TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Mr John Coles
Bury Hill Landscape Supplies Ltd
The Estate Office
Old Bury Hill
Westcott
Nr Dorking
Surrey, RH4 3JU

5th January 2024
Our Ref: TOHA/24/1197/2/SS
Your Ref: see below

Dear Sirs

Subsoil Analysis Report: Bury Hill Horsham Yard – Intensive Lightweight Subsoil (S)

We have completed the analysis of the soil sample recently submitted, referenced *Intensive Lightweight Subsoil (S)* and have pleasure reporting our findings.

The purpose of the analysis was to determine the suitability of the material for use as a lightweight subsoil in a rooftop or podium garden environment.

This report presents the results of analysis for the sample submitted to our office, and it should be considered 'indicative' of the soil source. The report and results should therefore not be used by third parties as a means of verification or validation testing, waste designation purposes, or for any project-specific applications, especially after the soil has left the Bury Hill Landscape Supplies Ltd site.

SAMPLE EXAMINATION

The sample can be described as a reddish yellow (Munsell Colour, 5YR 6/6), moist, friable, non-calcareous SAND with a single grain structure. The sample was stone free and contained a moderate proportion of lightweight expanded clay aggregate 'leca'. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

Plate 1: Intensive Lightweight Subsoil (S) Sample

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 of the soil. The following parameters were determined:

- detailed particle size analysis (5 sands, silt, clay);
- stone content (2-20mm, 20-75mm, >75mm);
- bulk density (as received, field capacity);
- moisture content (as received, field capacity);
- saturated hydraulic conductivity;
- pH and electrical conductivity (1:2.5 water extract);
- exchangeable sodium percentage
- calcium carbonate.
- organic matter content;
- visible contaminants;
- heavy metals (Sb, As, B, Ba, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, V, Zn);
- total cyanide and total (mono) phenols;
- speciated PAHs (US EPA16 suite);
- aromatic and aliphatic TPH (C5-C35 banding);
- benzene, toluene, ethylbenzene, xylene (BTEX);
- asbestos screen.

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 & Stone Content

The sample fell into the *sand* texture class. Further detailed particle size analysis revealed the sample to have a narrow particle size distribution and a predominance of *medium sand* (0.25-0.50mm) and smaller proportions of *coarse sand* (0.50-1.0mm). This is usually acceptable for subsoil to be used in podium or roof garden environments as porosity levels are maintained under a degree of consolidation and the risk of particle interpacking is minimised.

With the exception of 'leca' particles, the sample was stone free and as such, stones should not restrict the use of the soil.

Bulk Density and Saturated Hydraulic Conductivity

The sample displayed a bulk density (at Field Capacity) value of 1.73 Mg/m^3, which is reasonably low compared to that of standard subsoil. The suitability of the bulk density result should be confirmed by the project engineer for the recipient site.

The saturated hydraulic conductivity of the sample was high (472mm/hour) and would be described as 'free-draining'. The appropriateness of this drainage rate will depend on the specifics of any particular roof garden design (e.g. overall soil depths, topsoil media performance, plant species selection, irrigation provision, environmental conditions).

pH and Electrical Conductivity Values

The sample was slightly acid in reaction (pH 6.3), with a pH value that would be considered ideal for subsoil in general landscape purposes.

The electrical conductivity (salinity) values (water and $CaSO_4$ extracts) were low, which indicates that soluble salts were not present at levels that would be harmful to plants.

Organic Matter Content

The organic matter content was low (<0.5%).

Potential Contaminants

In the absence of site-specific assessment criteria, the concentrations of selected potential contaminants that affect human health have been assessed for the concentrations that affect human health have been assessed for *residential* end-use against 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 for Assessment of Land Affected by Contamination – Policy Companion Document (2014).

Of the potential contaminants determined, none exceeded their respective guideline values.

Phytotoxic Contaminants

Of the phytotoxic (toxic to plants) contaminants determined (copper, nickel, zinc), none was found at levels that exceeded their guideline values.

CONCLUSION

The purpose of the analysis was to determine the suitability of the material for use as a lightweight subsoil for landscaping purposes in a podium or rooftop garden environment.

From the soil examination and subsequent laboratory analysis, the soil represented by this sample was described as a slightly acid, non-saline, non-calcareous sand with a single grain structure. The sample was stone free and contained a proportion of 'leca'. The saturated hydraulic conductivity value was high and the organic matter content was low. Of the potential contaminants determined, none exceeded their respective guideline values.

Based on our findings, the substrate represented by this sample should be suitable for use as a lightweight subsoil in a roof garden environment where a free-draining subsoil is required. The suitability of the bulk density and saturated hydraulic conductivity results should be confirmed by the project engineer and landscape designer.

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.

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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

H.MacRae

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Graduate Soil Scientist

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Senior Soil Scientist

For & on behalf of Tim O'Hare Associates LLP

TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Client:	**Bury Hill Landscape Supplies Ltd**
Project	**Bury Hill Horsham Yard**
Job:	**Subsoil Analysis**
Date:	**05/01/24**
Job Ref No:	**TOHA/24/1197/2/SS**

Sample Reference			**Intensive Lightweight Subsoil (S)**
		Accreditation	
Clay (<0.002mm)	%	UKAS	2
Silt (0.002-0.05mm)	%	UKAS	0
Very Fine Sand (0.05-0.15mm)	%	UKAS	2
Fine Sand (0.15-0.25mm)	%	UKAS	6
Medium Sand (0.25-0.50mm)	%	UKAS	52
Coarse Sand (0.50-1.0mm)	%	UKAS	34
Very Coarse Sand (1.0-2.0mm)	%	UKAS	4
Total Sand (0.05-2mm)	%	UKAS	98
Texture Class (UK Classification)	--	UKAS	S
Stones (2-20mm)	% DW	GLP	0
Stones (20-75mm)	% DW	GLP	0
Stones (>75mm)	% DW	GLP	0
Bulk Density (As Received)	Mg/m3	UKAS	1.59
Bulk Density (Field Capacity)	Mg/m3	UKAS	1.73
Moisture Content (As Received)	%	UKAS	8.2
Moisture Content (Field Capacity)	%	UKAS	18
Saturated Hydraulic Conductivity	mm/hr	A2LA	472
pH Value (1:2.5 water extract)	units	UKAS	6.3
Calcium Carbonate	%	UKAS	<1.0
Electrical Conductivity (1:2.5 water extract)	uS/cm	UKAS	416
Electrical Conductivity (1:2 $CaSO_4$ extract)	uS/cm	UKAS	2662
Organic Matter (LOI)	%	UKAS	<0.5
Exchangeable Sodium Percentage	%	UKAS	1.5
Visible Contaminants: Plastics >2.00mm	%	UKAS	0
Visible Contaminants: Sharps >2.00mm	%	UKAS	0
Total Antimony (Sb)	mg/kg	MCERTS	< 1.0
Total Arsenic (As)	mg/kg	MCERTS	4
Total Barium (Ba)	mg/kg	MCERTS	7.5
Total Beryllium (Be)	mg/kg	MCERTS	0.07
Total Cadmium (Cd)	mg/kg	MCERTS	< 0.2
Total Chromium (Cr)	mg/kg	MCERTS	5.9
Hexavalent Chromium (Cr VI)	mg/kg	MCERTS	< 1.8
Total Copper (Cu)	mg/kg	MCERTS	2.6
Total Lead (Pb)	mg/kg	MCERTS	< 1.0
Total Mercury (Hg)	mg/kg	MCERTS	< 0.3
Total Nickel (Ni)	mg/kg	MCERTS	3
Total Selenium (Se)	mg/kg	MCERTS	< 1.0
Total Vanadium (V)	mg/kg	MCERTS	12
Total Zinc (Zn)	mg/kg	MCERTS	4.4
Water Soluble Boron (B)	mg/kg	MCERTS	< 0.2
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	< 0.05
Anthracene	mg/kg	MCERTS	< 0.05
Fluoranthene	mg/kg	MCERTS	< 0.05
Pyrene	mg/kg	MCERTS	< 0.05
Benz(a)anthracene	mg/kg	MCERTS	< 0.05
Chrysene	mg/kg	MCERTS	< 0.05
Benzo(b)fluoranthene	mg/kg	MCERTS	< 0.05
Benzo(k)fluoranthene	mg/kg	MCERTS	< 0.05
Benzo(a)pyrene	mg/kg	MCERTS	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	MCERTS	< 0.05
Dibenzo(a,h)anthracene	mg/kg	MCERTS	< 0.05
Benzo(g,h,i)perylene	mg/kg	MCERTS	< 0.05
Total PAHs (sum USEPA16)	mg/kg	MCERTS	< 0.80
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	< 2.0
Aromatic TPH >C16 - C21	mg/kg	MCERTS	< 10
Aromatic TPH >C21 - C35	mg/kg	MCERTS	< 10
Aromatic TPH (C5 - C35)	mg/kg	MCERTS	< 10
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
Asbestos	D/ND	ISO 17025	Not-detected

S = SAND

Visual Examination

The sample can be described as a reddish yellow (Munsell Colour, 5YR 6/6), moist, non-plastic, non-calcareous SAND with a single grain structure. The sample was stone free and contained a moderate proportion of lightweight expanded clay aggregate 'leca'. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

H.MacRae

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