IAN FARMER ASSOCIATES

UKI Richmond Limited

Richmond Royal Hospital

VALIDATION REPORT

Contract: 22240090

Date: August 2024

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VALIDATION REPORT

Carried out at

Richmond Royal Hospital
Kew Foot Road
Richmond
TW9 2TE

Prepared for

UKI Richmond Limited
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Contract: 22240090

Date: August 2024

Document Control

Project:	**Richmond Royal Hospital**
Project No.:	**22240090**
Report title:	**VALIDATION REPORT**
Revision:	**00**
Document No.:	**22240090-VAL-00-140824**

Version	Date	Comment
00	14/08/2024	First issue

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1.0 INTRODUCTION

1.1 On the instructions of UKI Richmond Limited, works have been undertaken to validate remediation carried out on the site to address land contamination.

1.2 The development of the site comprised a new build section to the rear of the existing hospital, including an underground car park, relocation of a load-bearing structure and underpinning works, together with renovation of the existing buildings for residential use under London Borough of Richmond upon Thames planning application reference 18/3950/FUL. Final development and landscaping plans are included in Appendix 1.

1.3 This report should be read in conjunction with the following reports:

- Phase 1 Ground Contamination Desk Study, Arup, reference 247776-00, dated March 2016.
- Report on Ground Investigation (Geotechnical Report), Ian Farmer Associates (IFA), reference 52826, dated July 2019.
- Report on Ground Investigation (Ground Contamination Report), IFA, reference 52826A, dated August 2019.
- Remediation Method Statement (RMS), IFA, reference 2240090, dated November 2019.

1.4 It is recommended that a copy of this report be submitted to the relevant authorities to enable them to carry out their own site assessments and provide any comments.

1.5 This report has been prepared for the sole use of the Client for the purpose described and no extended duty of care to any third party is implied or offered, except for where specific requirements for extended warranties have been agreed and confirmed in writing by IFA. Any other third parties not named by IFA using any information contained within this report do so at their own risk.

2.0 SITE SETTING

2.1 Site Location

2.1.1 The site is situated at Richmond Royal Hospital, bound to the north by Evelyn Road and the west by Kew Foot Road, approximately 0.42km to the northeast of Richmond train station, and may be generally located by British National Grid Reference TQ 181 755.

2.2 Identified Contamination

2.2.1 The contamination risk assessment provided within the Ground Contamination Report (IFA reference 52826A) identified pollutant linkages associated with asbestos, lead and polycyclic aromatic hydrocarbons (PAH) compounds identified locally within the Made Ground potentially impacting upon end users of the site. Consequently, it was determined that remediation would be required to mitigate the risks identified.

2.2.2 Risks to controlled waters were considered to be low based on the results of groundwater testing and the setting of the site with regard to potential receptors.

2.2.3 Gas monitoring identified low concentrations and flow rates, resulting in a site classification of Characteristic Situation (CS) 1. Therefore, the installation of gas and / or vapour protection measures was not deemed necessary for the proposed development.

2.2.4 Possible risks to standard polyethylene (PE) potable water supply pipes were identified associated with concentrations of hydrocarbons identified within the near surface soils.

3.0 REMEDIATION STRATEGY

3.1 The following remediation strategy was provided within the RMS (IFA reference 2240090):

Step	Action
1.	Beneath the proposed structures and permanent hard standing, no exposure pathway will exist between the contamination within the Made Ground and end users of the site on completion of the development. The site is to be entirely capped with hard standing and building cover with the only landscaping/planting provided within concrete based planters. Therefore, no further remediation is proposed to address the risks to end users. A relatively low risk to controlled waters has been identified based on the results of groundwater analysis and the distance to receptors. The hard surface capping will limit infiltration and further reduce the risk of contaminants migrating off-site and therefore, no further remediation is required.
2.	Where soil is to be imported to concrete planters, certificates confirming contaminant concentrations for all imported soils will be obtained from the supplier prior to importation, to ensure that it is suitable for its intended use, and that it is compliant with the British Standards BS 3882 (2015) and BS 3601 (2013), specifications for topsoil and subsoil, respectively. The soils will be visually inspected by the ground worker on receipt, and independent chemical analysis of the material will also be undertaken of the imported topsoil, and subsoil if relevant, which will be tested in a UKAS accredited laboratory to ensure that contaminant concentrations are below the published screening criteria for a residential end use without home grown produce, as referenced in the ground investigation report. These works will be undertaken by a suitably experienced engineer. The sampling frequency will be one sample per 100m3 of imported soil and suite of testing will comprise asbestos, metals, speciated PAH and speciated TPH CWG with BTEX and MTBE. The total number of samples will be confirmed once the total volume and source(s) of imported soil are confirmed.
3.	Concentrations of TPH within the Made Ground exceeded the basic risk assessment criteria for plastic pipes in boreholes WS3 and WS4 and therefore, the local water supply company will be consulted as to whether barrier pipe or selection of an alternative material will be required for the new services proposed on the site, or whether further testing should be carried out along the proposed pipelines.
4.	A watching brief will be undertaken by the developer, comprising the visual and olfactory assessment of all exposed soils during site clearance and excavations. Should any previously unidentified contamination or deleterious materials be encountered during ground works, further assessment and remedial action will be undertaken as appropriate. Where contamination is identified or suspected, consultation will be undertaken with a suitably experienced engineer to decide the most appropriate action, which may include: • The removal from site and disposal to a suitably licensed tip of all material suspected of being contaminated. The material would need to be classified prior to disposal. • Short-term storage of the suspected material while undertaking verification testing for potential contamination. The material would need to be stored in a contained area to ensure that contamination does not migrate and affect other areas of the site. Depending upon the amounts of material under consideration, this could be either a skip or a lined area. • Following removal of any suspected or contaminated soil, validation sampling will be undertaken around the base and sides of any excavation to ensure no contamination is present in the remaining soils.
5.	All waste material will be disposed of to an appropriately licensed site. The chemical testing and assessments previously carried out may be used to aid classification of any soil that is to be disposed of. Any further testing required by the tip prior to disposal will be carried out using a UKAS accredited laboratory. Copies of the waste consignment documentation will be retained by the developer for inclusion in the Final Validation Report.

4.0 VALIDATION

4.1 Description of Works

4.1.1 Information regarding the remediation undertaken at the site has been provided by the client, which is summarised below:

- Ground works commenced in early 2021. At the time of this report, the development is currently ongoing and nearing completion, pending final importation of topsoil.
- The site has been entirely capped by hard standing and building cover, with small areas of planting provided within concrete and brick based planters, as indicated on the soft landscape and planting plans in Appendix 1. No exposed soil remains that is in direct contact with the underlying ground.
- During the ground works, approximately 200m^3 of excavated soil was removed from the site and disposed of as inert waste, together with ballast and hardcore.
- A total volume of 140m^3 of topsoil is currently being imported from a single source to fill the planters.
- Barrier pipe has been installed for the new potable water supply.

4.2 Evidence

4.2.1 Waste consignment documentation for the disposal of excavated material from the site has been provided to IFA and reviewed in accordance with the details supplied by the client. A log of the waste movements is provided in Appendix 2. All waste consignment documents have been retained and are available from the client or IFA, though due to the volume, these have not been included within the validation report.

4.2.2 The client has confirmed that a watching brief was carried out and no evidence of contamination was observed during the ground works. Consequently, no further investigation or risk assessment was required prior to completion of the development.

4.2.3 A certificate of analysis from the supplier for the topsoil that is being imported to the planters is provided in Appendix 3.

4.2.4 The laboratory determined contaminant concentrations reported on the certificate of analysis provided by the topsoil supplier have been compared to the human health screening criteria specified in the RMS and tabulated in Appendix 3, to confirm whether the material is suitable for use. The Assessment Criteria (AC) is based on the published Suitable 4 Use Levels (S4ULs) and Category 4 Screening Level (C4SLs), where applicable, for an end use of residential without home grown produce. Screening criteria for a soil organic matter (SOM) of 1% has been adopted for organic determinands as a conservative approach.

4.2.5 All of the results are below the relevant AC. Consequently, the imported soil is considered suitable for use within the planters, as summarised in the tables below:

Determinant	Soil Concentration Range (mg/kg)	Guidance Value (mg/kg)
Arsenic	6	40
Cadmium	<0.2	85
Chromium (III)	9	910
Chromium (VI)	<1.8	21
Copper	16	7100
Lead	32	310
Mercury	<0.3	1.2
Nickel	4	180
Selenium	<1	430
Zinc	35	4000
Acenaphthene	<0.05	3000
Acenaphthylene	<0.05	2900
Anthracene	<0.05	31000
Benzo(a)anthracene	0.42	11
Benzo(a)pyrene	0.41	3.2
Benzo(b)fluoranthene	0.52	3.9
Benzo(ghi)perylene	0.29	360
Benzo(k)fluoranthene	0.22	110
Chrysene	0.44	30
Dibenzo(ah)anthracene	0.07	0.31
Fluoranthene	0.85	1500
Fluorene	<0.05	2800
Indeno(123-cd)pyrene	0.27	45
Naphthalene	<0.05	2.3
Phenanthrene	0.34	1300
Pyrene	0.72	3700
Phenol	<1	750

Determinant	Soil Concentration Range (mg/kg)	Guidance Value (mg/kg)
TPH Aliphatic EC 5-6	<0.02	42
TPH Aliphatic EC >6-8	<0.02	100
TPH Aliphatic EC >8-10	<0.05	27
TPH Aliphatic EC >10-12	<1	130
TPH Aliphatic EC >12-16	<2	1100
TPH Aliphatic EC >16-35	<8	65000
TPH Aromatic EC 5-7	<0.01	370
TPH Aromatic EC >7-8	<0.01	860
TPH Aromatic EC >8-10	<0.05	47
TPH Aromatic EC >10-12	<1	250
TPH Aromatic EC >12-16	3.2	1800
TPH Aromatic EC >16-21	<10	1900
TPH Aromatic EC >21-35	22	1900
Benzene	<0.005	0.38
Toluene	<0.005	880
Ethylbenzene	<0.005	83
P & m Xylenes	<0.005	79
o Xylene	<0.005	88

4.2.6 Due to the small volume of soil required and its proposed use in constructed planters within communal areas, independent testing of the material following importation is not considered necessary.

4.2.7 The developer has confirmed that barrier pipe was adopted for the new potable water supply. Photographs showing the installation of the barrier pipe are provided in Appendix 4.

5.0 CONCLUSIONS

5.1 It is considered on the basis of the validation work undertaken and detailed above, that all potential pollutant linkages have been suitably addressed for the development and no long-term pollutant linkages remain that would require ongoing management.

5.2 This report should be submitted to the Local Planning Authority for approval and discharge of the remaining outstanding land contamination conditions.

APPENDIX 1

DRAWINGS

LEGEND

- Site boundary
- Hedge
- Courtyard woodland mix
- Shade Mix - Ornamental perennials and ferns
- Sun mix - Ornamental perennials and grasses
- Shrub mix - loosely trimmed shrubs
- Shade mix- Evergreen hanging plants
- Sun mix- Ornamental low herbaceous perennials
- Climbers planting
- Turf Lawn
- Existing trees
- Proposed trees

NOTES:

- All planting within the RPZ to be hand dug. Methodology and refinement to planting scheme to be developed with arboriculturalist at Stage 5.
- This drawing set is **Not for Construction** - For Tender and cost purposes only
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- This drawing to be read in conjunction with all other Spacehub drawings, schedules and specifications and other project consultants drawings & specifications
- Attenuation and drainage information (including podium drainage) by engineer. For detailed information refer engineers drawings and specification for further information
- Planting plans to be read in conjunction with landscape plant schedule: 8423-SCH-001
- Note: Detailed Planting set-out completed in Stage 5

- Exposure to biological hazards - ingestion hazard from toxic plant matter:Planting design and selection contains some species which may cause severe discomfort if ingested. Hazardous planting to be kept away from areas of play or path edges to avoid ingestion by children. Hazardous plant species to be included within operations manual
- Contact Hazard that may cause skin irritation - Toxic plant matter: Planting design and selection contains some species which may cause blistering or burns to skin if in contact. Maintenance workers to wear gloves at all times. Hazardous plant species to be included within operations manual
- Risky of injury - Installation and management of proposed trees. Risk of operators falling while working at a height - Contractor to submit installation method for approval before installation Danger of injury to operatives lifting and moving trees - unloading of trees is carried out as close to the final location as possible, minimising movement on site. Trees to be mechanically lifted. Risk of impact with operatives and residents'. Potential to clash with building causing damage, falling objects, cuts and musculoskeletal injuries. No trees to be installed in windy conditions.
- Falling into excavations causing injury - Risk of falling into tree pits. Pits to be phased and protected to prevent falls - contractor to submit method statement
- Risk of worker falling and risk of branches dropping causing injury - Management of trees. Where possible use long handled pruning equipment to avoid ladders and temporary scaffold equipment - contractor to submit method statements for pruning and working from a height.

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Rev	Date	Description	By	Chk
00	14/05/24	Stage 4 issue	AS	TS

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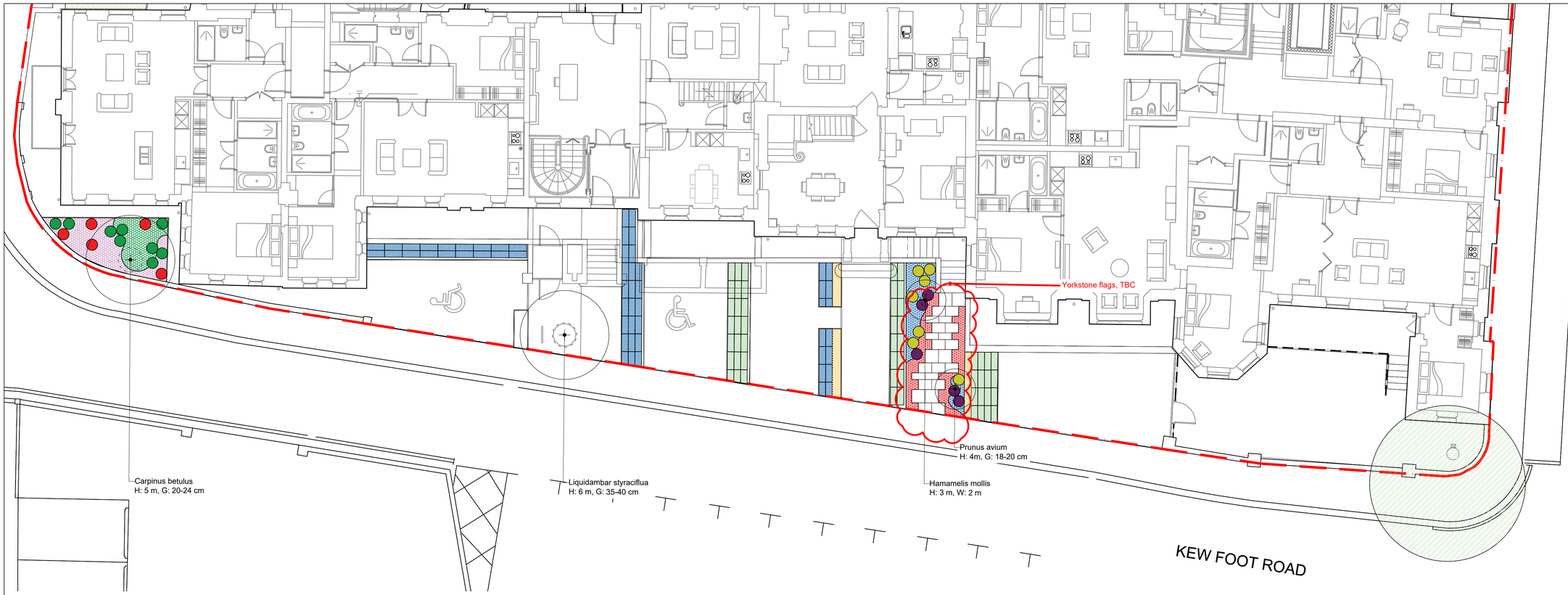
Project
Richmond Royal

Client
RER

Drawing title
100 - General Arrangements
Soft Landscape

Drawing status	Drawn by
Stage 4	AS
Date	Checked by
14/05/2024	TS
Drawing number / Rev	Scale
8423-PL-GA-100 / 00	1:200 @ A1



LEGEND

- Site boundary
- Hedge 01 - Lonicera nitida
- Hedge 02 - Prunus lausitanica
- Low planting mix 1 4.5 m²
- Low planting mix 2 2.9 m²
- Low planting mix 3 4.1 m²
- Planting mix 4 4.8 m²
- Planting mix 5 7 m²
- CT-Choysia ternata
- DE-Dryopteris erythosora
- HQ-Hydrangea quercifolia
- PT-Pittosporum tobira
- Proposed trees
- Existing trees

Trees						
Abbr.	Name	Container	Size	Habit	Total	Notes
CB	Carpinus betulus	containerised	H: 5 m, G: 20 24 cm	standard	1	Carpinus bet. 'A. Beockman' Standard Potted 200L Girth 25 30
HM	Hamamelis mollis	containerised	H: 3 m, W: 2 m	multistem	1	substituted with Amelanchier lamarckii H :2 2.5
LS	Liquidambar styraciflua	containerised	H: 6 m, G: 35-40 cm	standard	1	Liquidambar st. 'Worplesdon' Standard Potted 200L ,Girth 20-25
PA	Prunus avium	containerised	H: 4 m, G: 18-20 cm	standard	1	Prunus 'Snow Goose' (Umineko) Standard Potted 200L, Girth 20-25

Shrubs and ferns					
Abbr.	Name	Container	Density (per m2)	Percentage	Total
HQ	Hydrangea quercifolia	15L	as shown	/	4
CT	Choysia ternata	15L	as shown	/	7
DE	Dryopteris erythosora	15L	as shown	/	5
PT	Pittosporum tobira	15L	as shown	/	5

Hedges					
Abbr.	Name	Container	Density (per l/m)	Percentage	Total
PR	Prunus laurocerasus	trough 80x20 cm	as shown	/	56
LN	Lonicera nitida 'Elegant'	trough 80x20 cm	as shown	/	53

Low Mix 01					
total area (m2)					4.6
Abbr.	Name	Container	Density (per m2)	Percentage	Total
VM	Vinca minor 'Alba'	2L	11	70%	35
GI	Geranium sanguineum 'Album'	2L	11	30%	15
			TOTAL	100%	51

Low Mix 02					
total area (m2)					3
Abbr.	Name	Container	Density (per m2)	Percentage	Total
CA	Carex testacea 'Prairie Fire'	2L	11	50%	17
EK	Erigeron karvinskianus	2L	11	50%	17
			TOTAL	100%	17

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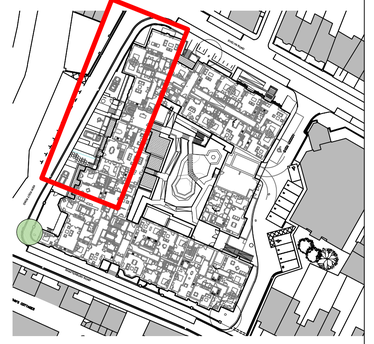
Low mix 03					
total area (m2)					4.1
Abbr.	Name	Container	Density (per m2)	Percentage	Total
VM	Vinca minor 'Alba'	2L	11	40%	18
EP	Epimedium stellatum 'Wudang Star'	2L	11	30%	14
PL	Pulmonaria longifolia	2L	11	30%	14
			TOTAL	100%	45

Planting mix 04					
total area (m2)					4.8
Abbr.	Name	Container	Density (per m2)	Percentage	Total
AG	Agapanthus 'White Giant'	2L	30	5%	7
AN	Anemone x hybrida 'Honorine Jobert'	2L	11	10%	5
HM	Hackonecloa macra	2L	11	30%	16
HE	Helleborus x erichsmithii 'Snow love'	2L	11	20%	11
GM	Geranium machrorrhizum 'White Ness'	2L	11	15%	8
DG	Digitalis grandiflora	2L	11	20%	11
			TOTAL	100%	57

Planting mix 05					
total area (m2)					7
Abbr.	Name	Container	Density (per m2)	Percentage	Total
AS	Astrantia 'White Angel'	2L	11	15%	12
EU	Euphorbia amygdaloides var. Robbiae	5L	11	20%	15
HE	Helleborus x erichsmithii	2L	11	10%	8
HM	Hackonecloa macra	2L	11	20%	15
HN	Hyacintoides non scripta	bulb	11	5%	4
PP	Polypodium vulgare	5L	11	20%	15
VM	Vinca minor 'Alba'	2L	11	10%	8
			TOTAL	100%	69



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Rev	Date	Description	By	Chk
00	14/05/24	Stage 4 issue	AS	TS

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Project
Richmond Royal

Client
RER

Drawing title
600-Planting Plans
Block B,C,D Planting Plan
1 of 4

Drawing status: For information
Drawn by: AS
Date: 22/04/2024
Checked by: TS

Drawing number: 8423-PL-PP-601
Rev: 00
Scale: 1:100 @ A1

Trees					
Abbr.	**Name**	**Container**	**Size**	**Habit**	**Total**
BP	Betula pendula	rootball	H: 5 m, G: 20-24 cm	standard	3

Shrubs and ferns					
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
CT	Choysia ternata	15L	as shown	/	6
CO	Cornus sanguinea 'Midwinter Fire'	15L	as shown	/	9
DE	Dryopteris erythosora	15L	as shown	/	10
PT	Pittosporum tobira	15L	as shown	/	10
SH	Sarcococca hookeriana var. humilis	15L	as shown	/	14
VT	Viburnum tinus	15L	as shown	/	6

Planting mix 01					
total area (m2)					**20.8**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
BA	Bistorta amplexicaulis 'Orange field'	2L	11	10%	23
EP	Epimedium stellatum 'Wudang Star'	2L	11	10%	23
BS	Blechnum spicant	2L	11	10%	23
HE	Helleborus niger	2L	11	10%	23
HM	Hackonecloa macra	5L	11	25%	57
HN	Hyacintoides non scripta	bulb	11	5%	11
HP	Hosta 'Devon Green'	2L	11	10%	23
PS	Polystichium setiferum	2L	11	10%	23
RP	Rodgersia pinnata	2L	11	10%	23
			TOTAL	100%	229

Planting mix 02					
total area (m2)					**18.3**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
BS	Blechnum spicant	2L	11	40%	92
PS	Polystichium setiferum	2L	11	30%	69
PP	Polypodium vulgare	5L	11	20%	15
VM	Vinca minor 'Alba'	2L	11	10%	20
			TOTAL	100%	20

Planting mix 03					
total area (m2)					**6.9**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
AS	Astrantia major 'Shaggy'	2L	11	15%	11
EU	Euphorbia amygdaloides var. Robbiae	5L	11	20%	15
HE	Helleborus niger	2L	11	10%	8
HM	Hackonecloa macra	2L	11	20%	15
HN	Hyacintoides non scripta	bulb	11	5%	4
PP	Polypodium vulgare	5L	11	20%	15
VM	Vinca minor 'Alba'	2L	11	10%	8
			TOTAL	100%	68

Low mix 04					
total area (m2)					**2.4**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
VM	Vinca minor 'Alba'	2L	11	40%	11
EP	Epimedium stellatum 'Wudang Star'	2L	11	30%	8
PL	Pulmonaria longifolia	2L	11	30%	8
			TOTAL	100%	26

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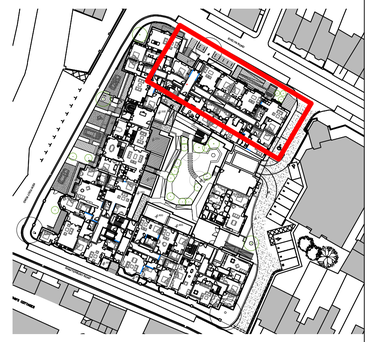
LEGEND

- Site boundary
- Planting mix 01 20.8 m²
- Low planting mix 02 18.3 m²
- Planting mix 03 6.9 m²
- Low planting mix 04 2.4 m²
- CT-Choysia ternata
- CO-Cornus sanguinea 'Midwinter fire'
- DE-Dryopteris erythosora
- PT-Pittosporum tobira
- SH-Sarcococca hookeriana var. humilis
- VT-Viburnum tinus
- Proposed trees
- Existing trees



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Rev	Date	Description	By	Chk
00	14/05/24	Stage 4 issue	AS	TS

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Client
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Drawing title
600-Planting Plans
Block E Planting Plan
2 of 4

Drawing status: Stage 4
Drawn by: AS
Date: 14/05/2024
Checked by: TS
Drawing number: 8423-PL-PP-602
Rev: 00
Scale: 1:100 @ A1

Trees					
Abbr.	**Name**	**Container**	**Size**	**Habit**	**Total**
CV	Crataegus monogyna	container:seo	H: 2 m, W: 2 m	mult stem	6
PS	Prunus serrula	container:seo	H: 5 m, G: 20-24 cm	heavy standard	1

Shrubs and ferns					
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
CS	Cornus sanguinea 'Midwinter fire'	30L	as shown	/	11
EM	Euphorbia mellifera	10L	as shown	/	22

Mix 01					
total area (m2)					**7.8**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
DC	Deschampsia cespitosa	5L	11	20%	17
EU	Euphorbia carachias subs. Wulfenii	2L	11	20%	17
SO	Sanguisorba officinalis	2L	11	15%	13
ST	Stipa tenuissima	5L	11	20%	17
TS	Thymus serpillum	2L	11	10%	9
TU	Tulipa 'Apricot Beauty'	bulb	50	5%	26
VB	Verbena bonariensis	2L	11	10%	9
			TOTAL	100%	107

Mix 02					
total area (m2)					**10.2**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
CA	Calamagrostis × acutiflora 'Karl Foerster'	5L	11	15%	17
EC	Echinacea purpurea	2L	11	15%	17
EU	Euphorbia carachias subs. Wulfenii	5L	11	20%	22
RF	Rudbeckia fulgida 'Goldsturm'	2L	11	15%	17
SN	Salvia nemorosa 'Caradonna'	2L	11	10%	11
ST	Stipa tenuissima	5L	11	20%	22
TU	Tulipa 'Apricot Beauty'	bulb	50	5%	26
			TOTAL	100%	132

Mix 03					
total area (m2)					**29**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
AP	Allium 'Purple Suze'	bulb	20	5%	8
DC	Deschampsia cespitosa	5L	11	15%	13
ER	Eringium yuccifolium	2L	11	10%	11
EU	Euphorbia carachias subs. Wulfenii	5L	11	20%	22
HE	Helenium 'Mohereim beauty'	2L	50	10%	51
OV	Origanum vulgare	2L	11	10%	11
SN	Salvia nemorosa 'Caradonna'	2L	11	10%	11
ST	Stipa tenuissima	5L	11	20%	22
			TOTAL	100%	142

Mix 04					
total area (m2)					**41.7**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
AC	Achillea millefolium 'Terracotta'	2L	11	10%	9
AP	Allium 'Purple Suze'	bulb	20	5%	8
DC	Deschampsia cespitosa	5L	11	15%	13
EC	Echinacea purpurea	2L	11	10%	11
EU	Euphorbia carachias subs. Wulfenii	5L	11	10%	11
GA	Gaura lindhemerii	2L	11	10%	11
OV	Origanum vulgare	2L	11	10%	11
SN	Salvia nemorosa 'Caradonna'	2L	11	10%	11
ST	Stipa tenuissima	5L	11	20%	22
			TOTAL	100%	91

Mix 05					
total area (m2)					**1.5**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
CT	Carex testacea 'Prairie fire'	2L	11	60%	51.48
EC	Echinacea purpurea	2L	11	20%	22.44
GA	Gaura lindhemerii	2L	11	20%	22
			TOTAL	100%	22

- Exposure to biological hazards - ingestion hazard from toxic plant matter:Planting design and selection contains some species which may cause severe discomfort if ingested. Hazardous planting to be kept away from areas of play or path edges to avoid ingestion by children. Hazardous plant species to be included within operations manual
- Contact Hazard that may cause skin irritation - Toxic plant matter: Planting design and selection contains some species which may cause blistering or burns to skin if in contact. Maintenance workers to wear gloves at all times. Hazardous plant species to be included within operations manual
- Risky of injury - Installation and management of proposed trees. Risk of operators falling while working at a height - Contractor to submit installation method for approval before installation Danger of injury to operatives lifting and moving trees - unloading of trees is carried out as close to the final location as possible, minimising movement on site. Trees to be mechanically lifted. Risk of impact with operatives and residents'. Potential to clash with building causing damage, falling objects, cuts and musculoskeletal injuries. No trees to be installed in windy conditions.
- Falling into excavations causing injury - Risk of falling into tree pits. Pits to be phased and protected to prevent falls - contractor to submit method statement
- Risk of worker falling and risk of branches dropping causing injury - Management of trees. Where possible use long handled pruning equipment to avoid ladders and temporary scaffold equipment - contractor to submit method statements for pruning and working from a height.

LEGEND

- Site boundary
- Planting mix 01 7.8 m²
- Low planting mix 02 10.2 m²
- Planting mix 03 29 m²
- Planting mix 04 41.7 m²
- Planting mix 05 1.5 m²
- EM-Euphorbia mellifera
- CS-Cornus sanguinea 'Midwinter fire'
- Proposed trees
- Existing trees

NOTES:

- All planting within the RPZ to be hand dug. Methodology and refinement to planting scheme to be developed with arboriculturalist at Stage 5.
- This drawing set is **Not for Construction** - For Tender and cost purposes only
- Do not scale from drawing, use figured dimensions only
- All dimensions and levels to be checked onsite
- All dimensions are in millimetres unless otherwise noted
- All drawings to be read in colour
- Any error in information found must be relayed back to Landscape Architect for remediation
- Proposed works outside of the red line boundary are not detailed or specified within this set
- This drawing to be read in conjunction with all other Spacehub drawings, schedules and specifications and other project consultants drawings & specifications
- Attenuation and drainage information (including podium drainage) by engineer. For detailed information refer engineers drawings and specification for further information
- Planting plans to be read in conjunction with landscape plant schedule: 8423-SCH-001
- Note: Detailed Planting set-out completed in Stage 5

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Rev	Date	Description	By	Chk
00	14/05/24	Stage 4 issue	AS	TS

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Drawing title
600-Planting Plans
Block A, F Planting Plan
3 of 4

Drawing status: Stage 4
Drawn by: AS
Date: 14/05/2024
Checked by: TS
Drawing number: 8423-PL-PP-603
Rev: 00
Scale: 1:100 @ A1

Trees						
Abbr.	**Name**	**Container**	**Size**	**Habit**	**Total**	**Notes**
AU	Arbutus unedo	containerised	H: 3 m, W: 2.5 m	multistem	5	
CA	Corylus avellana	containerised	H: 3 m, W: 2.5 m	multistem	4	
HM	Hamamelis mollis	containerised	H: 3 m, W: 2.5 m	multistem	6	substituted with Amelanchier lamarckii H:2-2.5

Shrubs and ferns					
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
CT	Choysia ternata	15L	as shown	/	19
DE	Dryopteris erythosora	5L	as shown	/	43
CS	Cornus sanguinea 'Midwinter fire'	15L	as shown	/	23
SH	Sarcococca hookeriana var. humilis	15L	as shown	/	28
VT	Viburnum tinus	15L	as shown	/	26

Climbers					
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
HHW	Hedera helix 'Woerner'	15 L	as shown	/	28

Mix 01					
total area (m2)					**124**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
AH	Anemone x hybrida 'Honorine Jobert'	2L	11	10%	136
BM	Briza media	2L	11	20%	273
CT	Carex testacea 'Prairie Fire'	2L	11	10%	136
ES	Epimedium stellatum 'Wudang Star'	2L	11	10%	136
HE	Helleborus x erichsmithii 'Snow love'	2L	11	10%	136
HM	Hackonecloa macra	2L	11	20%	273
RP	Rodgersia pinnata	2L	11	10%	136
VM	Vinca minor 'Alba'	2L	11	10%	136
			TOTAL	100%	1228

Mix 02					
total area (m2)					**11.7**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
CO	Coreopsis 'Mango Punch'	2L	11	20%	25.74
SS	Sesleria autumnalis	5L	11	30%	38.61
ST	Stipa tenuissima	5L	11	30%	38.61
VB	Verbena bonariensis	2L	11	20%	25.74
			TOTAL	100%	64

Mix 03					
total area (m2)					**0.7**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
SA	Salvia nemorosa 'Caradonna'	2L	11	60%	5
TH	Thymus serpillum	2L	11	20%	2
ST	Stipa tenuissima	5L	11	20%	2
			TOTAL	100%	2

Mix 04					
total area (m2)					**30.4**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
HH	Hedera helix	2L	11	50%	167
DA	Dryopteris affinis	5L	11	50%	167
			TOTAL	100%	167

Mix 05					
total area (m2)					**1.2**
Abbr.	**Name**	**Container**	**Density (per m2)**	**Percentage**	**Total**
AL	Anemanthele lessoniana	2L	11	40%	51.48
AQ	Aquilegia vulgaris var. stellata' Ruby port	2L	11	20%	25.74
ER	Erigeron karvinkianus	2L	11	20%	25.74
KN	Kniphophia 'Tawny King'	2L	11	20%	25.74
			TOTAL	100%	51

NOTES:

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- Planting plans to be read in conjunction with landscape plant schedule: 8423-SCH-001
- Note: Detailed Planting set-out completed in Stage 5

- Exposure to biological hazards - ingestion hazard from toxic plant matter:Planting design and selection contains some species which may cause severe discomfort if ingested. Hazardous planting to be kept away from areas of play or path edges to avoid ingestion by children. Hazardous plant species to be included within operations manual
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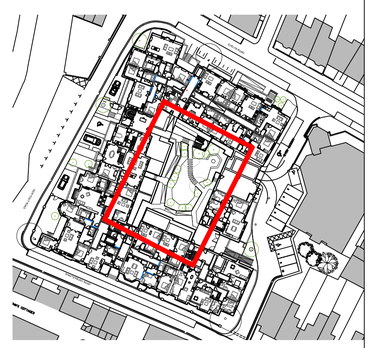
- Falling into excavations causing injury - Risk of falling into tree pits. Pits to be phased and protected to prevent falls - contractor to submit method statement
- Risk of worker falling and risk of branches dropping causing injury - Management of trees. Where possible use long handled pruning equipment to avoid ladders and temporary scaffold equipment - contractor to submit method statements for pruning and working from a height.

LEGEND

- Site boundary
- Planting mix 01 124 m²
- Planting mix 02 11.7 m²
- Planting mix 03 0.7 m²
- Planting mix 04 30.4 m²
- Planting mix 05 1.2 m²
- Amenity lawn - shade tolerant 70.2 m²
- CT-Choysia ternata
- CS-Cornus sanguinea 'Midwinter fire'
- DE-Dryopteris erythosora
- PT-Pittosporum tobira
- SH-Sarcococca hookeriana var. humilis
- VT-Viburnum tinus
- HH-Hedera helix 'Woerner'
- Proposed trees



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Rev	Date	Description	By	Chk
00	14/05/24	Stage 4 issue	AS	TS

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Drawing title
600-Planting Plans
Courtyard Planting Plan
4 of 4

Drawing status: Stage 4
Drawn by: AS
Date: 14/05/2024
Checked by: TS
Drawing number: 8423-PL-PP-604
Rev: 00
Scale: 1:100 @ A1

APPENDIX 2

EXCAVATED SOILS

Date	Type	Quant	Transfer From	Transfer to	Column1	European Waste Code
17.01.22	Ballast Away	8	Richmond Royal Hospital	Al Concrete maple cross	Challenge road ashford middlesex,TW15 1AX	17.01.07 Clean Hardcore
18.01.22	Ballast Away	16	Richmond Royal Hospital	Al Concrete maple cross	Challenge road ashford middlesex,TW15 1AX	17.01.07 Clean Hardcore
19.01.22	Ballast Away	19	Richmond Royal Hospital	Al Concrete maple cross	Challenge road ashford middlesex , TW15 1AX	17.01.07 Clean Hardcore
21.01.22	Ballast Away	6	Richmond Royal Hospital	Al Concrete maple cross	Challenge road ashford middlesex, TW15 1AX	17.01.07 Clean Hardcore
04.02.21- 26.02.21	Tarmac Away	3	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.05.04 Soil And Stone Inert
03.06.21- 14.06.21	Hardcore Away	4	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.01.07 Clean Hardcore
30.07.21-04.08.21	Hardcore Away	4	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.01.07 Clean Hardcore
05.04.21	Hardcore Away	4	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.01.07 Clean Hardcore
05.05.22 - 17.06.22	Muck Away	65	Richmond Royal Hospital	Holly Bush Lane	Hilfeild Lane, Aldenham, Watford WD25 8DT	17.05.04 Soil And Stone Inert
06.01.22	Muck Away	8	Richmond Royal Hospital	Holly Bush Lane	Hilfeild Lane, Aldenham, Watford WD25 8DT	17.05.04 Soil And Stone Inert
06.07.21 - 20.07.21	4x Muck Away, 14x Hardcore away	18	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.05.04 Soil And Stone Inert
07.01.22	Muck Away	10	Richmond Royal Hospital	Holly Bush Lane	Hilfeild Lane, Aldenham, Watford WD25 8DT	17.05.04 Soil And Stone Inert
08.04.21- 20.04.21	Muck Away	15	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.05.04 Soil And Stone Inert
10.01.22	Muck Away	12	Richmond Royal Hospital	Holly Bush Lane	Hilfeild Lane, Aldenham, Watford WD25 8DT	17.05.04 Soil And Stone Inert
11.01.22	Muck Away	12	Richmond Royal Hospital	Holly Bush Lane	Hilfeild Lane, Aldenham, Watford WD25 8DT	17.05.04 Soil And Stone Inert
12.01.22	Muck Away	12	Richmond Royal Hospital	Holly Bush Lane	Hilfeild Lane, Aldenham, Watford WD25 8DT	17.05.04 Soil And Stone Inert
12.04.22 - 06.05.22	Muck Away	71	Richmond Royal Hospital	Holly Bush Lane	Hilfeild Lane, Aldenham, Watford WD25 8DT	17.05.04 Soil And Stone Inert
13.01.22	Muck Away	10	Richmond Royal Hospital	Holly Bush Lane	Hilfeild Lane, Aldenham, Watford WD25 8DT	17.05.04 Soil And Stone Inert
14.01.22	Muck Away	9	Richmond Royal Hospital	Holly Bush Lane	Hilfeild Lane, Aldenham, Watford WD25 8DT	17.05.04 Soil And Stone Inert
15.02.21-25.02.21	Muck Away	61	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.05.04 Soil And Stone Inert
17.01.22	6x Muck Away 4x Ballast Away	10	Richmond Royal Hospital	Holly Bush Lane	Hilfeild Lane, Aldenham, Watford WD25 8DT	17.05.04 Soil And Stone Inert
18.06.21- 28.06.21	6x Muck Away 3x Hardcore Away	9	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.05.04 Soil And Stone Inert
21.04.21 - 28.05.21	16x Muck Away 12x Concrete Away	28	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.01.07 Clean Hardcore
24,11.21 - 26.11.21	Muck Away	8	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.01.07 Clean Hardcore
26.02.21 - 30.03.21	15xMuck Away 2x Conctrete Away	17	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.05.04 Soil And Stone Inert
26.02.21-01.03.21	Muck Away	8	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.01.07 Clean Hardcore
26.07.21	1x Harcore Away 1x Muck Away	2	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.05.04 Soil And Stone Inert
30.06.21 - 05.07.21	Hardcore Away	18	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.01.07 Clean Hardcore
30.11.21 - 05.01.22	Muck Away	9	Richmond Royal Hospital	Shepperton	Littleton lane, shepperton,middlesex, TW17 0NF	17.05.04 Soil And Stone Inert
10.06.21 - 24.06.21	Rejected Ballast	45	Richmond Royal Hospital	Surrey	readymix concrete and pumping suppliers ltd	17.05.04 Soil And Stone Inert
25.06.21 - 05.07.21	Rejected Ballast	30	Richmond Royal Hospital	Surrey	readymix concrete and pumping suppliers ltd	17.05.04 Soil And Stone Inert
03.02.22 - 18.01.22 -	Rejected Ballast	23	Richmond Royal Hospital	Surrey	readymix concrete and pumping suppliers ltd	17.05.04 Soil And Stone Inert

IAN FARMER ASSOCIATES

MUCKAWAY LOG

Job no. 2240090

Richmond Royal Hospital, TW9 2DE

APPENDIX 3

IMPORTED SOILS

TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

31st May 2024
Our Ref: TOHA/24/1378/1/SS

PROSPECT MATERIALS LTD.
Tel: 01932 355365
Fax: 01932 344692

Dear Sirs

Topsoil Analysis Report: The Plant Centre

We have completed the analysis of the soil sample recently submitted, referenced *BS3882 Topsoil,* and have pleasure reporting our findings.

The purpose of the analysis was to determine the suitability of the sample for general landscape purposes (trees, shrubs, amenity grass). In addition, this sample has been assessed to determine its compliance with the requirements of the British Standard for Topsoil *(BS3882:2015 – Specification for Topsoil – Table 1, Multipurpose Topsoil).*

This report presents the results of analysis for the sample submitted to our office, and it should be considered 'indicative' of the topsoil source. The report and results should therefore not be used by third parties as a means of verification or validation testing or waste designation purposes, especially after the topsoil has left the Wilson Plant site.

SAMPLE EXAMINATION

The sample was described as a very dark grey (Munsell Colour 10YR 2/2), slightly moist, friable, slightly calcareous SAND, with weakly developed, fine granular structure*. The sample was virtually stone-free and no unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

*This appraisal of soil structure was made from examination of a disturbed sample. Structure is a key soil characteristic that may only be accurately assessed by examination in an in-situ state.

ANALYTICAL SCHEDULE

The sample was submitted to a UKAS and MCERTS accredited laboratory for a range of physical and chemical tests to confirm the composition and fertility of the soil, and the concentration of selected potential contaminants. The following parameters were determined:

- particle size analysis (sand, silt, clay);
- stone content (2-20mm, 20-50mm, >50mm);
- pH and electrical conductivity values;
- exchangeable sodium percentage;
- major plant nutrients (N, P, K, Mg);
- organic matter content;
- C:N ratio;
- heavy metals (As, B, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn);
- total cyanide and total (mono) phenols;
- speciated PAHs (US EPA16 suite);
- aromatic and aliphatic TPH (C5-C35 banding);
- benzene, toluene, ethylbenzene, xylene (BTEX).

The results are presented on the attached Certificate of Analysis and an interpretation of the results is given below.

RESULTS OF ANALYSIS

Particle Size Analysis and Stone Content

The sample fell into the *sand* texture class, and at 96 % sand it fell outside of the specified textural range given in BS3882:2015 – Figure 1.

Such sandy soils typically have good aeration and drainage properties but can possess poor water and nutrient retention capacities. As a consequence, they often have a greater risk of excessive leaching and drought particularly during dry periods. In this instance, however, the adequate organic matter content of the sample (5.0%) should assist in offsetting these factors and aid in water and nutrient retention. However, consideration should be made for additional irrigation.

The sample was virtually stone-free and, as such, stones should not restrict the use of the soil for general landscape purposes.

pH and Electrical Conductivity Values

The sample was slightly alkaline in reaction (pH 7.2), with a pH value that would be suitable for general landscape purposes.

The electrical conductivity (salinity) value (water extract) was low, which indicates that soluble salts were not present at levels that would be harmful to plants.

The electrical conductivity value by $CaSO_4$ extract (*BS3882* requirement) fell below the maximum specified value (3300 µS/cm) given in *BS3882:2015 – Table 1.*

Organic Matter and Fertility Status

The sample was adequately supplied with organic matter and most major plant nutrients, with the exception of a deficiency of extractable magnesium.

The C:N ratio of the sample was acceptable for general landscape purposes.

Potential Contaminants

With reference to *BS3882:2015 - Table 1*: Notes 3 and 4, there is a requirement to confirm levels of potential contaminants in relation to the topsoil's proposed end use. This includes human health, environmental protection and metals considered toxic to plants. In the absence of site-specific assessment criteria, the concentrations that affect human health have been compared with the *residential with homegrown produce* land use in the Suitable For Use Levels (S4ULs) presented in *The LQM/CIEH S4ULs for Human Health Risk Assessment* (2015) and the DEFRA SP1010: *Development of Category 4 Screening Levels* (C4SLs) *for Assessment of Land Affected by Contamination – Policy Companion Document* (2014).

Of the potential contaminants determined, none was found at levels that exceeded their guideline values.

Phytotoxic Contaminants

Of the phytotoxic (toxic to plants) contaminants determined (copper, nickel, zinc), none was found at levels that exceeded the maximum permissible levels specified in *BS3882:2015 – Table 1.*

CONCLUSION

The purpose of the analysis was to determine the suitability of the topsoil sample for general landscape purposes. The analysis has also been undertaken to determine the sample's compliance with the requirements of the British Standard for Topsoil *(BS3882:2015 – Specification for Topsoil – Table 1, Multipurpose Topsoil).*

From the soil examination and subsequent laboratory analysis, the sample was described as an alkaline, non-saline, slightly calcareous *sand* with an adequate structure and low stone content. The sample was adequately supplied with organic matter and most major plant nutrients, with the exception of a deficiency of extractable magnesium. Of the potential contaminants determined, none exceeded their respective guideline values.

To conclude, based on our findings, the topsoil represented by this sample would be considered suitable for general landscape purposes (trees, shrubs and amenity grass), provided the physical condition of the soil is maintained and the deficiency in extractable magnesium is remedied by a suitable application of compost or fertiliser. Consideration shou deb given to providing irrigation for sensitive planting types and/or at locations vulnerable to drought.

The topsoil was mostly compliant with the requirements of the British Standard for Topsoil *(BS3882:2015 – Specification for Topsoil – Table 1, Specific Purpose Topsoil - Acidic)* with the exception of the following parameters:

- high sand content
- extractable magnesium

On this occasion, these non-compliances are considered minor when reviewed in the context of all the other results and considering the proposed end-use of this soil.

RECOMMENDATIONS

Soil Handling Recommendations

It is important to maintain the physical condition of the soil and avoid structural damage during all phases of soil handling (e.g. stockpiling, respreading, cultivating, planting, seeding or turfing). As a consequence, soil handling operations should be carried out when soil is reasonably dry and non-plastic (friable) in consistency.

It is important to ensure that the soil is not unnecessarily compacted by trampling or trafficking by site machinery, and soil handling should be stopped during and after heavy rainfall and not continued until the soil is friable in consistency. If the soil is structurally damaged and compacted at any stage during the course of soiling or landscaping works, it should be cultivated appropriately to relieve the compaction and to restore the soil's structure prior to any planting, turfing or seeding.

Further details on soil handling are provided in Annex A of *BS3882:2015.*

Compost for Planting

To address the deficiency in magnesium for planting purposes, we recommend applying and incorporating suitable compost (e.g. PAS100:2011 /Landscape Institute/WRAP grade (10mm screened) green compost) at a rate of **10%** by volume, toa a depth of 200mm ensuring the soil is dry and friable.

Fertiliser for Amenity Grass Establishment

To address the nutrient deficiencies and to help promote effective grass establishment, we recommend applying and incorporating the pre-seeding grass fertiliser *ICL Sportsmaster Pre-seeder* (8%N:12%P_2O_5:8%K_2O+3%MgO) prior to seeding or turfing at a rate of 35 g/m² and to a depth of 100mm.

We hope this report meets with your approval and provides the necessary information. Please do not hesitate to contact the undersigned if we can be of further assistance.

Yours faithfully

PROSPECT MATERIALS LTD.
Tel: 01932 353365
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Ebony Gheorghe
BSc MSc
Soil Scientist

Tim White
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Senior Associate

For & on behalf of Tim O'Hare Associates LLP

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TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Client:	
Project:	The Plant Centre
Job:	Topsoil Analysis - BS3882:2015
Date:	31/05/2024
Job Ref No:	TOHA/24/1378/1/SS

Sample Reference			BS3882 Topsoil
Clay (<0.002mm)	%	UKAS	1
Silt (0.002-0.063mm)	%	UKAS	3
Sand (0.063-2.0mm)	%	UKAS	96
Texture Class (UK Classification)		UKAS	S
Stones (2-20mm)	% DW	GLP	1
Stones (20-50mm)	% DW	GLP	0
Stones (>50mm)	% DW	GLP	0
pH Value (1:2.5 water extract)	units	UKAS	7.2
Electrical Conductivity (1:2.5 water extract)	uS/cm	UKAS	371
Electrical Conductivity (1:2 $CaSO_4$ extract)	uS/cm	UKAS	2305
Exchangeable Sodium Percentage	%	UKAS	1.7
Organic Matter (LOI)	%	UKAS	5.0
Total Nitrogen (Dumas)	%	UKAS	0.20
C : N Ratio	ratio	UKAS	15
Extractable Phosphorus	mg/l	UKAS	28
Extractable Potassium	mg/l	UKAS	172
Extractable Magnesium	mg/l	UKAS	45
Total Arsenic (As)	mg/kg	MCERTS	6
Total Cadmium (Cd)	mg/kg	MCERTS	< 0.2
Total Chromium (Cr)	mg/kg	MCERTS	9
Hexavalent Chromium (Cr VI)	mg/kg	MCERTS	< 1.8
Total Copper (Cu)	mg/kg	MCERTS	16
Total Lead (Pb)	mg/kg	MCERTS	32
Total Mercury (Hg)	mg/kg	MCERTS	< 0.3
Total Nickel (Ni)	mg/kg	MCERTS	4
Total Selenium (Se)	mg/kg	MCERTS	< 1.0
Total Zinc (Zn)	mg/kg	MCERTS	35
Water Soluble Boron (B)	mg/kg	MCERTS	0.5
Total Cyanide (CN)	mg/kg	MCERTS	< 1.0
Total (mono) Phenols	mg/kg	MCERTS	< 1.0
Naphthalene	mg/kg	MCERTS	< 0.05
Acenaphthylene	mg/kg	MCERTS	< 0.05
Acenaphthene	mg/kg	MCERTS	< 0.05
Fluorene	mg/kg	MCERTS	< 0.05
Phenanthrene	mg/kg	MCERTS	0.34
Anthracene	mg/kg	MCERTS	< 0.05
Fluoranthene	mg/kg	MCERTS	0.85
Pyrene	mg/kg	MCERTS	0.72
Benz(a)anthracene	mg/kg	MCERTS	0.42
Chrysene	mg/kg	MCERTS	0.44
Benzo(b)fluoranthene	mg/kg	MCERTS	0.52
Benzo(k)fluoranthene	mg/kg	MCERTS	0.22
Benzo(a)pyrene	mg/kg	MCERTS	0.41
Indeno(1,2,3-cd)pyrene	mg/kg	MCERTS	0.27
Dibenzo(a,h)anthracene	mg/kg	MCERTS	0.07
Benzo(g,h,i)perylene	mg/kg	MCERTS	0.29
Total PAHs (sum USEPA16)	mg/kg	MCERTS	5
Aliphatic TPH >C5 - C6	mg/kg	MCERTS	< 0.020
Aliphatic TPH >C6 - C8	mg/kg	MCERTS	< 0.020
Aliphatic TPH >C8 - C10	mg/kg	MCERTS	< 0.050
Aliphatic TPH >C10 - C12	mg/kg	MCERTS	< 1.0
Aliphatic TPH >C12 - C16	mg/kg	MCERTS	< 2.0
Aliphatic TPH >C16 - C21	mg/kg	MCERTS	< 8.0
Aliphatic TPH >C21 - C35	mg/kg	MCERTS	< 8.0
Aliphatic TPH (C5 - C35)	mg/kg	MCERTS	< 10
Aromatic TPH >C5 - C7	mg/kg	MCERTS	< 0.010
Aromatic TPH >C7 - C8	mg/kg	MCERTS	< 0.010
Aromatic TPH >C8 - C10	mg/kg	MCERTS	< 0.050
Aromatic TPH >C10 - C12	mg/kg	MCERTS	< 1.0
Aromatic TPH >C12 - C16	mg/kg	MCERTS	3.2
Aromatic TPH >C16 - C21	mg/kg	MCERTS	< 10
Aromatic TPH >C21 - C35	mg/kg	MCERTS	22
Aromatic TPH (C5 - C35)	mg/kg	MCERTS	25
Benzene	mg/kg	MCERTS	< 0.005
Toluene	mg/kg	MCERTS	< 0.005
Ethylbenzene	mg/kg	MCERTS	< 0.005
p & m-xylene	mg/kg	MCERTS	< 0.005
o-xylene	mg/kg	MCERTS	< 0.005
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	MCERTS	< 0.005

S = SAND

Visual Examination

The sample was described as a very dark grey (Munsell Colour 10YR 2/2), slightly moist, friable, slightly calcareous SAND, with weakly developed, fine granular structure. The sample was virtually stone-free and no unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

Ebony Gheorghe
BSc MSc
Soil Scientist

Results of analysis should be read in conjunction with the report they were issued with

Assessment Criteria – Human Health

Residential End Use without Homegrown Produce

Residential without Homegrown Produce	Determinant	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Primary Data Source
		1% SOM	2.5% SOM	6% SOM	
PAH	Acenaphthene	3000(57.0)	4700(141)	6000(336)	LQM/CIEH S4UL
	Acenaphthylene	2900(86.1)	4600(212)	6000(506)	LQM/CIEH S4UL
	Anthracene	31000(1.17)	35000	37000	LQM/CIEH S4UL
	Benzo(a)anthracene	11	14	15	LQM/CIEH S4UL
	Benzo(a)pyrene	3.2	3.2	3.2	LQM/CIEH S4UL
	Benzo(b)fluoranthene	3.9	4	4	LQM/CIEH S4UL
	Benzo(ghi)perylene	360	360	360	LQM/CIEH S4UL
	Benzo(k)fluoranthene	110	110	110	LQM/CIEH S4UL
	Chrysene	30	31	32	LQM/CIEH S4UL
	Dibenzo(ah)anthracene	0.31	0.32	0.32	LQM/CIEH S4UL
	Fluoranthene	1500	1600	1600	LQM/CIEH S4UL
	Fluorene	2800(30.9)	3800(76.5)	4500(183)	LQM/CIEH S4UL
	Indeno(123-cd)pyrene	45	46	46	LQM/CIEH S4UL
	Naphthalene	2.3	5.6	13	LQM/CIEH S4UL
	Phenanthrene	1300(36.0)	1500	1500	LQM/CIEH S4UL
	Pyrene	3700	3800	3800	LQM/CIEH S4UL
Other Organics	Phenol	750	1300	2300	LQM/CIEH S4UL
Metals	Arsenic	40	40	40	LQM/CIEH S4UL
	Beryllium	1.7	1.7	1.7	LQM/CIEH S4UL
	Boron	11000	11000	11000	LQM/CIEH S4UL
	Cadmium	85	85	85	LQM/CIEH S4UL
	Chromium (III)	910	910	910	LQM/CIEH S4UL
	Chromium (VI)	21	21	21	LQM/CIEH S4UL
	Copper	7100	7100	7100	LQM/CIEH S4UL
	Lead	310	310	310	EA C4SL
	Mercury	1.2	1.2	1.2	LQM/CIEH S4UL
	Nickel	180	180	180	LQM/CIEH S4UL
	Selenium	430	430	430	LQM/CIEH S4UL
	Vanadium	1200	1200	1200	LQM/CIEH S4UL
	Zinc	40000	40000	40000	LQM/CIEH S4UL

SOM = Soil Organic Matter

Values in brackets indicate the solubility or vapour saturation limit where this is exceeded by the AC

Residential without Homegrown Produce	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Guidance Value (mg/kg)	Primary Data Source
	1% SOM	2.5% SOM	6% SOM	
Aliphatic				
EC 5-6	42	78	160	LQM/CIEH S4UL
EC >6-8	100	230	530	LQM/CIEH S4UL
EC >8-10	27	65	150	LQM/CIEH S4UL
EC >10-12	130 (48)	330 (118)	760 (283)	LQM/CIEH S4UL
EC >12-16	1100 (24)	2400 (59)	4300 (142)	LQM/CIEH S4UL
EC >16-35	65000 (8.48)	92000 (21)	110000	LQM/CIEH S4UL
EC >35-44	65000 (8.48)	92000 (21)	110000	LQM/CIEH S4UL
Aromatic				
EC 5-7 (benzene)	370	690	1400	LQM/CIEH S4UL
EC >7-8 (toluene)	860	1800	3900	LQM/CIEH S4UL
EC >8-10	47	110	270	LQM/CIEH S4UL
EC >10-12	250	590	1200	LQM/CIEH S4UL
EC >12-16	1800	2300 (419)	2500	LQM/CIEH S4UL
EC >16-21	1900	1900	1900	LQM/CIEH S4UL
EC >21-35	1900	1900	1900	LQM/CIEH S4UL
EC >35-44	1900	1900	1900	LQM/CIEH S4UL
Aliphatic and Aromatic				
EC >44-70	1900	1900	1900	LQM/CIEH S4UL
BTEX				
Benzene	0.38	0.70	1.4	LQM/CIEH S4UL
Toluene	880	1900	3900	LQM/CIEH S4UL
Ethylbenzene	83	190	440	LQM/CIEH S4UL
m Xylenes	79	180	430	LQM/CIEH S4UL
p Xylenes				
o Xylene	88	210	480	LQM/CIEH S4UL

SOM = Soil Organic Matter

Values in brackets indicate the solubility or vapour saturation limit where this is exceeded by the AC

APPENDIX 4

POTABLE WATER SUPPLIES

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