TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Drew Wetherell
Bourne Amenity Ltd
The Wharf
Newenden
Cranbrook
Kent TN18 5QG

13th April 2023
Our Ref: TOHA/23/7891/1/SS
Your Ref: PO 114361

Dear Sirs

Topsoil Analysis Report: WH TS6 Topsoil

We have completed the analysis of the soil sample recently received, referenced *WH TS6 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 received, 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, waste designation purposes or for any project-specific application, especially after the topsoil has left the Bourne Amenity site.

SAMPLE EXAMINATION

The sample was described as a very dark brown (Munsell Colour 10YR 3/3), slightly moist, friable, slightly calcareous SANDY LOAM with a weakly developed, very fine to medium granular and occasionally subangular structure*. The sample was very slightly stony, comprising stones up to 7mm in size, and contained a moderate proportion of organic fines and occasional woody fragments. 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.

Plate 1 – WH TS6 Topsoil 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 and fertility of the soil, and the concentration of selected potential contaminants. The following parameters were determined:

- detailed particle size analysis (5 sands, silt, clay);
- stone content (2-20mm, 20-50mm, >50mm);
- saturated hydraulic conductivity;
- pH and electrical conductivity values;
- calcium carbonate;
- exchangeable sodium percentage;
- major plant nutrients (N, P, K, Mg);
- organic matter content;
- C:N ratio;
- visible contaminants (>2mm);
- heavy metals (Sb, As, B, Ba, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, V, Zn);
- total cyanide and total (mono) phenols;
- elemental sulphur, acid volatile sulphur and water soluble sulphate;
- 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

Detailed Particle Size Analysis and Stone Content

The sample fell into the *sandy loam* texture class, which is usually considered suitable for general landscape applications provided the soil's physical condition is satisfactory.

Further detailed particle size analysis revealed the grading to comprise predominantly *medium sand* (0.25-0.50mm), with reasonably equal proportions of the remaining mineral fractions. As such, this topsoil could potentially allow reasonable drainage performance, although the proportion of 'fines' (particles <0.15mm: 27%) could interpack the pore spaces between the larger particles and reduce this to an extent. To reduce this risk, it is important not to over-compact this topsoil during placement and we recommend it is not placed thicker than a maximum depth of 300mm, which is in line with *BS3882:2015*, section A.3.

The sample was very slightly stony and, as such, stones should not restrict the use of the soil for general landscape purposes.

Saturated Hydraulic Conductivity

The saturated hydraulic conductivity result (8 mm/hr) recorded for the sample indicates that the material would be considered as slowly permeable for a general landscape topsoil.

pH and Electrical Conductivity Values

The sample was strongly alkaline in reaction (pH 8.4). This pH value would be considered suitable for general landscape purposes provided species with a wide pH tolerance or those known to prefer alkaline soils are selected for planting, turfing and seeding.

The electrical conductivity (salinity) value (water extract) was low, which indicates that soluble salts should not be 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 well supplied with organic matter and all major plant nutrients.

The organic matter level of the sample was found to be high. This may not affect the growth of trees and shrubs; however, it may result in variable settlement across amenity grass areas. As organic matter decomposes, the topsoil volume reduces, leading to an uneven surface which may be undesirable in formal lawn areas.

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 a strongly alkaline, non-saline, slightly calcareous sandy loam with a weakly developed structure and very low stone content. The sample contained sufficient reserves of organic matter and plant nutrients. Of the potential contaminants determined, none exceeded their respective guideline values.

The organic matter content of the topsoil would be suitable for general planting purposes and probably for lower foot traffic amenity grass areas (e.g. road verges). However, the high organic matter content of the topsoil may lead to variable settlement and a soft, uneven surface in these areas, particularly if used for higher performance amenity grass establishment, e.g. sports pitches or formal lawns.

To conclude, based on our findings, the topsoil represented by this sample would be considered suitable for general landscape purposes (trees, shrubs and low footfall amenity grass), provided species with a wide pH tolerance or those known to prefer alkaline soils are selected for planting, turfing and seeding and the physical condition of the soil is satisfactory.

The topsoil was also fully compliant with the requirements of the British Standard for Topsoil *(BS3882:2015 – Specification for Topsoil – Table 1, Multipurpose Topsoil).*

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 sufficiently dry to be 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.*

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

Harriet MacRae
BSc MSc
Graduate Soil Scientist

Matthew Heins
BSc (Hons) MISoilSci
Senior Soil Scientist

For & on behalf of Tim O'Hare Associates LLP

Client:	**Bourne Amenity Ltd**
Project:	**WH TS6 Topsoil**
Job:	**Topsoil Analysis (BS3882:2015)**
Date:	**13/04/2023**
Job Ref No:	**TOHA/23/7891/1/SS**

TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Sample Reference			**WH TS6 Topsoil**
		Accreditation	
Clay (<0.002mm)	%	UKAS	13
Silt (0.002-0.05mm)	%	UKAS	4
Very Fine Sand (0.05-0.15mm)	%	UKAS	10
Fine Sand (0.15-0.25mm)	%	UKAS	14
Medium Sand (0.25-0.50mm)	%	UKAS	44
Coarse Sand (0.50-1.0mm)	%	UKAS	11
Very Coarse Sand (1.0-2.0mm)	%	UKAS	4
Total Sand (0.5 - 2.0mm)	%	UKAS	83
Texture Class (UK Classification)	--	UKAS	SL
Stones (2-20mm)	% DW	GLP	1
Stones (20-50mm)	% DW	GLP	0
Stones (>50mm)	% DW	GLP	0
Visible Contaminants: Plastics >2.00mm	%	UKAS	0
Visible Contaminants: Sharps >2.00mm	%	UKAS	0
Saturated Hydraulic Conductivity	mm/hr	A2LA	8
pH Value (1:2.5 water extract)	units	UKAS	8.4
Calcium Carbonate	%	UKAS	1.0
Electrical Conductivity (1:2.5 water extract)	uS/cm	UKAS	830
Electrical Conductivity (1:2 $CaSO_4$ extract)	uS/cm	UKAS	2846
Exchangeable Sodium Percentage	%	UKAS	3.5
Organic Matter (LOI)	%	UKAS	11.8
Total Nitrogen (Dumas)	%	UKAS	0.35
C : N Ratio	ratio	UKAS	20
Extractable Phosphorus	mg/l	UKAS	47
Extractable Potassium	mg/l	UKAS	1202
Extractable Magnesium	mg/l	UKAS	170
Total Antimony (Sb)	mg/kg	MCERTS	< 1.0
Total Arsenic (As)	mg/kg	MCERTS	21
Total Barium (Ba)	mg/kg	MCERTS	29
Total Beryllium (Be)	mg/kg	MCERTS	0.69
Total Cadmium (Cd)	mg/kg	MCERTS	< 0.2
Total Chromium (Cr)	mg/kg	MCERTS	43
Hexavalent Chromium (Cr VI)	mg/kg	MCERTS	< 1.8
Total Copper (Cu)	mg/kg	MCERTS	13
Total Lead (Pb)	mg/kg	MCERTS	25
Total Mercury (Hg)	mg/kg	MCERTS	< 0.3
Total Nickel (Ni)	mg/kg	MCERTS	21
Total Selenium (Se)	mg/kg	MCERTS	< 1.0
Total Vanadium (V)	mg/kg	MCERTS	77
Total Zinc (Zn)	mg/kg	MCERTS	50
Water Soluble Boron (B)	mg/kg	MCERTS	1.3
Total Cyanide (CN)	mg/kg	MCERTS	< 1.0
Total (mono) Phenols	mg/kg	MCERTS	< 1.0
Elemental Sulphur	mg/kg	MCERTS	< 5.0
Water Soluble Sulphate (SO_4)	g/l	MCERTS	1.4
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	0.13
Pyrene	mg/kg	MCERTS	0.10
Benzo(a)anthracene	mg/kg	MCERTS	0.06
Chrysene	mg/kg	MCERTS	0.05
Benzo(b)fluoranthene	mg/kg	MCERTS	0.12
Benzo(k)fluoranthene	mg/kg	MCERTS	< 0.05
Benzo(a)pyrene	mg/kg	MCERTS	0.07
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	< 0.001
Aliphatic TPH >C6 - C8	mg/kg	MCERTS	< 0.001
Aliphatic TPH >C8 - C10	mg/kg	MCERTS	< 0.001
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	< 0.001
Aromatic TPH >C7 - C8	mg/kg	MCERTS	< 0.001
Aromatic TPH >C8 - C10	mg/kg	MCERTS	< 0.001
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 Screen	ND/D	ISO 17025	Not-detected

SL = SANDY LOAM

Visual Examination

The sample was described as a very dark brown (Munsell Colour 10YR 3/3), slightly moist, friable, slightly calcareous SANDY LOAM with a weakly developed, very fine to medium granular and occasionally subangular structure. The sample was very slightly stony, comprising stones up to 7mm in size, and contained a moderate proportion of organic fines and occasional woody fragments. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

H.MacRae

Harriet MacRae
BSc MSc
Graduate Soil Scientist

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