TIM O'HARE ASSOCIATES

SOIL & LANDSCAPE CONSULTANCY

Mr Jonathan Bourne
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The Wharf, Rye Road
Newenden
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13th November 2019
Our Ref: TOHA/19/9281/SS
Your Ref: as below

Dear Sirs

Topsoil Analysis Report: Wissington – TS1-F Topsoil

We have completed the analysis of the TS1-F TOPSOIL sample recently submitted and have pleasure reporting our findings.

The purpose of the analysis was to assess the suitability of the TS1-F TOPSOIL sample as a topsoil for sports pitch construction and as a top dressing for grass pitch repairs.

This report presents the results of analysis for the TS1-F TOPSOIL 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.

SAMPLE EXAMINATION

The sample was described as a dark yellowish brown (Munsell Colour 10YR 4/4), very moist, non-plastic, very slightly calcareous LOAMY SAND with a 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.

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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 and stone content;
- 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, 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. The interpretation considers the use of TS1-F TOPSOIL as a topsoil for sports pitch construction and as a top dressing for soil-based pitch maintenance and repairs. It is not the intention to use TS1-F TOPSOIL as a top dressing for sand rootzone pitches or pitches with sand slits.

RESULTS OF ANALYSIS

Particle Size Analysis and Stone Content

The sample fell into the *loamy sand* texture class. Further detailed particle size analysis revealed the sample to have a sufficiently narrow particle size distribution and a predominance of *medium sand* (0.25-0.50mm). This is usually ideal for topsoil in sports pitch applications as reasonable porosity levels are generally maintained in a consolidated state and the risk of particle interpacking is reduced. The sample should therefore provide adequate drainage and aeration properties for sports pitch construction and for the maintenance and repair of soil-based sports pitches.

The sample was stone-free and, as such, stones should not affect the use of the soil on sports pitches

pH and Electrical Conductivity Values

The sample was strongly alkaline in reaction (pH 8.4). This pH value would be suitable for sports pitch and amenity grass cultivars, provided species with a broad pH tolerance or those that prefer alkaline soils are selected.

The electrical conductivity (salinity) value (water extract) was moderate, 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 fell below our maximum specified value (3300 µS/cm).

Organic Matter and Fertility Status

The sample was adequately supplied with organic matter and all major plant nutrients.

The C:N ratio of the sample was acceptable for sports pitch construction.

Potential Contaminants

With reference to *BS3882:2015* - Table 1: Notes 3 and 4, there is a recommendation 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 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 for Assessment of Land Affected by Contamination – Policy Companion Document* (2014). The concentration of barium has been compared with the *residential* land use given in the document *EIC/AGS/CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment* (2010).

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 would present phytotoxic risk.

CONCLUSION

The purpose of the analysis was to assess the suitability of the TS1-F TOPSOIL sample as a topsoil for sports pitch construction and as a top dressing for grass pitch repairs.

From the soil examination and subsequent laboratory analysis, the sample was described as a strongly alkaline, non-saline loamy sand with a single grain structure. The sample contained sufficient reserves of organic matter, nitrogen and mineral plant nutrients. Of the potential contaminants determined, none was found at levels that exceeded their guideline values.

To conclude, based on our findings, the SPORTS 10 sample would be considered suitable for sports pitch construction and for soil-based pitch maintenance and repairs.

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 turfing or seeding.

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 sincerely

Matthew Lowry
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Graduate Soil Scientist

Ceri Spears
BSc MSc MISoilSci
Senior Associate

For & on behalf of Tim O'Hare Associates LLP

Client:	**Bourne Amenity Ltd**
Client Ref:	**Wissington**
Job:	**Topsoil Analysis**
Date:	**13/11/2019**
Job Ref No:	**TOHA/19/9281/SS**

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Sample Reference			**TS1-F TOPSOIL**
Clay (<0.002mm)	%	U	8
Silt (0.002-0.05mm)	%	U	5
Very Fine Sand (0.05-0.15mm)	%	U	5
Fine Sand (0.15-0.25mm)	%	U	26
Medium Sand (0.25-0.50mm)	%	U	55
Coarse Sand (0.50-1.0mm)	%	U	1
Very Coarse Sand (1.0-2.0mm)	%	U	0
Texture Class (UK Classification)	--	U	LS
Stones (2-20mm)	% DW	G	0
Stones (20-50mm)	% DW	G	0
Stones (>50mm)	% DW	G	0
pH Value (1:2.5 water extract)	units	G	8.4
Electrical Conductivity (1:2.5 water extract)	uS/cm	U	818
Electrical Conductivity (1:2 $CaSO_4$ extract)	uS/cm	U	2716
Exchangeable Sodium Percentage	%	U	11.0
Moisture Content	%	U	9.4
Organic Matter (LOI)	%	U	2.1
Total Nitrogen (Dumas)	%	U	0.15
C:N Ratio	:1	U	8
Extractable Phosphorus	mg/l	U	25
Extractable Potassium	mg/l	U	402
Extractable Magnesium	mg/l	U	56
Total Arsenic (As)	mg/kg	M	26
Total Barium (Ba)	mg/kg	M	22
Total Beryllium (Be)	mg/kg	M	0.59
Total Cadmium (Cd)	mg/kg	M	< 0.2
Total Chromium (Cr)	mg/kg	M	14
Hexavalent Chromium (Cr)	mg/kg	M	< 4.0
Total Copper (Cu)	mg/kg	M	5.8
Total Lead (Pb)	mg/kg	M	11
Total Mercury (Hg)	mg/kg	M	< 0.3
Total Nickel (Ni)	mg/kg	M	10
Total Selenium (Se)	mg/kg	M	< 1.0
Total Vanadium (V)	mg/kg	M	32
Total Zinc (Zn)	mg/kg	M	36
Water Soluble Boron (B)	mg/kg	M	0.8
Total Cyanide (CN)	mg/kg	M	< 1
Total (mono) Phenols	mg/kg	M	< 1.0
Naphthalene	mg/kg	M	< 0.05
Acenaphthylene	mg/kg	M	< 0.05
Acenaphthene	mg/kg	M	< 0.05
Fluorene	mg/kg	M	< 0.05
Phenanthrene	mg/kg	M	< 0.05
Anthracene	mg/kg	M	< 0.05
Fluoranthene	mg/kg	M	< 0.05
Pyrene	mg/kg	M	< 0.05
Benzo(a)anthracene	mg/kg	M	< 0.05
Chrysene	mg/kg	M	< 0.05
Benzo(b)fluoranthene	mg/kg	M	< 0.05
Benzo(k)fluoranthene	mg/kg	M	< 0.05
Benzo(a)pyrene	mg/kg	M	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	M	< 0.05
Dibenzo(a,h)anthracene	mg/kg	M	< 0.05
Benzo(g,h,i)perylene	mg/kg	M	< 0.05
Total PAHs (sum USEPA16)	mg/kg	M	< 0.80
Aliphatic TPH (C5-C6)	mg/kg	U	< 0.001
Aliphatic TPH (C6-C8)	mg/kg	U	< 0.001
Aliphatic TPH (C8-C10)	mg/kg	U	< 0.001
Aliphatic TPH (C10-C12)	mg/kg	U	< 1.0
Aliphatic TPH (C12-C16)	mg/kg	U	< 2.0
Aliphatic TPH (C16-C21)	mg/kg	U	< 8.0
Aliphatic TPH (C21-C35)	mg/kg	U	< 8.0
Aliphatic TPH (C5-C35)	mg/kg	U	< 10
Aromatic TPH (C5-C7)	mg/kg	U	< 0.001
Aromatic TPH (C7-C8)	mg/kg	U	< 0.001
Aromatic TPH (C8-C10)	mg/kg	U	< 0.001
Aromatic TPH (C10-C12)	mg/kg	U	< 1.0
Aromatic TPH (C12-C16)	mg/kg	U	< 2.0
Aromatic TPH (C16-C21)	mg/kg	U	< 10
Aromatic TPH (C21-C35)	mg/kg	U	< 10
Aromatic TPH (C5-C35)	mg/kg	U	< 10
Benzene	mg/kg	M	< 0.001
Toluene	mg/kg	M	< 0.001
Ethylbenzene	mg/kg	M	< 0.001
p&m-xylene	mg/kg	M	< 0.001
o-xylene	mg/kg	M	< 0.001
MTBE (Methyl Tertiary Butyl Ether)	mg/kg	M	< 0.001
Asbestos Screen	ND/D	I	Not-detected

Visual Examination

The sample was described as a dark yellowish brown (Munsell Colour 10YR 4/4), very moist, non-plastic, very slightly calcareous LOAMY SAND with a 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.

LS	Loamy Sand Texture Class
M	MCERTS accredited method (& UKAS accredited method)
U	UKAS accredited method
I	ISO 17025 accredited method
G	GLP accredited method

This report presents the results of analysis for the TS1-F TOPSOIL 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.

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