+03	1.29E+04	4.58E+02	4.42E+02	2.84E+03
Xylene - m		2.32E+04	8.25E+01	8.22E+01	6.25E+02	2.32E+04	1.95E+02	1.93E+02	1.47E+03	2.32E+04	4.56E+02	4.47E+02	3.46E+03
Xylene - o		2.32E+04	8.87E+01	8.83E+01	4.78E+02	2.32E+04	2.08E+02	2.06E+02	1.12E+03	2.32E+04	4.86E+02	4.76E+02	2.62E+03
Xylene - p		2.32E+04	7.93E+01	7.90E+01	5.76E+02	2.32E+04	1.86E+02	1.85E+02	1.35E+03	2.32E+04	4.36E+02	4.28E+02	3.17E+03
Total xylene		2.32E+04	7.93E+01	7.90E+01	6.25E+02	2.32E+04	1.86E+02	1.85E+02	1.47E+03	2.32E+04	4.36E+02	4.28E+02	3.46E+03
Methyl tertiary-Butyl ether (MTBE)		3.87E+04	1.04E+02	1.04E+02	2.04E+04	3.87E+04	1.69E+02	1.69E+02	3.31E+04	3.87E+04	3.21E+02	3.19E+02	6.27E+04
Trichloroethene (TCE)		9.73E-03	3.61E-02	NR	1.54E+03	2.04E-02	7.57E-02	NR	3.22E+03	4.52E-02	1.68E-01	NR	7.14E+03
Tetrachloroethene (PCE)		1.80E+03	3.19E-01	3.19E-01	4.24E+02	1.80E+03	7.15E-01	7.15E-01	9.51E+02	1.80E+03	1.64E+00	1.64E+00	2.18E+03
1,1,1-Trichloroethane		7.74E+04	9.01E+00	9.01E+00	1.43E+03	7.74E+04	1.84E+01	1.84E+01	2.92E+03	7.74E+04	4.04E+01	4.04E+01	6.39E+03
1,1,1,2 Tetrachloroethane		7.34E+02	1.54E+00	1.53E+00	2.60E+03	7.34E+02	3.56E+00	3.55E+00	6.02E+03	7.34E+02	8.29E+00	8.20E+00	1.40E+04
1,1,2,2-Tetrachloroethane		7.34E+02	3.92E+00	3.90E+00	2.67E+03	7.34E+02	8.04E+00	7.95E+00	5.46E+03	7.34E+02	1.76E+01	1.72E+01	1.20E+04
Carbon Tetrachloride		5.15E+02	2.58E-02	2.58E-02	1.52E+03	5.15E+02	5.65E-02	5.64E-02	3.32E+03	5.15E+02	1.28E-01	1.28E-01	7.54E+03
1,2-Dichloroethane		1.55E+01	9.20E-03	9.20E-03	3.41E+03	1.55E+01	1.33E-02	1.33E-02	4.91E+03	1.55E+01	2.28E-02	2.27E-02	8.43E+03
Vinyl Chloride (chloroethene)		4.85E+00	1.47E-02	1.47E-02	1.36E+03	4.85E+00	1.90E-02	1.90E-02	1.76E+03	4.85E+00	2.91E-02	2.89E-02	2.69E+03
1,2,4-Trimethylbenzene		NR	5.58E+00	NR	4.74E+02	NR	1.29E+01	NR	1.16E+03	NR	2.69E+01	NR	2.76E+03
1,3,5-Trimethylbenzene	(e)	NR	NR	NR	2.30E+02	NR	NR	NR	5.52E+02	NR	NR	NR	1.30E+03
Semi-Volatile Organic Compounds													
Acenaphthene		7.64E+03	4.86E+04	6.60E+03	5.70E+01	7.64E+03	1.18E+05	7.17E+03	1.41E+02	7.64E+03	2.68E+05	7.43E+03	3.36E+02
Acenaphthylene		7.65E+03	4.59E+04	6.55E+03	8.61E+01	7.65E+03	1.11E+05	7.15E+03	2.12E+02	7.65E+03	2.53E+05	7.42E+03	5.06E+02
Anthracene		3.82E+04	1.53E+05	3.06E+04	1.17E+00	3.82E+04	3.77E+05	3.47E+04	2.91E+00	3.82E+04	8.76E+05	3.66E+04	6.96E+00
Benzo(a)anthracene		1.98E+01	2.47E+01	1.10E+01	1.71E+00	1.98E+01	4.37E+01	1.36E+01	4.28E+00	1.98E+01	6.26E+01	1.50E+01	1.03E+01
Benzo(a)pyrene	(a)	5.34E+00	3.51E+01	NR	9.11E-01	5.34E+00	3.77E+01	NR	2.28E+00	5.34E+00	3.89E+01	NR	5.46E+00
Benzo(b)fluoranthene		4.97E+00	1.93E+01	3.95E+00	1.22E+00	4.97E+00	2.13E+01	4.03E+00	3.04E+00	4.97E+00	2.22E+01	4.06E+00	7.29E+00
Benzo(g,h,i)perylene		4.38E+02	1.87E+03	3.55E+02	1.54E-02	4.38E+02	1.94E+03	3.58E+02	3.85E-02	4.38E+02	1.97E+03	3.59E+02	9.23E-02
Benzo(k)fluoranthene		1.31E+02	5.41E+02	1.06E+02	6.87E-01	1.31E+02	5.76E+02	1.07E+02	1.72E+00	1.31E+02	5.91E+02	1.07E+02	4.12E+00
Chrysene		3.95E+01	1.19E+02	2.97E+01	4.40E-01	3.95E+01	1.49E+02	3.12E+01	1.10E+00	3.95E+01	1.66E+02	3.19E+01	2.64E+00

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - RESIDENTIAL WITHOUT HOME-GROWN PRODUCE

Table 3

Human Health Generic Assessment Criteria by Pathway for Residential Scenario Without Home-Grown Produce

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Dibenzo(a,h)anthracene		3.95E-01	1.45E+00	3.10E-01	3.93E-03	3.95E-01	1.64E+00	3.18E-01	9.82E-03	3.95E-01	1.74E+00	3.22E-01	2.36E-02
Fluoranthene		1.59E+03	3.83E+04	1.53E+03	1.89E+01	1.59E+03	8.87E+04	1.56E+03	4.73E+01	1.59E+03	1.83E+05	1.58E+03	1.13E+02
Fluorene		5.09E+03	6.20E+03	2.80E+03	3.09E+01	5.09E+03	1.53E+04	3.82E+03	7.65E+01	5.09E+03	3.62E+04	4.47E+03	1.83E+02
Indeno(1,2,3-cd)pyrene		5.65E+01	2.12E+02	4.46E+01	6.13E-02	5.65E+01	2.38E+02	4.56E+01	1.53E-01	5.65E+01	2.50E+02	4.60E+01	3.68E-01
Naphthalene		2.50E+03	2.33E+01	2.31E+01	7.64E+01	2.50E+03	5.58E+01	5.46E+01	1.83E+02	2.50E+03	1.31E+02	1.25E+02	4.32E+02
Phenanthrene		1.58E+03	7.17E+03	1.30E+03	3.60E+01	1.58E+03	1.76E+04	1.45E+03	8.96E+01	1.58E+03	4.07E+04	1.52E+03	2.14E+02
Pyrene		3.82E+03	8.79E+04	3.66E+03	2.20E+00	3.82E+03	2.04E+05	3.75E+03	5.49E+00	3.82E+03	4.23E+05	3.79E+03	1.32E+01
Phenol		6.48E+04	4.58E+02	4.55E+02	2.42E+04	6.48E+04	6.95E+02	6.88E+02	3.81E+04	6.48E+04	1.19E+03	1.17E+03	7.03E+04
Total Petroleum Hydrocarbons													
Aliphatic hydrocarbons EC_5-EC_6		3.23E+05	4.24E+01	4.24E+01	3.04E+02	3.23E+05	7.79E+01	7.79E+01	5.58E+02	3.23E+05	1.61E+02	1.61E+02	1.15E+03
Aliphatic hydrocarbons >EC_6-EC_8		3.23E+05	1.04E+02	1.04E+02	1.44E+02	3.23E+05	2.31E+02	2.31E+02	3.22E+02	3.23E+05	5.29E+02	5.29E+02	7.36E+02
Aliphatic hydrocarbons >EC_8-EC_{10}		6.45E+03	2.68E+01	2.68E+01	7.77E+01	6.45E+03	6.55E+01	6.53E+01	1.90E+02	6.45E+03	1.56E+02	1.55E+02	4.51E+02
Aliphatic hydrocarbons >EC_{10}-EC_{12}		6.45E+03	1.33E+02	1.32E+02	4.75E+01	6.45E+03	3.31E+02	3.27E+02	1.18E+02	6.45E+03	7.93E+02	7.67E+02	2.83E+02
Aliphatic hydrocarbons >EC_{12}-EC_{16}		6.45E+03	1.11E+03	1.06E+03	2.37E+01	6.45E+03	2.78E+03	2.42E+03	5.91E+01	6.45E+03	6.67E+03	4.37E+03	1.42E+02
Aliphatic hydrocarbons >EC_{16}-EC_{35}	(b)	6.50E+04	NR	NR	8.48E+00	9.25E+04	NR	NR	2.12E+01	1.11E+05	NR	NR	5.09E+01
Aliphatic hydrocarbons >EC_{35}-EC_{44}	(b)	6.50E+04	NR	NR	8.48E+00	9.25E+04	NR	NR	2.12E+01	1.11E+05	NR	NR	5.09E+01
Aromatic hydrocarbons >EC_8-EC_{10}		2.58E+03	4.74E+01	4.72E+01	6.13E+02	2.58E+03	1.16E+02	1.15E+02	1.50E+03	2.58E+03	2.77E+02	2.69E+02	3.58E+03
Aromatic hydrocarbons >EC_{10}-EC_{12}		2.58E+03	2.58E+02	2.52E+02	3.64E+02	2.58E+03	6.39E+02	5.94E+02	8.99E+02	2.58E+03	1.52E+03	1.24E+03	2.15E+03
Aromatic hydrocarbons >EC_{12}-EC_{16}		2.58E+03	2.85E+03	1.80E+03	1.69E+02	2.58E+03	7.07E+03	2.30E+03	4.19E+02	2.58E+03	1.68E+04	2.48E+03	1.00E+03
Aromatic hydrocarbons >EC_{16}-EC_{21}	(b)	1.86E+03	NR	NR	5.37E+01	1.90E+03	NR	NR	1.34E+02	1.92E+03	NR	NR	3.21E+02
Aromatic hydrocarbons >EC_{21}-EC_{35}	(b)	1.93E+03	NR	NR	4.83E+00	1.93E+03	NR	NR	1.21E+01	1.93E+03	NR	NR	2.90E+01
Aromatic hydrocarbons >EC_{35}-EC_{44}	(b)	1.93E+03	NR	NR	4.83E+00	1.93E+03	NR	NR	1.21E+01	1.93E+03	NR	NR	2.90E+01

Notes:

EC - equivalent carbon. GrAC - groundwater assessment criteria. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%.

Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.

Calculated SAC does not exceed the soil saturation limit.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for boron and selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC16 should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The Oral SAC should be adopted for zinc and benzo(a)pyrene.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.

(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

Table 4
Human health generic assessment criteria for residential without home-grown produce

Compound	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	40	40	40
Barium	1,300	1,300	1,300
Beryllium	1.7	1.7	1.7
Boron	11,000	11,000	11,000
Cadmium	149	149	149
Chromium (III) - trivalent	910	910	910
Chromium (VI) - hexavalent	21	21	21
Copper	7,100	7,100	7,100
Lead	310	310	310
Elemental Mercury (Hg^0)	0.2	0.6	1.2
Inorganic Mercury (Hg^{2+})	56	56	56
Methyl Mercury (Hg^{4+})	9	12	15
Nickel	180	180	180
Selenium	430	430	430
Vanadium	1,200	1,200	1,200
Zinc	40,000	40,000	40,000
Cyanide (free)	40	40	40
Volatile Organic Compounds			
Benzene	0.9	1.6	3.3
Toluene	900 (869)	1,900	3,900
Ethylbenzene	80	190	440
Xylene - m	80	190	450
Xylene - o	90	210	480
Xylene - p	80	180	430
Total xylene	80	180	430
Methyl tertiary-Butyl ether (MTBE)	100	170	320
Trichloroethene (TCE)	0.010	0.020	0.045
Tetrachloroethene (PCE)	0.32	0.71	1.64
1,1,1-Trichloroethane	9.0	18.4	40.4
1,1,1,2 Tetrachloroethane	1.5	3.5	8.2
1,1,2,2-Tetrachloroethane	3.9	8.0	17.2
Carbon Tetrachloride	0.026	0.056	0.128
1,2-Dichloroethane	0.009	0.013	0.023
Vinyl Chloride (chloroethene)	0.015	0.019	0.029
1,2,4-Trimethylbenzene	5.6	12.9	26.9
1,3,5-Trimethylbenzene	NR	NR	NR
Semi-Volatile Organic Compounds			
Acenaphthene	6,600 (57)	7,200	7,400
Acenaphthylene	6,600 (86)	7,200	7,400
Anthracene	31,000 (1.17)	35,000	37,000
Benzo(a)anthracene	11.0	13.6	15.0
Benzo(a)pyrene	5.3	5.3	5.3
Benzo(b)fluoranthene	4.0	4.0	4.1
Benzo(g,h,i)perylene	355	358	359
Benzo(k)fluoranthene	106	107	107
Chrysene	30	31	32
Dibenzo(a,h)anthracene	0.31	0.32	0.32
Fluoranthene	1,500	1,600	1,600
Fluorene	2,800 (31)	3,800 (77)	4,500 (183)
Indeno(1,2,3-cd)pyrene	45	46	46
Naphthalene	23	55	125
Phenanthrene	1,300 (36)	1,450	1,520
Pyrene	3,700	3,800	3,800
Phenol	440*	688	1,170
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC_5-EC_6	42	78	161
Aliphatic hydrocarbons >EC_6-EC_8	100	230	530
Aliphatic hydrocarbons >EC_8-EC_{10}	27	65	155
Aliphatic hydrocarbons >EC_{10}-EC_{12}	130 (48)	330 (118)	770 (283)
Aliphatic hydrocarbons >EC_{12}-EC_{16}	1,100 (24)	2,400 (59)	4,400 (142)
Aliphatic hydrocarbons >EC_{16}-EC_{35}	65,000 (8)	92,000 (21)	111,000
Aliphatic hydrocarbons >EC_{35}-EC_{44}	65,000 (8)	92,000 (21)	111,000
Aromatic hydrocarbons >EC_8-EC_{10}	47	115	269
Aromatic hydrocarbons >EC_{10}-EC_{12}	300	600	1,200
Aromatic hydrocarbons >EC_{12}-EC_{16}	1,800 (169)	2,300 (419)	2,500
Aromatic hydrocarbons >EC_{16}-EC_{21}	1,900	1,900	1,900
Aromatic hydrocarbons >EC_{21}-EC_{35}	1,900	1,900	1,900
Aromatic hydrocarbons >EC_{35}-EC_{44}	1,900	1,900	1,900
Minerals			
Asbestos	Stage 1 test – No asbestos detected with ID; Stage 2 test - <0.001% dry weight (exceedance of either equates to an exceedance of the GAC)[1]		

Notes:

'-' Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.

NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used

EC - equivalent carbon. SAC - soil assessment criteria.

[1] LOD for weight of asbestos per unit weight of soil calculated on a dry weight basis using PLM, handpicking and gravimetry.

The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58.
1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3.

(VALUE IN BRACKETS)

RSK has adopted an approach for petroleum hydrocarbons in accordance with LQM/CIEH whereby the concentration modelled for each petroleum hydrocarbon fraction has been tabulated as the SAC with the corresponding solubility or vapour saturation limits given in brackets.

Appendix E.2 Residential Without Plant Uptake Screening Values (for use beneath areas of proposed soft landscaping)

Generic assessment criteria for human health: public open space (public park) scenario

Background

RSK's generic assessment criteria (GAC) were initially prepared following the publication by the Environment Agency (EA) of soil guideline value (SGV) and toxicological (TOX) reports, and associated publications in 2009[1]. RSK GAC were updated following the publication of GAC by LQM/CIEH in 2009[2]. RSK GAC are periodically revised when updated information on toxicological, land use or receptor parameters is published.

Updates to the RSK GAC

In 2014 the publication of Category 4 Screening Levels (C4SL)[3,4], as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3)[5] used in the generation of SGVs. The publication of C4SL introduced two new land-use scenarios relating to public open spaces.

C4SL were initially published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010[3]). Further C4SL were published in 2021 for vinyl chloride, tetrachloroethene (PCE) and trichloroethene (TCE). Where a C4SL has been published, the RSK GAC duplicates the C4SL using all input parameters within the SP1010 final project report[3] and associated chemical specific reports[6], and adopts them as GAC for these substances. Due to the use of decimal places rather than significant figures applied to the Contaminated Land Exposure Assessment (CLEA) tool outputs, the GAC presented may be marginally differently to the C4SL values, however any differences between the values are minimal and would not equate to an unacceptable risk.

For all other substances the C4SL exposure modifications have been applied. The RSK GAC have also been produced with updated toxicology published by LQM/CIEH in 2015[7] or by the USEPA[14], where a C4SL has not been published.

RSK GAC derivation for metals and organic compounds

Model selection

Soil assessment criteria (SAC) were calculated using the CLEA tool v1.071, supporting EA guidance[5,8,9] and revised exposure scenarios published for the C4SL[3].

Conceptual model

This GAC derivation considers POS_{Park} be used for the following scenarios:

- family visits and picnics
- children's play areas
- sporting activities such as football on an informal basis (not considered as a dedicated sports pitch)

- dog walking.

The POS_{Park} scenario considers risk to a child receptor (female) between the ages of 0 and 6 years old. In accordance with Section 3.6.4.3 of the SP1010 project report[3], the pathways considered for production of SAC in the POS_{Park} scenario are

- ingestion of soil outdoors
- dermal contact with soil outdoors
- inhalation of dust outdoors
- inhalation of vapours outdoors.

Figure 1 is a conceptual model illustrating these linkages.

In line with guidance in the EA SGV report for cadmium[1], the RSK GAC for cadmium has been derived based on estimates representative of lifetime exposure. Although young children are generally more likely to have higher exposures to soil contaminants, the renal toxicity of cadmium, and the derivation of the TDI_{oral} and TDI_{inh}, are based on considerations of the kidney burden accumulated over 50 years or so. It is therefore reasonable to consider exposure not just in childhood but averaged over a longer period.

With respect to volatilisation, the CLEA model assumes a simple linear partitioning of a chemical in the soil between the sorbed, dissolved and vapour phase[9]. The upper boundaries of this partitioning are represented by the maximum aqueous solubility and pure saturated vapour concentration of the chemical. The CLEA model estimates saturated soil concentrations where these limits are reached[9]. The CLEA software uses a traffic light system to identify when individual and/or combined assessment criteria exceed the lower of either the aqueous- or vapour-based soil saturation limits. Model output cells are flagged red where the saturated soil concentration has been exceeded and the contribution of the indoor and outdoor vapour pathway to total exposure is greater than 10%. In this case, further consideration of the following is required[9]:

- Free phase contamination may be present.
- Exposure from the vapour pathways will be over-predicted by the model, as in reality the vapour phase concentration will not increase at concentrations above saturation limits
- Where the vapour pathway is greater than 90%, it is unlikely the relevant health criteria value (HCV) will be exceeded at soil concentrations at least a factor of ten higher than the relevant HCV.

Where the vapour pathway is the predominant pathway (contributes greater than 90% of exposure) or the only exposure route considered and the cell is highlighted red (SAC exceeds saturation limit), the risk based on the assumed conceptual model is likely to be negligible, as the vapour risk is assumed to be tolerable at maximum possible soil concentrations. In such circumstances the vapour pathway should be considered based on the presence of free phase or non-aqueous phase liquid sources and the measured concentrations of volatile organic compounds (VOC) in the vapour phase. Screening could be considered based on setting the SAC as the modelled soil saturation limits. However, as stated within the CLEA handbook[9], this is likely to not be practical in many cases because of the very low saturation limits and, in any case, is highly conservative.

It should also be noted that for mixtures of compounds, free phase may be present where soil (or groundwater) concentrations are well below saturation limits for individual compounds.

Where the vapour pathway is only one of the exposure pathways considered, an additional approach can then be utilised as detailed within Section 4.12 of the CLEA model handbook[9], which explains how to calculate an effective assessment criterion manually.

SR3[5] states that, as a general rule of thumb, it is recognised that estimating vapour phase concentrations from dissolved and sorbed phase contamination by petroleum hydrocarbons are at least a factor of ten higher than those likely to be measured on-site. RSK has therefore applied an empirical subsurface correction factor of 10 into the CLEA chemical database for all petroleum hydrocarbons (including BTEX, trimethylbenzenes, and the polycyclic aromatic hydrocarbons (PAH) naphthalene, acenaphthene and acenaphthylene) to reduce this conservatism.

Input selection

The most up-to-date published chemical and toxicological data was obtained from EA Report SC050021/SR7[10], the EA TOX[1] reports, the C4SL SP1010 project report and associated chemical specific reports[3,6], the 2015 LQM/CIEH report[7] or the USEPA IRIS database[14]. Where a LLTC[3,6] has been published for a substance, RSK has used these input parameters to derive the RSK GAC. Toxicological and specific chemical parameters for 1,2,4-trimethylbenzene, barium and methyl tertiary-butyl ether (MTBE) were obtained from the CL:AIRE Soil Generic Assessment Criteria report[11].

For TPH, aromatic hydrocarbons C_5–C_8 were not modelled, as this range comprises benzene (>EC5-EC7) and toluene (>EC7-EC8), which are modelled separately.

Physical parameters

For the POS_{Park} scenario, project report SP1010[3] considers there to be no buildings with the public park, the park being a relatively large area (>0.5ha) of predominantly grassed open space with no more than 25% of exposed soil. The input parameters were based on the air dispersion model and the vapour model detailed in SR3[5]. Full details of the land-use scenario are presented in Table 3.7 of project report SP1010[3].

The parameters for a sandy loam soil type were used in line with SR3[5]. This includes a value of 6% for the percentage of soil organic matter (SOM) within the soil. In RSK's experience, this is rather high for many sites. To avoid undertaking site-specific risk assessments for this parameter, RSK has produced an additional set of SAC for an SOM of 1% and 2.5%.

The SAC were produced using the input parameters in Table 1 below and Table 3.6 of project report SP1010[3]. The GAC by pathway are presented in Table 2 and the combined GAC presented in Table 3.

Figure 1: Conceptual model for CLEA public open space (park) scenario

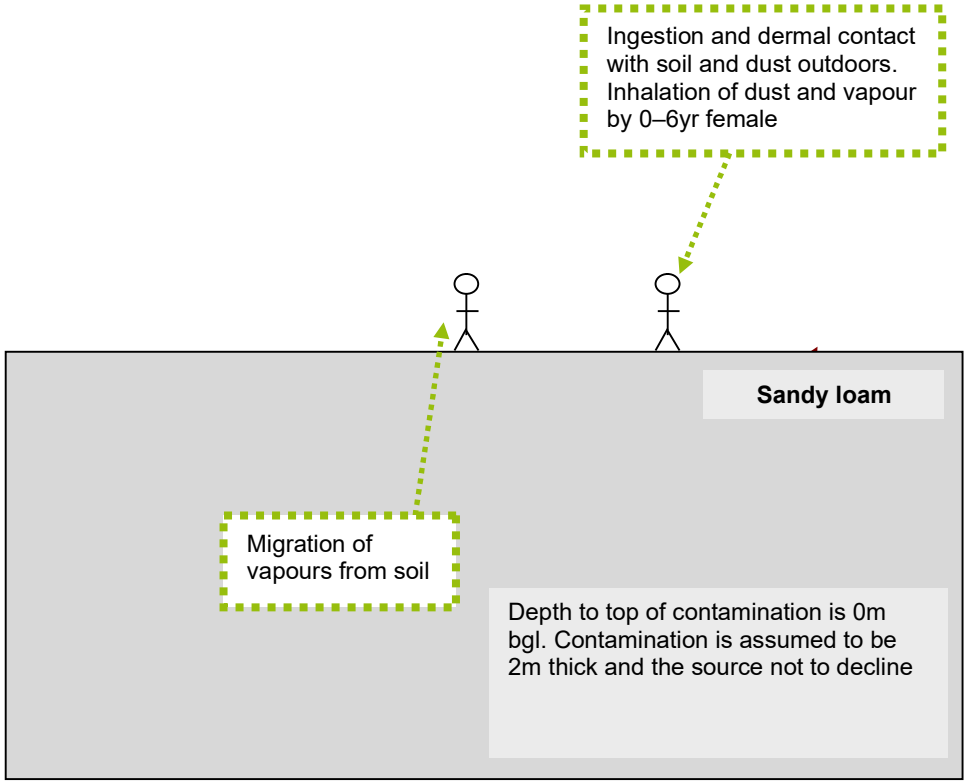


Table 1: Exposure assessment parameters for public open space (park) scenario

Parameter	Value	Justification
Land use	Public open space (park)	Chosen land use. Table 3.7 of SP1010[3]
Receptor	Female child	Taken as female child exposed over 6 years from 0 to 6 years, Table 3.7, SP1010[3]
Soil type	Sandy loam	Most common UK soil type (Section 4.3.1, Table 4.4, SR3[5])
Start age class (AC)	1	Range of AC corresponding to key generic assumption that the critical receptor is a young female child aged 0–6 years. From Table 3.7, SP1010[3]
End AC	6	
SOM (%)	6	Representative of sandy loam according to EA guidance note dated January 2009 entitled 'Changes We Have Made to the CLEA Framework Documents'[13]
	1	To provide SAC for sites where SOM < 6% as often observed by RSK
	2.5	
pH	7	Model default

References

1. Environment Agency (2009), Science Reports SC050021 - SGV and TOX reports for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'; 'Supplementary information for the derivation of SGV for: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs' and 'Contaminants in soil: updated collation of toxicological data and intake values for humans: benzene, toluene, ethylbenzene, xylene, mercury, selenium, nickel, arsenic, cadmium, phenol, dioxins, furans and dioxin-like PCBs'. Available at: https://www.gov.uk/government/publications/contaminants-in-soil-updated-collation-of-toxicological-data-and-intake-values-for-humans and https://www.gov.uk/government/publications/land-contamination-soil-guideline-values-sgvs (accessed 4 February 2015).

2. Nathanial, C. P., McCaffrey, C., Ashmore, M., Cheng, Y., Gillet, A. G., Ogden, R. C. and Scott, D. (2009), *LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment*, second edition (Nottingham: Land Quality Press).

3. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014), 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination', Revision 2, DEFRA research project SP1010'.

4. Department for Environment, Food and Rural Affairs (Defra) (2014), 'SP1010: Development of Category 4 Screening Levels for assessment of land affected by contamination – Policy Companion Document', Revision 2.

5. Environment Agency (2009), *Science Report – SC050021/SR3. Updated technical background to the CLEA model* (Bristol: Environment Agency).

6. Contaminated Land: Applications in Real Environment (CL:AIRE) (2014), 'Appendices C to H). DEFRA research project SP1010'. CL:AIRE (2021). Category 4 Screening Levels: Trichloroethene (TCE). CL:AIRE, London. ISBN 978-1-905046-38-6. CL:AIRE (2021). Category 4 Screening Levels: Vinyl Chloride. CL:AIRE, London. ISBN 978-1-905046-36-2. CL:AIRE (2021). Category 4 Screening Levels: Tetrachloroethene (PCE). CL:AIRE, London. ISBN 978-1-905046-37-9.

7. Nathanial, C. P., McCaffrey, C., Gillet, A. G., Ogden, R. C. and Nathanial, J. F. (2015), *The LQM/CIEH S4ULs for Human Health Risk Assessment* (Nottingham Land Quality Press).

8. Environment Agency (2009), *Human health toxicological assessment of contaminants in soil. Science Report – Final SC050021/SR2* (Bristol: Environment Agency).

9. Environment Agency (2009), *Science Report – SC050021/SR4 CLEA Software (version 1.05) Handbook* (Bristol: Environment Agency).

10. Environment Agency (2008), *Science Report SC050021/SR7. Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values* (Bristol: Environment Agency).

11. CL:AIRE (2010), *Soil Generic Assessment Criteria for Human Health Risk Assessment* (London: CL:AIRE).

12. USEPA (2011), *Exposure factors handbook*, EPA/600/R-090/052F (Washington DC: Office of Research and Development).

13. Environment Agency (2009), 'Changes made to the CLEA framework documents after the three-month evaluation period in 2008', released January 2009'.

14. USEPA (2010). Hydrogen cyanide and cyanide salts. Integrated Risk Information Systems (IRIS) Chemical Assessment Summary. September 2010. https://www.epa.gov/iris (accessed 9 December 2015)

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - PUBLIC OPEN SPACE (PUBLIC PARK)

Table 2

Human Health Generic Assessment Criteria for Public Open Space (public park)

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Metals													
Arsenic	(a,b)	1.68E+02	1.91E+04	NR	NR	1.68E+02	1.91E+04	NR	NR	1.68E+02	1.91E+04	NR	NR
Barium	(b)	5.77E+03	NR	NR	NR	5.77E+03	NR	NR	NR	5.77E+03	NR	NR	NR
Beryllium		6.68E+02	6.27E+01	NR	NR	6.68E+02	6.27E+01	NR	NR	6.68E+02	6.27E+01	NR	NR
Boron		4.62E+04	1.89E+08	NR	NR	4.62E+04	1.89E+08	NR	NR	4.62E+04	1.89E+08	NR	NR
Cadmium	(a)	9.13E+02	2.35E+04	8.82E+02	NR	9.13E+02	2.35E+04	8.82E+02	NR	9.13E+02	2.35E+04	8.82E+02	NR
Chromium (III) - trivalent	(c)	8.47E+04	3.30E+04	NR	NR	8.47E+04	3.30E+04	NR	NR	8.47E+04	3.30E+04	NR	NR
Chromium (VI) - hexavalent	(a,d)	2.52E+02	7.48E+02	NR	NR	2.52E+02	7.48E+02	NR	NR	2.52E+02	7.48E+02	NR	NR
Copper		4.62E+04	5.12E+05	4.44E+04	NR	4.62E+04	5.12E+05	4.44E+04	NR	4.62E+04	5.12E+05	4.44E+04	NR
Lead	(a)	1.35E+03	NR	NR	NR	1.35E+03	NR	NR	NR	1.35E+03	NR	NR	NR
Elemental Mercury (Hg^0)	(d)	NR	2.63E+01	NR	4.31E+00	NR	2.86E+01	NR	1.07E+01	NR	3.02E+01	NR	2.58E+01
Inorganic Mercury (Hg^{2+})		2.45E+02	1.32E+05	2.44E+02	NR	2.45E+02	1.32E+05	2.44E+02	NR	2.45E+02	1.32E+05	2.44E+02	NR
Methyl Mercury (Hg^{4+})		7.32E+01	4.59E+02	6.32E+01	7.33E+01	7.32E+01	6.40E+02	6.57E+01	1.42E+02	7.32E+01	9.33E+02	6.79E+01	3.04E+02
Nickel	(d)	8.04E+02	6.60E+03	NR	NR	8.04E+02	6.60E+03	NR	NR	8.04E+02	6.60E+03	NR	NR
Selenium	(b)	1.85E+03	NR	NR	NR	1.85E+03	NR	NR	NR	1.85E+03	NR	NR	NR
Vanadium		5.03E+03	5.32E+04	NR	NR	5.03E+03	5.32E+04	NR	NR	5.03E+03	5.32E+04	NR	NR
Zinc	(b)	1.73E+05	1.32E+09	NR	NR	1.73E+05	1.32E+09	NR	NR	1.73E+05	1.32E+09	NR	NR
Cyanide (free)		1.72E+02	4.98E+05	1.71E+02	NR	1.72E+02	4.98E+05	1.71E+02	NR	1.72E+02	4.98E+05	1.71E+02	NR
Volatile Organic Compounds													
Benzene	(a)	2.99E+02	5.20E+02	1.90E+02	1.22E+03	2.99E+02	7.09E+02	2.11E+02	2.26E+03	2.99E+02	1.02E+03	2.32E+02	4.71E+03
Toluene		1.17E+05	3.44E+05	8.71E+04	8.69E+02	1.17E+05	5.11E+05	9.50E+04	1.92E+03	1.17E+05	7.70E+05	1.01E+05	4.36E+03
Ethylbenzene		5.24E+04	2.41E+04	1.65E+04	5.18E+02	5.24E+04	3.70E+04	2.17E+04	1.22E+03	5.24E+04	5.65E+04	2.72E+04	2.84E+03
Xylene - m		9.43E+04	2.06E+04	1.69E+04	6.25E+02	9.43E+04	3.16E+04	2.37E+04	1.47E+03	9.43E+04	4.84E+04	3.20E+04	3.46E+03
Xylene - o		9.43E+04	2.13E+04	1.74E+04	4.78E+02	9.43E+04	3.27E+04	2.43E+04	1.12E+03	9.43E+04	4.99E+04	3.26E+04	2.62E+03
Xylene - p		9.43E+04	2.02E+04	1.66E+04	5.76E+02	9.43E+04	3.09E+04	2.33E+04	1.35E+03	9.43E+04	4.73E+04	3.15E+04	3.17E+03
Total xylene		9.43E+04	2.02E+04	1.66E+04	6.25E+02	9.43E+04	3.09E+04	2.33E+04	1.47E+03	9.43E+04	4.73E+04	3.15E+04	3.46E+03
Methyl tertiary-Butyl ether (MTBE)		1.58E+05	2.62E+05	9.84E+04	2.04E+04	1.58E+05	3.34E+05	1.07E+05	3.31E+04	1.58E+05	4.60E+05	1.17E+05	6.27E+04
Trichloroethene (TCE)		4.10E+01	2.01E+02	NR	1.54E+03	5.36E+01	2.91E+02	NR	3.22E+03	6.91E+01	4.33E+02	NR	7.14E+03
Tetrachloroethene (PCE)		7.31E+03	1.73E+03	1.40E+03	4.24E+02	7.31E+03	2.58E+03	1.91E+03	9.51E+02	7.31E+03	3.91E+03	2.55E+03	2.18E+03
1,1,1-Trichloroethane		3.15E+05	6.99E+04	5.72E+04	1.43E+03	3.15E+05	1.00E+05	7.59E+04	2.92E+03	3.15E+05	1.48E+05	1.01E+05	6.39E+03
1,1,1,2 Tetrachloroethane		2.99E+03	2.89E+03	1.47E+03	2.60E+03	2.99E+03	4.40E+03	1.78E+03	6.02E+03	2.99E+03	6.71E+03	2.07E+03	1.40E+04
1,1,2,2-Tetrachloroethane		2.99E+03	4.60E+03	1.81E+03	2.67E+03	2.99E+03	6.58E+03	2.06E+03	5.46E+03	2.99E+03	9.75E+03	2.29E+03	1.20E+04
Carbon Tetrachloride		2.10E+03	1.98E+02	1.89E+02	1.52E+03	2.10E+03	2.94E+02	2.73E+02	3.32E+03	2.10E+03	4.42E+02	3.96E+02	7.54E+03
1,2-Dichloroethane		6.31E+01	3.17E+01	2.11E+01	3.41E+03	6.31E+01	3.81E+01	2.37E+01	4.91E+03	6.31E+01	4.98E+01	2.78E+01	8.43E+03
Vinyl Chloride (chloroethene)		1.98E+01	2.68E+02	1.84E+01	1.36E+03	1.98E+01	3.04E+02	1.86E+01	1.76E+03	1.98E+01	3.76E+02	1.88E+01	2.69E+03
1,2,4-Trimethylbenzene		NR	3.09E+02	NR	4.74E+02	NR	3.63E+02	NR	1.16E+03	NR	4.08E+02	NR	2.76E+03
1,3,5-Trimethylbenzene	(e)	NR	NR	NR	2.30E+02	NR	NR	NR	5.52E+02	NR	NR	NR	1.30E+03
Semi-Volatile Organic Compounds													
Acenaphthene		3.07E+04	5.14E+05	2.89E+04	5.70E+01	3.07E+04	8.07E+05	2.95E+04	1.41E+02	3.07E+04	1.24E+06	2.99E+04	3.36E+02
Acenaphthylene		3.07E+04	4.91E+05	2.89E+04	8.61E+01	3.07E+04	7.69E+05	2.95E+04	2.12E+02	3.07E+04	1.18E+06	2.99E+04	5.06E+02
Anthracene		1.53E+05	5.73E+06	1.49E+05	1.17E+00	1.53E+05	8.99E+06	1.51E+05	2.91E+00	1.53E+05	1.38E+07	1.52E+05	6.96E+00
Benzo(a)anthracene		7.93E+01	1.27E+02	4.88E+01	1.71E+00	7.93E+01	1.96E+02	5.65E+01	4.28E+00	7.93E+01	2.94E+02	6.25E+01	1.03E+01
Benzo(a)pyrene	(a)	2.14E+01	7.45E+01	NR	9.11E-01	2.14E+01	1.14E+02	NR	2.28E+00	2.14E+01	1.70E+02	NR	5.46E+00
Benzo(b)fluoranthene		2.00E+01	3.91E+01	1.32E+01	1.22E+00	2.00E+01	6.02E+01	1.50E+01	3.04E+00	2.00E+01	8.97E+01	1.63E+01	7.29E+00
Benzo(g,h,i)perylene		1.76E+03	6.52E+03	1.39E+03	1.54E-02	1.76E+03	9.80E+03	1.49E+03	3.85E-02	1.76E+03	1.41E+04	1.57E+03	9.23E-02
Benzo(k)fluoranthene		5.27E+02	1.21E+03	3.67E+02	6.87E-01	5.27E+02	1.86E+03	4.11E+02	1.72E+00	5.27E+02	2.75E+03	4.42E+02	4.12E+00
Chrysene		1.59E+02	2.22E+02	9.25E+01	4.40E-01	1.59E+02	3.44E+02	1.09E+02	1.10E+00	1.59E+02	5.19E+02	1.21E+02	2.64E+00
Dibenzo(a,h)anthracene		1.59E+00	4.16E+00	1.15E+00	3.93E-03	1.59E+00	6.35E+00	1.27E+00	9.82E-03	1.59E+00	9.34E+00	1.36E+00	2.36E-02

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - PUBLIC OPEN SPACE (PUBLIC PARK)

Table 2

Human Health Generic Assessment Criteria for Public Open Space (public park)

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Fluoranthene		6.39E+03	4.87E+05	6.30E+03	1.89E+01	6.39E+03	7.61E+05	6.33E+03	4.73E+01	6.39E+03	1.16E+06	6.35E+03	1.13E+02
Fluorene		2.04E+04	4.57E+05	1.96E+04	3.09E+01	2.04E+04	7.17E+05	1.99E+04	7.65E+01	2.04E+04	1.10E+06	2.01E+04	1.83E+02

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - PUBLIC OPEN SPACE (PUBLIC PARK)

Table 2

Human Health Generic Assessment Criteria for Public Open Space (public park)

Compound	Notes	SAC Appropriate to Pathway SOM 1% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 2.5% (mg/kg)			Soil Saturation Limit (mg/kg)	SAC Appropriate to Pathway SOM 6% (mg/kg)			Soil Saturation Limit (mg/kg)
		Oral	Inhalation	Combined		Oral	Inhalation	Combined		Oral	Inhalation	Combined	
Indeno(1,2,3-cd)pyrene		2.27E+02	4.12E+02	1.46E+02	6.13E-02	2.27E+02	6.35E+02	1.67E+02	1.53E-01	2.27E+02	9.48E+02	1.83E+02	3.68E-01
Naphthalene		1.00E+04	1.24E+03	1.10E+03	7.64E+01	1.00E+04	1.92E+03	1.61E+03	1.83E+02	1.00E+04	2.95E+03	2.28E+03	4.32E+02
Phenanthrene		6.35E+03	2.44E+05	6.19E+03	3.60E+01	6.35E+03	3.83E+05	6.25E+03	8.96E+01	6.35E+03	5.88E+05	6.28E+03	2.14E+02
Pyrene		1.53E+04	1.11E+06	1.51E+04	2.20E+00	1.53E+04	1.73E+06	1.52E+04	5.49E+00	1.53E+04	2.64E+06	1.52E+04	1.32E+01
Phenol		2.77E+05	7.78E+03	7.57E+03	2.42E+04	2.77E+05	8.60E+03	8.34E+03	3.81E+04	2.77E+05	9.66E+03	9.34E+03	7.03E+04
Total Petroleum Hydrocarbons													
Aliphatic hydrocarbons EC_5-EC_6		1.31E+06	9.65E+04	9.47E+04	3.04E+02	1.31E+06	1.31E+05	1.27E+05	5.58E+02	1.31E+06	1.88E+05	1.81E+05	1.15E+03
Aliphatic hydrocarbons >EC_6-EC_8		1.31E+06	1.51E+05	1.46E+05	1.44E+02	1.31E+06	2.25E+05	2.15E+05	3.22E+02	1.31E+06	3.41E+05	3.16E+05	7.36E+02
Aliphatic hydrocarbons >EC_8-EC_{10}		2.63E+04	1.85E+04	1.43E+04	7.77E+01	2.63E+04	2.89E+04	1.83E+04	1.90E+02	2.63E+04	4.45E+04	2.14E+04	4.51E+02
Aliphatic hydrocarbons >EC_{10}-EC_{12}		2.63E+04	4.12E+04	2.09E+04	4.75E+01	2.63E+04	6.49E+04	2.31E+04	1.18E+02	2.63E+04	1.00E+05	2.43E+04	2.83E+02
Aliphatic hydrocarbons >EC_{12}-EC_{16}		2.63E+04	1.19E+05	2.47E+04	2.37E+01	2.63E+04	1.88E+05	2.53E+04	5.91E+01	2.63E+04	2.91E+05	2.57E+04	1.42E+02
Aliphatic hydrocarbons >EC_{16}-EC_{35}	(b)	4.55E+05	NR	NR	8.48E+00	4.78E+05	NR	NR	2.12E+01	4.94E+05	NR	NR	5.09E+01
Aliphatic hydrocarbons >EC_{35}-EC_{44}	(b)	4.55E+05	NR	NR	8.48E+00	4.78E+05	NR	NR	2.12E+01	4.94E+05	NR	NR	5.09E+01
Aromatic hydrocarbons >EC_8-EC_{10}		1.05E+04	1.12E+04	7.22E+03	6.13E+02	1.05E+04	1.75E+04	8.50E+03	1.50E+03	1.05E+04	2.70E+04	9.29E+03	3.58E+03
Aromatic hydrocarbons >EC_{10}-EC_{12}		1.05E+04	2.61E+04	9.24E+03	3.64E+02	1.05E+04	4.10E+04	9.75E+03	8.99E+02	1.05E+04	6.33E+04	1.00E+04	2.15E+03
Aromatic hydrocarbons >EC_{12}-EC_{16}		1.05E+04	8.62E+04	1.02E+04	1.69E+02	1.05E+04	1.36E+05	1.03E+04	4.19E+02	1.05E+04	2.10E+05	1.04E+04	1.00E+03
Aromatic hydrocarbons >EC_{16}-EC_{21}	(b)	7.63E+03	NR	NR	5.37E+01	7.72E+03	NR	NR	1.34E+02	7.77E+03	NR	NR	3.21E+02
Aromatic hydrocarbons >EC_{21}-EC_{35}	(b)	7.82E+03	NR	NR	4.83E+00	7.84E+03	NR	NR	1.21E+01	7.85E+03	NR	NR	2.90E+01
Aromatic hydrocarbons >EC_{35}-EC_{44}	(b)	7.82E+03	NR	NR	4.83E+00	7.84E+03	NR	NR	1.21E+01	7.85E+03	NR	NR	2.90E+01

Notes:

Public open space (resi) and (park) GAC are based on the exposure parameters detailed within SP1010 "Development of Category 4 Screening Levels for Assessment of Land affected by Contamination", Final, 20th December 2013

EC - equivalent carbon. GrAC - groundwater assessment criteria. SAC - soil assessment criteria.

The CLEA model output is colour coded depending upon whether the soil saturation limit has been exceeded.

Calculated SAC exceeds soil saturation limit and may significantly affect the interpretation of any exceedances as the contribution of the indoor and outdoor vapour pathway to total exposure is >10%.

Calculated SAC exceeds soil saturation limit but the exceedance will not affect the SAC significantly as the contribution of the indoor and outdoor vapour pathway to total exposure is <10%.

Calculated SAC does not exceed the soil saturation limit.

The SAC for organic compounds are dependant upon soil organic matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene, BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway (Section 10.1.1, SR3)

(a) SAC for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead are derived using the C4SL toxicology data.

(b) SAC for barium and selenium should not include the inhalation pathway as no expert group HCV has been derived; aliphatic and aromatic hydrocarbons >EC16 should not include inhalation pathway due to their non-volatile nature and inhalation exposure being minimal (oral, dermal and inhalation exposure is compared to the oral HCV); arsenic should only be based on oral contribution (rather than combined) owing to the relative small contribution from inhalation in accordance with the SGV report. The Oral SAC should be adopted for zinc and benzo(a)pyrene.

(c) SAC for CrIII should be based on the lower of the oral and inhalation SAC (see LQM/CIEH 2015 Section 6.8)

(d) SAC for elemental mercury, chromium VI and nickel should be based on the inhalation pathway only.

(e) SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used.

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH - PUBLIC OPEN SPACE (PUBLIC PARK)

Table 3
Human Health Generic Assessment Criteria for Public Open Space (public park)

Compound	SAC for Soil SOM 1% (mg/kg)	SAC for Soil SOM 2.5% (mg/kg)	SAC for Soil SOM 6% (mg/kg)
Metals			
Arsenic	170	170	170
Barium	5,770	5,770	5,770
Beryllium	60	60	60
Boron	46,000	46,000	46,000
Cadmium	880	880	880
Chromium (III) - trivalent	33,000	33,000	33,000
Chromium (VI) - hexavalent	250	250	250
Copper	44,000	44,000	44,000
Lead	1,300	1,300	1,300
Elemental Mercury (Hg^0)	30 (4)	30 (11)	30 (26)
Inorganic Mercury (Hg^{2+})	240	240	240
Methyl Mercury (Hg^{4+})	63	66	68
Nickel	800	800	800
Selenium	1,800	1,800	1,800
Vanadium	5,000	5,000	5,000
Zinc	173,200	173,200	173,200
Cyanide (free)	170	170	170
Volatile Organic Compounds			
Benzene	190	210	230
Toluene	90,000 (869)	90,000 (1,916)	100,000 (4,357)
Ethylbenzene	17,000 (518)	22,000 (1,216)	27,000 (2,844)
Xylene - m	17,000 (625)	24,000 (1,474)	32,000 (3,457)
Xylene - o	17,000 (478)	24,000 (1,120)	33,000 (2,618)
Xylene - p	17,000 (576)	23,000 (1,353)	31,000 (3,167)
Total xylene	17,000 (625)	23,000 (1,474)	31,000 (3,457)
Methyl tertiary-Butyl ether (MTBE)	98,400 (20,400)	107,100 (33,100)	117,400 (62,700)
Trichloroethene (TCE)	41	54	69
Tetrachloroethene (PCE)	1,400 (424)	1,900 (951)	2,500 (2,180)
1,1,1-Trichloroethane	60,000 (1,425)	80,000 (2,915)	100,000 (6,392)
1,1,1,2 Tetrachloroethane	1,500	1,800	2,100
1,1,2,2-Tetrachloroethane	1,800	2,100	2,300
Carbon Tetrachloride	189	273	396
1,2-Dichloroethane	21	24	28
Vinyl Chloride (chloroethene)	18	19	19
1,2,4-Trimethylbenzene	310	360	410
1,3,5-Trimethylbenzene	NR	NR	NR
Semi-Volatile Organic Compounds			
Acenaphthene	29,000	30,000	30,000
Acenaphthylene	29,000	30,000	30,000
Anthracene	149,000	151,000	152,000
Benzo(a)anthracene	49	56	62
Benzo(a)pyrene	21	21	21
Benzo(b)fluoranthene	13	15	16
Benzo(g,h,i)perylene	1,390	1,490	1,570
Benzo(k)fluoranthene	367	411	442
Chrysene	93	109	121
Dibenzo(a,h)anthracene	1.1	1.3	1.4
Fluoranthene	6,300	6,300	6,400
Fluorene	19,600	19,900	20,100
Indeno(1,2,3-cd)pyrene	146	167	183
Naphthalene	1,200 (76)	1,900 (183)	3,000
Phenanthrene	6,200	6,200	6,300
Pyrene	15,000	15,000	15,000
Phenol	440*	690*	1,300*
Total Petroleum Hydrocarbons			
Aliphatic hydrocarbons EC_5-EC_6	90,000 (304)	130,000 (558)	180,000 (1,150)
Aliphatic hydrocarbons >EC_6-EC_8	150,000 (144)	210,000 (322)	320,000 (736)
Aliphatic hydrocarbons >EC_8-EC_{10}	14,000 (78)	18,000 (190)	21,000 (451)
Aliphatic hydrocarbons >EC_{10}-EC_{12}	21,000 (48)	23,000 (118)	24,000 (283)
Aliphatic hydrocarbons >EC_{12}-EC_{16}	25,000 (24)	25,000 (59)	26,000 (142)
Aliphatic hydrocarbons >EC_{16}-EC_{35}	450,000	480,000	490,000
Aliphatic hydrocarbons >EC_{35}-EC_{44}	450,000	480,000	490,000
Aromatic hydrocarbons >EC_8-EC_{10}	7,200 (613)	8,500 (1,503)	9,300 (3,580)
Aromatic hydrocarbons >EC_{10}-EC_{12}	9,200 (364)	9,700 (899)	10,000
Aromatic hydrocarbons >EC_{12}-EC_{16}	10,200	10,300	10,400
Aromatic hydrocarbons >EC_{16}-EC_{21}	7,600	7,700	7,800
Aromatic hydrocarbons >EC_{21}-EC_{35}	7,800	7,800	7,900
Aromatic hydrocarbons >EC_{35}-EC_{44}	7,800	7,800	7,900
Minerals			
Asbestos	Stage 1 test – No asbestos detected with ID; Stage 2 test - <0.001% dry weight (exceedance of either equates to an exceedance of the GAC)[1]		

Notes:

'-' Generic assessment criteria not calculated owing to low volatility of substance and therefore no pathway, or an absence of toxicological data.

NR - SAC for 1,3,5-trimethylbenzene is not recorded owing to the lack of toxicological data, SAC for 1,2,4 trimethylbenzene may be used

EC - equivalent carbon. GrAC - groundwater assessment criteria. SAC - soil assessment criteria.

* The GAC for Phenol is based on a threshold which is protective of direct contact (SC050021/Phenol SGV report)

Public open space (resi) and (park) GAC are based on the exposure parameters detailed within SP1010 "Development of Category 4 Screening Levels for Assessment of Land affected by Contamination", Final, 20th December 2013

The SAC for organic compounds are dependent on Soil Organic Matter (SOM) (%) content. To obtain SOM from total organic carbon (TOC) (%) divide by 0.58. 1% SOM is 0.58% TOC. DL Rowell Soil Science: Methods and Applications, Longmans, 1994.

SAC for TPH fractions, PAHs napthalene, acenaphthene and acenaphthylene,BTEX and trimethylbenzene compounds were produced using an attenuation factor for the indoor air inhalation pathway of 10 to reduce conservatism associated with the vapour inhalation pathway, section 10.1.1, SR3.

(VALUE IN BRACKETS) The SAC has been set as the model calculated SAC with the saturation limit shown in brackets.

APPENDIX F
SOIL & GROUNDWATER RTV COMPARISONS

Comparison of RTVs against measured concentrations in soil

COPC	Lab sample ID	22/07379/8	23/09425/2	23/09425/5	23/09491/7	23/09491/2	23/09491/3	23/09229/2	23/09229/4	23/09229/5	23/09229/6	23/10932/9	23/10932/10	23/11040/1	23/11040/4	23/10932/4	23/10932/7	23/10932/12	23/10932/13	23/10932/14	23/10932/2	22/07002/5	22/07002/2
	Borehole ID	RBH203	RBH401	RBH401	RBH401	RBH402	RBH402	RBH403	RBH403	RBH403	RBH403	RBH501	RBH501	RBH502	RBH502	RBH503	RBH503	RBH504	RBH504	RBH504	RBH505	TP202	TP203
	Depth to top	3	6.5	15	1	1.5	3.7	3.5	6	9.9	10.2	0.8	2	1	4.5	1.2	4	1.5	1.9	3.1	2.1	0.5	0.3
	Depth to bottom																						
	Date sampled	25/07/2022	20/09/2023	21/09/2023	20/09/2023	19/09/2023	19/09/2023	13/09/2023	14/09/2023	14/09/2023	14/09/2023	01/11/2023	01/11/2023	03/11/2023	07/11/2023	31/10/2023	31/10/2023	02/11/2023	02/11/2023	02/11/2023	31/10/2023	13/07/2022	12/07/2022
	Sample type																						
	RTV (mg/kg)																						
Trichloroethene	0.224	0.006	<0.025	<0.001	<0.025	<0.001	<0.025	<0.025	<0.025	<0.025	<0.001	0.151	<0.001	0.018	0.011	<0.001	<0.001	0.049	0.009	0.007	<0.001	0.012	<0.001
Carbon tetrachloride	0.116	<0.001	<0.025	<0.001	<0.025	<0.001	<0.025	<0.025	<0.025	<0.025	<0.001	<0.001	<0.001	0.002	0.028	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Notes:

LMDL Laboratory method detection limit

COPC Contaminant of potential concern

DQRA Detailed quantitative risk assessment

< Result less than the LMDL

RTV Remedial target value

- COPC not analysed

Measured concentration in excess of RTV

Comparison of RTVs against measured concentrations in soil

COPC	Lab sample ID	22/07217/6	22/07217/5	22/07217/2	22/07217/8	23/03693/3	23/03693/1	22/07379/1	22/07379/2	22/07002/6	22/07379/6	23/03602/17	23/03602/18	23/03602/19	23/03602/20	23/03602/21	23/03602/13	23/03602/14	23/03602/15	23/03602/16	23/03602/1	23/03602/2	23/03602/3
	Borehole ID	TP214	TP215	TP216	TP218	TP307	TP310	WS202	WS203	WS204	WS210	WS301	WS301	WS301	WS301	WS301	WS302	WS302	WS302	WS302	WS303	WS303	WS303
	Depth to top	0.8	1	0.6	0.5	0.6	0.5	1.5	0.5	0.4	0.5	0.5	1.5	2.5	3.5	4.5	0.5	1.5	2.5	3.5	0.4	1.2	1.8
	Depth to bottom																						
	Date sampled	18/07/2022	18/07/2022	18/07/2022	19/07/2022	12/04/2023	12/04/2023	21/07/2022	21/07/2022	13/07/2022	22/07/2022	04/04/2023	04/04/2023	04/04/2023	04/04/2023	04/04/2023	04/04/2023	04/04/2023	04/04/2023	04/04/2023	03/04/2023	03/04/2023	03/04/2023
	Sample type																						
	RTV (mg/kg)																						
Trichloroethene	0.224	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.03	<0.001	<0.001	0.067	0.026	0.017	0.043	<0.001	0.004	0.602	0.021	0.094	0.015	0.036	0.007
Carbon tetrachloride	0.116	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.005	<0.001	<0.001	0.003	<0.001	<0.001	<0.025	0.001	0.008	<0.001	<0.025	<0.001

Notes:

LMDL Laboratory method detection limit

COPC Contaminant of potential concern

DQRA Detailed quantitative risk assessment

< Result less than the LMDL

RTV Remedial target value

- COPC not analysed

Measured concentration in excess of RTV

Comparison of RTVs against measured concentrations in soil

COPC	Lab sample ID	23/03602/4	23/03602/28	23/03602/30	23/03602/32	23/03602/33	23/03602/5	23/03602/6	23/03602/25	23/03602/26	23/03602/27	23/03602/34	23/03602/7	23/03602/8	23/03602/9	23/03602/10	23/03602/11	23/03602/12	23/03693/8	23/03602/35	23/03602/36	23/03958/3	23/03602/37
	Borehole ID	WS303	WS304	WS304	WS304	WS304	WS305	WS305	WS306	WS306	WS306	WS307	WS308	WS308	WS308	WS309	WS309	WS309	WS309	WS310	WS311	WS311	WS312
	Depth to top	3.1	0.5	1.5	2.5	3.5	0.5	1	0.5	1.5	2.5	0.4	0.6	1	2	0.7	1.9	2.5	0.4	0.4	0.4	1.8	0.6
	Depth to bottom																						
	Date sampled	03/04/2023	04/04/2023	04/04/2023	04/04/2023	04/04/2023	03/04/2023	03/04/2023	04/04/2023	04/04/2023	04/04/2023	04/04/2023	03/04/2023	03/04/2023	03/04/2023	03/04/2023	03/04/2023	03/04/2023	11/04/2023	05/04/2023	05/04/2023	20/04/2023	05/04/2023
	Sample type																						
	RTV (mg/kg)																						
Trichloroethene	0.224	<0.025	0.23	0.016	0.074	0.043	0.06	0.427	0.098	0.15	0.006	0.066	0.569	1.13	0.039	0.072	0.015	0.003	<0.001	0.001	<0.001	<0.001	<0.025
Carbon tetrachloride	0.116	<0.025	0.004	<0.001	0.004	0.002	0.002	0.009	<0.001	<0.002	<0.001	<0.002	0.034	0.038	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.025

Notes:

LMDL Laboratory method detection limit

COPC Contaminant of potential concern

DQRA Detailed quantitative risk assessment

< Result less than the LMDL

RTV Remedial target value

- COPC not analysed

Measured concentration in excess of RTV

Comparison of RTVs against measured concentrations in soil

COPC	Lab sample ID	23/03602/38	Maximum concentration detected in soil (mg/kg)	Total No. of soil samples analysed	Number of detects in soil above the RTV
	Borehole ID	WS312			
	Depth to top	1			
	Depth to bottom				
	Date sampled	05/04/2023			
	Sample type				
	RTV (mg/kg)				
Trichloroethene	0.224	<0.001	1.13	67	5
Carbon tetrachloride	0.116	<0.001	0.038	67	0

Notes:

LMDL Laboratory method detection limit

COPC Contaminant of potential concern

DQRA Detailed quantitative risk assessment

< Result less than the LMDL

RTV Remedial target value

- COPC not analysed

Measured concentration in excess of RTV

Comparison of RTVs against measured concentrations in groundwater

COPC	Lab sample ID	22/09651/12	22/09651/13	23/00479/2	22/09831/2	23/00479/3	23/04296/7	23/04477/5	22/09651/1	22/09651/2	22/09651/5	22/09831/1	23/00479/1	23/04296/6	23/04477/4	23/11247/1	23/04296/1	23/04477/1	23/04296/2	23/04477/2	23/11247/2
	Borehole ID	LK BH01	LK BH01 (2) Duplicate	LK BH01	LK BH03	LK BH03	LK BH03	LK BH03	RBH201	RBH201 (2) Duplicate	RBH203	RBH203	RBH203	RBH203	RBH203	RBH203	RBH301	RBH301	RBH302	RBH302	RBH302
	Depth to top	13	13	5.4	10	7.45	7.6	7.6	22	22	13	10	7.4	7.6	7.6	14.9	5.65	5.7	7.5	7.5	10.65
	Depth to bottom																				
	Date sampled	27/09/2022	27/09/2022	19/01/2023	04/10/2022	19/01/2023	04/05/2023	10/05/2023	27/09/2022	27/09/2022	27/09/2022	04/10/2022	19/01/2023	04/05/2023	10/05/2023	13/11/2023	04/05/2023	10/05/2023	04/05/2023	10/05/2023	13/11/2023
	Sample type																				
	RTV (µg/l)																				
Trichloroethene (TCE)	27.1	2	2	2	250	80	43	39	<1	<1	480	572	418	214	200	215	<1	<1	4	3	2
Carbon tetrachloride (tetrachloromethane)	149	<1	<1	3	58	73	53	48	<1	<1	95	104	265	164	107	84	<1	<1	207	159	142
Cis/trans 1,2-dichloroethene (DCE)	90	490	485	602	3	6	3	4	4	<1	2	2	4	4	3	4	86	102	1	1	<1
Vinyl Chloride (chloroethene)	4.25	16	15	11	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	2	1	<1	<1	<1

Notes:

LMDL Laboratory method detection limit

COPC Contaminant of potential concern

DQRA Detailed quantitative risk assessment

< Result less than the LMDL

RTV Remedial target value

- COPC not analysed

Measured concentration in excess of RTV

Comparison of RTVs against measured concentrations in groundwater

COPC	Lab sample ID	23/11247/3	23/11247/4	23/11247/9	23/11487/1	23/11247/5	23/11247/7	23/11247/10	23/11247/6	23/11247/8	22/09651/3	22/09651/4	23/04296/3	23/04477/3	23/04296/4	23/04510/1	23/11247/11	23/04296/5	23/04510/2	22/08782/1	22/09651/7	22/08782/2
	Borehole ID	RBH501	RBH502 P1	RBH502 P2	BH502 P2	RBH503	RBH505 P1	RBH505 P2	RBH504	WS311	RBH202	RBH202 (2)	RBH303	RBH303	RBH305	RBH305	RBH305	RBH306	RBH306	BH205	RBH205	BH206
	Depth to top	13.7	15.8	18.9	18.9	8.7	11.2	13.7	10.7	1	23	23	7.05	7.1	6.5	6.5	7	6	6	6.5	22	7
	Depth to bottom																					
	Date sampled	13/11/2023	13/11/2023	13/11/2023	20/11/2023	13/11/2023	13/11/2023	13/11/2023	13/11/2023	13/11/2023	27/09/2022	27/09/2022	04/05/2023	10/05/2023	04/05/2023	11/05/2023	13/11/2023	04/05/2023	11/05/2023	02/09/2022	27/09/2022	02/09/2022
	Sample type																					
	RTV (µg/l)																					
Trichloroethene (TCE)	27.1	27	3		4	<1	<1	<1	17	<1	4	3	277	221	3	<1	<1	<1	<1	<1	<1	<1
Carbon tetrachloride (tetrachloromethane)	149	17	24		<1	<1	<1	<1	14	<1	<1	<1	38	22	2	<1	<1	<1	<1	<1	<1	<1
Cis/trans 1,2-dichloroethene (DCE)	90	2	<1		80	100	<1	<1	151	<1	<1	<1	81	84	<1	<1	<1	<1	<1	<1	<1	<1
Vinyl Chloride (chloroethene)	4.25	<1	<1		<1	44	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Notes:

LMDL Laboratory method detection limit

COPC Contaminant of potential concern

DQRA Detailed quantitative risk assessment

< Result less than the LMDL

RTV Remedial target value

- COPC not analysed

Measured concentration in excess of RTV

Comparison of RTVs against measured concentrations in groundwater

COPC	Lab sample ID	22/09132/1	22/09651/8	22/09132/3	22/09651/9	22/09132/2	22/09651/10	22/09132/4	22/09651/11	Maximum concentration detected in groundwater (mg/l)	Total No. of groundwater samples analysed	Number of detects in groundwater above the RTV
	Borehole ID	RBH207	RBH207	RBH208	RBH208	RBH209	RBH209	RBH210	RBH210			
	Depth to top	22	22.5	15.5	21.5	21.5	15.5	22	22			
	Depth to bottom											
	Date sampled	14/09/2022	27/09/2022	14/09/2022	27/09/2022	14/09/2022	27/09/2022	14/09/2022	27/09/2022			
	Sample type											
	RTV (µg/l)											
Trichloroethene (TCE)	27.1	<1	<1	<1	<1	<1	<1	<1	<1	572	48	12
Carbon tetrachloride (tetrachloromethane)	149	<1	<1	<1	<1	<1	<1	<1	<1	265	48	4
Cis/trans 1,2-dichloroethene (DCE)	90	<1	<1	<1	<1	<1	<1	<1	<1	602	48	6
Vinyl Chloride (chloroethene)	4.25	<1	<1	<1	<1	<1	<1	<1	<1	44	48	4

Notes:

LMDL Laboratory method detection limit

COPC Contaminant of potential concern

DQRA Detailed quantitative risk assessment

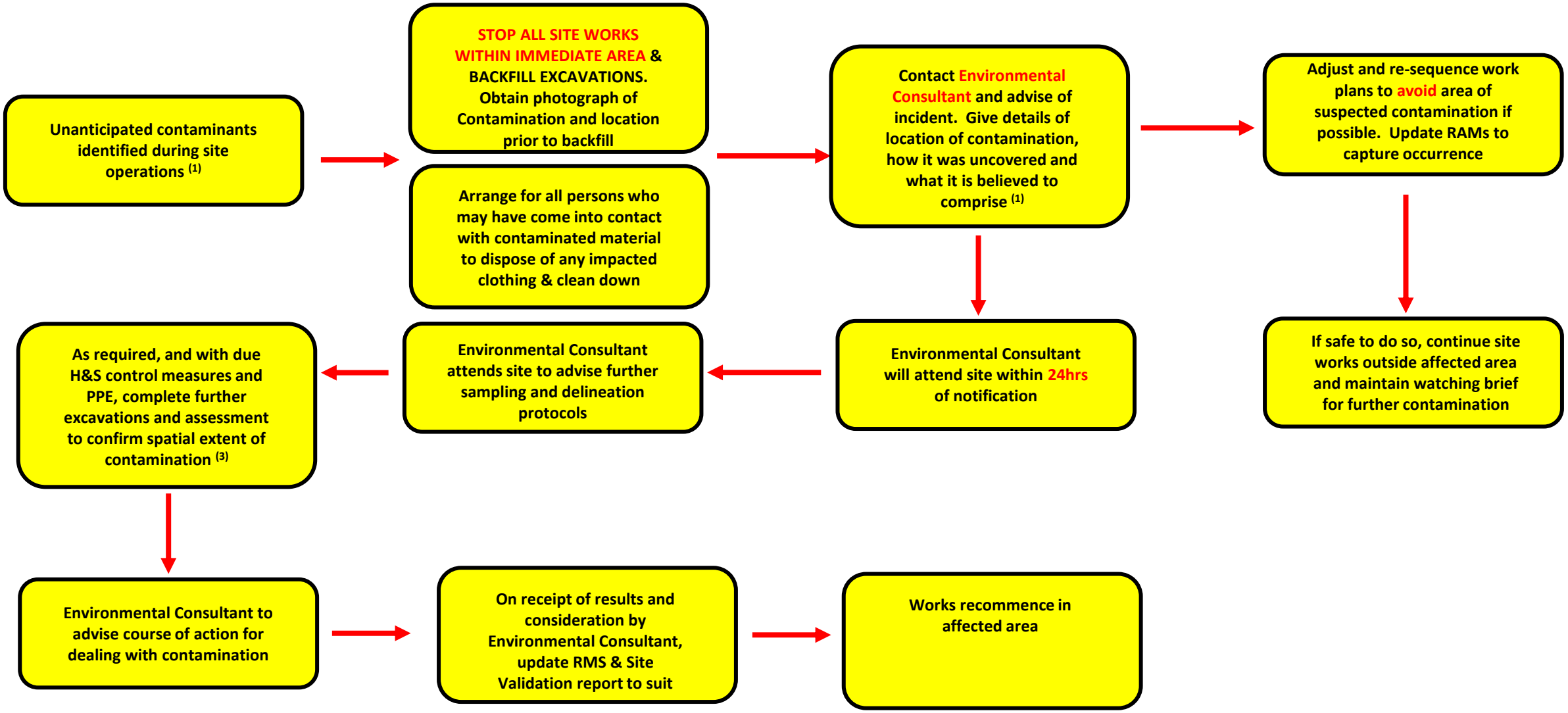
< Result less than the LMDL

RTV Remedial target value

- COPC not analysed

Measured concentration in excess of RTV

APPENDIX G
CONTAMINATION DISCOVERY STRATEGY



1) See examples of potential sources of contamination on sketch ESK101
2) Site manager should also confirm any persons who have come into contact with material are not feeling any health effects Including sampling of soils and groundwater to confirm risks posed

RSK GEOSCIENCES

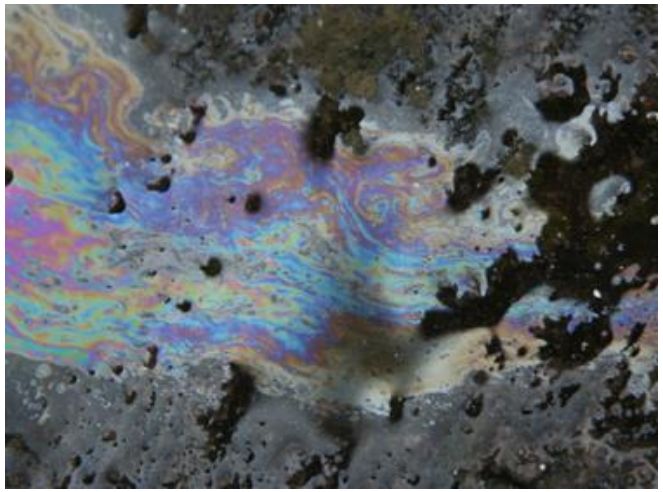
JOB NO	11834	SKETCH NO	ESK100	DRAWN BY : As 10/11/2023
PROJECT TITLE	Plot NT02.3 & 4	SKETCH TITLE	Unexpected Contamination, Discovery Strategy	



Asbestos Contamination



Soil Impacted Hydrocarbon (fuel oils) Contamination*



Groundwater Impacted Hydrocarbon (fuel oils) Contamination*



“Blue Billy” Gas Works spent oxide Contamination



Unrecorded waste disposal or landfill practices



Unrecorded below ground storage tank

* Will also likely be accompanied by strong chemical or oil odor

RSK GEOSCIENCES

JOB NO	11834	SKETCH NO	ESK101	DRAWN BY : As 10/11/2023
PROJECT TITLE	Plot NT02.3 & 4	SKETCH TITLE	Example sources of contamination, note these are generic and may not apply to this site	

APPENDIX H
MONITORING WELL RETENTION PLAN

GROUNDWATER MONITORING WELLS

BH I.D.	Easting	Northing	Response zone from (mOD)	Response zone to (mOD)	Lithology at response zone
RBH505 P1	384588.94	399458.10	26.91	19.61	CF
RBH505 P2	384588.94	399458.10	18.41	16.91	MM
RBH504	384644.07	399415.75	29.54	22.09	CF
RBH503	384612.61	399439.30	26.65	21.65	CF
RBH502 P1	384599.85	399394.37	28.09	15.29	CF
RBH502 P2	384599.85	399394.37	14.29	13.29	MM
RBH501	384638.99	399388.87	29.09	18.59	CF
RBH403	384717.73	399423.13	31.98	26.53	RD
RBH401	384697.40	399411.32	32.02	26.57	RD
RBH301	384576.68	399444.27	27.41	21.41	CF
RBH302	384608.42	399383.57	28.59	21.59	CF
RBH303	384640.07	399422.36	28.01	23.01	CF
RBH304	384680.66	399402.07	29.66	25.66	Terrace Deposits
RBH305	384636.01	399469.21	27.15	23.15	CF
RBH306	384692.00	399446.81	24.73	22.73	MM
RBH307	384749.15	399493.27	30.84	19.84	MM
RBH201	384597.08	399455.18	10.40	6.40	MM
RBH202	384638.05	399446.26	11.76	7.76	MM
RBH203	384619.36	399403.83	23.59	18.59	CF
RBH205	384721.68	399517.64	11.38	6.38	MM
RBH206	384701.70	399491.17	11.00	7.00	MM
RBH207	384797.90	399510.73	16.17	11.17	MM
RBH208	384757.48	399461.38	23.00	18.00	MM
RBH209	384796.49	399492.29	28.46	23.46	MM
RBH210	384845.14	399489.02	21.38	16.38	MM
LKBH01	384593.48	399443.85	26.41	16.41	CF & MM
LKBH03	384634.56	399391.59	30.59	13.59	CF & MM

ROC RBH205
ROC RBH207
ROC RBH206
ROC RBH307
ROC RBH209
ROC RBH210
ROC RBH208
ROC RBH305
ROC RBH306
ROC RBH201
ROC RBH505
LK BH01
ROC RBH301
ROC RBH503
ROC RBH202
ROC RBH403
ROC RBH303
ROC RBH504
ROC RBH401
ROC RBH203
ROC RBH304
ROC RBH502
LK BH03
ROC RBH501
ROC RBH302

ALL GROUNDWATER MONITORING WELLS ARE TO BE RETAINED UNTIL THE GROUNDWATER REMEDIATION DESIGN IS FINALISED BY THE REMEDIATION CONTRACTOR

RETAINED MONITORING WELLS ARE TO HAVE RAISED COVERS FITTED TO PROVIDE ADDITIONAL PROTECTION DURING DEMOLITION WORKS.

DECOMMISSIONING OF WELLS IS TO BE UNDERTAKEN IN ACCORDANCE WITH ENVIRONMENT AGENCY SCIENCE REPORT SC020093 "GUIDANCE ON THE DESIGN AND INSTALLATION OF GROUNDWATER QUALITY MONITORING POINTS".

THIS DRAWING IS THE PROPERTY OF RoCp. COPYRIGHT IS RESERVED BY THEM AND THE DRAWING IS ISSUED ON THE CONDITION THAT IT IS NOT COPIED, REPRODUCED, RETAINED OR DISCLOSED TO ANY UNAUTHORISED PERSON EITHER WHOLLY OR IN PART WITHOUT THE WRITTEN CONSENT OF RoCp

NOTES

ROC RBH3XX — GROUNDWATER MONITORING WELL TO BE DECOMMISSIONED

ROC RBH3XX — GROUNDWATER MONITORING WELL TO BE RETAINED

APPROX PLOT NT02 BOUNDARY

APPROX PLOT NT03 BOUNDARY

APPROX PLOT NT04 BOUNDARY

EXTENT OF SOIL TURNOVER

DRAWING NOTES

1. TO BE READ IN CONJUNCTION WITH ROC CONSULTING PHASE 1 DESKTOP STUDY REF: 4328-ROC-ZZ-XX-RP-ES-PH1DTS AND PHASE 2 SITE INVESTIGATION REPORT REF: 4328-ROC-ZZ-XX-RP-ES-P2-101.
2. EXPLORATORY HOLE LOCATIONS SHOWN AT APPROXIMATE EXTENTS.
3. EXISTING SITE LEVEL INFORMATION TAKEN FROM PARAGON SURVEYS TOPOGRAPHICAL SURVEY REF:PS-2158-TS--00
4. ROC CONSULTING ACCEPTS NOT RESPONSIBILITY FOR ANY DAMAGES OR LOSS ARISING AS A RESULT OF THE USE OF THIS DRAWING

REV.	DATE	DETAILS	DRN.	CHK.
02	JAN 24	LKBH01 ADDED TO LIST OF WELLS TO BE RETAINED	RM	AS
01	JAN 24	FIRST ISSUE	RM	AS

DRAWING STATUS: INFORMATION

RIBA STAGE:

RoC CONSULTING
Commercial Wharf
6 Commercial Street
Manchester M15 4PZ
T 0161 214 5390
W rocconsulting.com

DRAWN	DATE	SCALES
RM	JAN 24	1:500
CHECKED	DATE	THE ABOVE SCALES APPLY WHEN PLOTTED AT A1 SIZE --DO NOT SCALE--
AS	JAN 24	
APPRVD.	DATE	EMAIL FOR DRAWINGS
AS	JUN 24	info@rocconsulting.com

CLIENT: FAR EAST CONSORTIUM INTERNATIONAL LTD

PROJECT TITLE: PLOTS NTO2, NTO3 & NTO4 NORTHERN GATEWAY

DRAWING TITLE: GROUNDWATER MONITORING WELL DECOMMISSIONING PLAN

DRAWING No.: 4328-ROC-ZZ-XX-DR-ES-ES214

REV.: 02

© RoCp Ltd.

G:\Common\Jobs\4328 Plot NT02 Dantzic St\01 ROC\Drawings\ES\4328-ROC-ZZ-XX-DR-ES-ES214.dwg



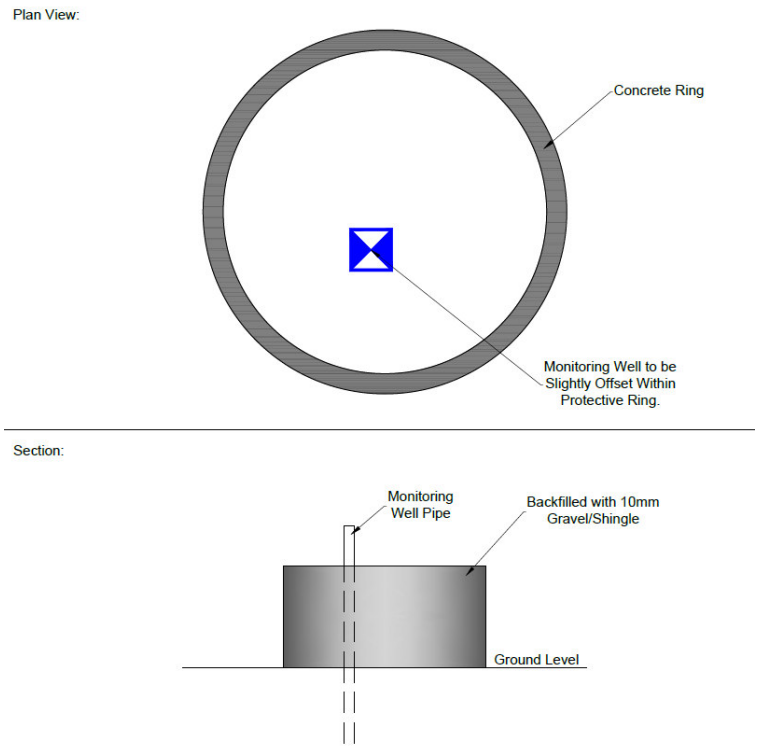
Example 1 : Fenced in well enclosure



Example 2 : Marker post well identification



Example 3 : Concrete manhole rig enclosure



Example 3 : Concrete manhole rig enclosure design example

Note : Example 3 using concrete manhole chamber is likely to be the most effective on this site

RSK GEOSCIENCES

JOB NO	11834	SKETCH NO	ESK100	DRAWN BY : 10 01 2024 AS
PROJECT TITLE	Plot NT02,03 & 04	SKETCH TITLE	Examples of Groundwater Monitoring Well Protection Measure	

APPENDIX I
REGULATORY CORRESPONDENCE

From: Laura Miller <laura.miller@manchester.gov.uk>
Sent: 27 November 2023 09:27
To: Mike Newman
Cc: Reece McGuinness; Alex Smiles
Subject: Re: Environmental Health Soil Screening Criterial - Permission 136814/FO/2023 [Filed 27 Nov 2023 10:12]

Categories: Filed by Mail Manager

CAUTION: This email originated from outside the Organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Good morning Mike

Thank you for the added information.

I am happy with the approach to zone the site and use public open space criteria for reuse for the green areas and commercial reuse under the buildings and hardstanding areas.

For the Orange areas and planting on the podium areas will this all be imported soil or are there plans to reuse site won soils as part of the 1200mm depth of soil?

Kind Regards

Laura

Laura Miller (MRes, MA, BSc(Hons))

Please note that due to working compressed hours Wednesdays are a non-working day for me, I will respond to your email when I return to the office

Environmental Protection Officer
Environmental Protection Section
Environmental Health
Neighbourhoods Directorate
Manchester City Council

email: laura.miller@manchester.gov.uk
website: www.manchester.gov.uk
Telephone: 0161 234 1742
Internal: 31742

We are now on Twitter, for latest news and updates follow us @EnvHealthMcr

Please consider the environment before printing an e-mail

From: Mike Newman <mike.newman@rocconsulting.com>
Sent: 20 November 2023 09:27
To: Laura Miller <laura.miller@manchester.gov.uk>
Cc: Reece McGuinness <reece.mcguinness@rocconsulting.com>; Alex Smiles <ASmiles@rsk.co.uk>
Subject: RE: Environmental Health Soil Screening Criterial - Permission 136814/FO/2023