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SECTION 1 INTRODUCTION

1.1 Idom Merebrook (Merebrook) was commissioned by Linden Homes Thames Valley (Linden) and Bovis Homes South West (Bovis) to act as their environmental consultant on a scheme to re-develop the former RAF Little Rissington airbase at Upper Rissington, Gloucestershire. The following document was submitted and approved in fulfilment of the relevant planning condition prior to the start of the scheme:

i. Remediation Method Statement, Former RAF Little Rissington, Upper Rissington, RMS-17183-13-2 Rev B, Merebrook Consulting, March 2013.

1.2 Following completion and validation of the residential phases of the scheme, several stockpiles of mixed material were left in public open space (POS) areas which were not validated for re-use within the development and therefore this addendum has been produced to supplement the original RMS. The stockpiles each comprised various materials including made ground arisings and as-dug natural arisings from the pond, road, services and foundation excavations.

1.3 Natural as-dug arisings were identified as being suitable for export to a site at Moreton-on-Marsh where material was required in order to raise the landform for site drainage purposes. This movement of this material will be carried out following the Definition of Waste Code of Practice following submission of an MMP (Materials Management Plan). The material will be verified as suitable for use following the agreed remediation strategy for the site at Moreton which has been submitted and approved as part of the planning process:

i. Remediation Method Statement, Plot of Land at FSC Moreton-in-Marsh, RMS-20341-16-506 Rev A, Idom Merebrook, February 2017

1.4 To achieve the consented landform for the scheme at Rissington, a number of areas requiring infilling on the site have been identified. A drawing showing the locations to be filled is provided in Appendix 1. This document sets out the principles and measures required to retain and re-use the stockpiles of made ground materials on the site within the landscaped areas.

SECTION 2 STOCKPILE IDENTIFICATION

2.1 A drawing showing the stockpile locations is provided in Appendix 2. Table 1 below sets out the type and quantity of material within each stockpile:

Table 1: Stockpile Identification

Stockpile Reference	Type of Material	Quantity (m^3)	Comment
A	natural as dug arisings	2,960	export to Moreton under MMP
B	natural as dug arisings	3,479	export to Moreton under MMP
C	made ground arisings	14,176	re-use on site to achieve consented landform
D	made ground arisings	3,607	re-use on site to achieve consented landform
D1	6F2	2,930	resource material for road construction
E	made ground arisings	7,652	re-use on site to achieve consented landform
F	made ground arisings	3,780	re-use on site to achieve consented landform
G	made ground arisings	503	re-use on site to achieve consented landform
H	made ground arisings	1,286	re-use on site to achieve consented landform
K	Imported topsoil used to complete residential plots	266	assigned to complete residential plots
L	natural as dug arisings	2,449	export to Moreton under MMP

SECTION 3 STOCKPILE SAMPLING

3.1 In order to confirm that the material in stockpiles C, D, E, F, G and H were chemically suitable to remain on site for the intended use, a sampling exercise was undertaken. Analysis was scheduled for identified contaminants of concern at the site: arsenic, PAH (polyaromatic hydrocarbons) and asbestos.

3.2 Idom Merebrook attended site between 6 and 7 October 2016. Representative samples around each stockpile and from within each stockpile were obtained with the assistance of a machine excavator. Approximately half of the samples from each stockpile were scheduled for analysis with the remainder placed on hold pending any requirement to increase the dataset for any additional statistical analysis. A drawing showing samples locations is provided in Appendix 3. Table 2 below details the sampling regime and descriptions taken at the time of sampling:

Table 2: Stockpile Sampling Regimen

Stockpile Ref	Drawing Ref (Appendix 3)	Total Number of Samples Taken	Description
C	306-026	55 (MV01-55)	Reworked light orange grey brown sandy, gravelly, cobbly clay. Cobbles and gravel are angular brick, concrete, limestone, slate, plastic and metal bar. Frequent black ashy components throughout.
D	306-022	15 (MV01-15)	Reworked orange brown very sandy gravelly clay with inclusions of organic material and rolls of turf. Cobbles and gravel are limestone, asphalt, brick, concrete, plastic and black ash.
E	306-021	31 (MV01-31)	Reworked light orange brown very soft, sandy, gravelly clay with cobbles of limestone. Gravel is angular flint, chalk, brick, concrete, wood and occasional black ash
F	306-020	15 (MV01-15)	Light grey mottled orange brown soft slightly sandy gravelly with angular limestone cobbles. Gravel is angular limestone and rare concrete and brick fragments
G	306-027	2 (MV01-MV02)	Light grey mottled orange brown soft slightly sandy gravelly with angular limestone cobbles. Gravel is angular limestone and rare concrete and brick fragments
H	306-024	6 (MV01-06)	Light grey brown mottled dark orange brown soft slightly sandy gravelly clay with angular limestone cobbles. Gravel is angular limestone and rare metal rebar fragments

SECTION 4 ENVIRONMENTAL ASSESSMENT

4.1 SOIL QUALITY

4.1.1 The laboratory chemical analysis certificates and summary tables of the results are contained in Appendix 4. The results of the analysis are summarised in Table 3.

4.1.2 An initial screening exercise has been undertaken whereby contaminant concentrations recorded in soils have been assessed against *Suitable for Use Levels* (S4ULs) published in 2015 by LQM/CIEH[1]. These precautionary screening levels are designed to be representative of minimal risk to human health in a number of land use scenarios. In this report S4ULs have been selected for public open space land use in a residential setting (POSresi) and assuming a soil organic matter of 1 %.

4.1.3 For asbestos, where detected, a quantitation was undertaken to determine the percentage by weight content of the soil sample.

Table 3: Summary of Soils Chemical Analysis Results

CONTAMINANT	UNITS	MAX	MEAN	No of Tests	SCREENING LEVEL (SL)	No > SL*
HUMAN HEALTH RISK ASSESSMENT						
Arsenic	$mg.kg^{-1}$	26	14.17	66	79	0
Acenaphthene	$mg.kg^{-1}$	6.9	0.52	66	15000	0
Acenaphthylene	$mg.kg^{-1}$	1.2	0.16	66	15000	0
Anthracene	$mg.kg^{-1}$	11	0.71	66	74000	0
Benz(a)anthracene	$mg.kg^{-1}$	15	1.62	66	29	0
Benzo(a)pyrene	$mg.kg^{-1}$	12	1.74	66	5.7	4
Benzo(b)fluoranthene	$mg.kg^{-1}$	10	1.37	66	7.1	2
Benzo(ghi)perylene	$mg.kg^{-1}$	7.5	1.09	66	190	0
Benzo(k)fluoranthene	$mg.kg^{-1}$	5.3	0.74	66	640	0
Chrysene	$mg.kg^{-1}$	14	1.59	66	57	0
Dibenz(ah)anthracene	$mg.kg^{-1}$	1.3	0.27	66	0.57	7
Fluoranthene	$mg.kg^{-1}$	36	3.65	66	3100	0
Fluorene	$mg.kg^{-1}$	9.4	0.53	66	9900	0
Indeno(123-cd)pyrene	$mg.kg^{-1}$	8	1.26	66	82	0
Naphthalene	$mg.kg^{-1}$	6.1	0.23	66	4900	0
Phenanthrene	$mg.kg^{-1}$	39	2.49	66	3100	0
Pyrene	$mg.kg^{-1}$	27	3.14	66	7400	0

Notes: * Number of samples exceeding screening level

[1] Nathanail, C. P., McCaffrey, C., Gillett, A. G., Ogden, R. C. and Nathanail, J. F. 2015. *The LQM/CIEH S4ULs for Human Health Risk Assessment*. Land Quality Press, Nottingham. Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3100. All rights reserved. Including August 2015 nickel update.

4.1.4 **Zootoxic Metals (harmful to human health)**

4.1.4.1 There were no recorded exceedances to the adopted screening level for arsenic.

4.1.5 **Organic Contaminants**

4.1.5.1 Exceedances to the adopted screening levels are summarised in Table 4 below:

Table 4: Summary of PAH Exceedances

Stockpile Ref	No of Tests	Determinand	Sample Ref Exceedance(s)
C	30	Benzo(a)pyrene	MV01, MV29, MV35
		Benzo(b)fluoranthene	MV35
		Dibenz(ah)anthracene	MV01, MV29, MV35
E	16	Benzo(a)pyrene	-
		Benzo(b)fluoranthene	-
		Dibenz(ah)anthracene	MV08, MV12, MV13
F	8	Benzo(a)pyrene	MV09
		Benzo(b)fluoranthene	MV09
		Dibenz(ah)anthracene	MV09

4.1.6 **Asbestos**

4.1.6.1 A total of 66 samples were screened for asbestos. Five samples were found to contain chrysotile asbestos and a quantification was undertaken to determine the content. Table 5 below summarises the findings:

Table 5: Summary of Asbestos Results

Stockpile Ref	No of Tests	Samples found to contain asbestos	Asbestos Content (%)
C	30	C14	<0.001
		C16	<0.001
		C24	<0.001
		C54	<0.001
E	16	E6	0.001

SECTION 5 RISK ASSESSMENT AND REMEDIATION STRATEGY

5.1 Benzo(a)pyrene, benzo(b)fluoranthene and dibenzo(ah)anthracene have been recorded at elevated concentrations and further assessment is required to determine the degree of risk to future site users.

5.2 The benzo(a)pyrene, benzo(b)fluoranthene and dibenzo(ah)anthracene concentrations recorded in stockpiles C and F, and the dibenzo(ah)anthracene concentrations in stockpile E have been assessed using the guidance published by CL:AIRE *Guidance on Comparing Soil Contamination Data with a Critical Concentration* which is recognised by the Environment Agency. The statistical hypothesis being tested is as follows:

Is there sufficient evidence that the true mean concentrations of benzo(a)pyrene, benzo(b)fluoranthene and dibenzo(ah)anthracene in the stockpiles are greater than the critical concentrations (i.e. the adopted screening levels of 5.7, 7.1 and 0.57 $mg.kg^{-1}$ respectively)?

5.3 No outliers have been removed from the datasets as there is no strong evidence to suggest that elevated concentrations are not part of the same overall distribution.

5.4 The data distribution has been checked to determine whether it follows a normal distribution or not to determine the most appropriate statistical test. Where the probability plot and Shapiro-Wilks test for normality suggested that the distribution departed significantly from normality a non-parametric statistical test (the one-sided Chebychev Theorem) was deemed appropriate; whereas if no significant departure from normality was observed the T-Test was deemed appropriate. A summary of the statistical analyses is presented in Table 6 below and the statistical output is presented in Appendix 5.

Table 6: Summary of Statistical Analyses Results

Stockpile Ref	**Contaminant**	**Test for Normality**	**Null Hypothesis Rejected or Accepted** *H_0: the true mean concentration is equal to, or greater than, the critical concentration or screening level*
C	Benzo(a)pyrene	data not normal	rejected
	Benzo(b)fluoranthene	data not normal	rejected
	Dibenz(ah)anthracene	data not normal	rejected
E	Dibenz(ah)anthracene	data normal	rejected
F	Benzo(a)pyrene	data not normal	accepted
	Benzo(b)fluoranthene	data not normal	rejected
	Dibenz(ah)anthracene	data not normal	accepted

5.5 The resulting calculations demonstrated that, at the 95 % confidence level, the true mean benzo(a)pyrene, benzo(b)fluoranthene and dibenzo(ah)anthracene concentrations in stockpile C; dibenzo(ah)anthracene concentrations in stockpile E; and benzo(b)fluoranthene concentrations in stockpile F were less than the critical concentrations. It is therefore considered that there is no significant risk to future site users and no remedial action is required in respect of these contaminants in their respective stockpiles.

5.6 However, the true mean benzo(a)pyrene and dibenzo(ah)anthracene concentrations in stockpile F were greater than the critical concentration indicating a potential risk requiring remedial action.