



TIM O'HARE ASSOCIATES  
SOIL & LANDSCAPE CONSULTANCY

Mr Jason Lock  
Boughton Loam Ltd  
Telford Way Industrial Estate  
Telford Way  
Kettering  
Northamptonshire NN16 8UN

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Our Ref: TOHA/25/1658/3/SS  
Your Ref: PO 9765

Dear Sirs

**Soil Analysis Report: Extensive Roof Garden Substrate**

We have completed the analysis of the soil sample recently submitted, referenced *EX1 Garden Roof Substrate*, and have pleasure reporting our findings.

The purpose of the analysis was to determine the suitability of the material for use as an extensive lightweight substrate in a rooftop garden environment.

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 Boughton Loam Ltd site.

**SAMPLE EXAMINATION**

The sample was described as a mix of predominantly stone sized lightweight expanded clay aggregate particles (leca), with a proportion of 'fines' comprising dry, friable to non-plastic, slightly calcareous SAND.

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Tim O'Hare Associates LLP  
Howbery Park Wallingford Oxfordshire OX10 8BA  
T:01491 822653 E:info@toha.co.uk  
www.toha.co.uk



Plate 1: EX1 Extensive Roof Garden Substrate 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 & gravel, silt, clay);
- saturated hydraulic conductivity;
- bulk density;
- pH and electrical conductivity values;
- organic matter content;
- exchangeable sodium percentage;
- plant available phosphate;
- plant available potassium;
- total nitrogen;
- carbon : nitrogen 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 Certificates of Analyses and an interpretation of the results is given below.

## **RESULTS OF ANALYSIS**

### **Particle Size Analysis**

The particle size analysis indicated the grading of the material to comprise predominantly coarse gravel sized material (4.0-8.0mm) with relatively equal proportions of each five sand fractions, silt and clay. This grading should be acceptable for extensive roof garden vegetation.

### **Saturated Hydraulic Conductivity and Bulk Density**

The saturated hydraulic conductivity of the sample (12 mm/minute or 720 mm/hour) should enable efficient conveyance of water through the substrate to the underlying drainage system.

The sample displayed low bulk density values, which would usually be acceptable for roof garden schemes where loading restrictions apply. The suitability of the bulk density results should be confirmed by the project engineer for the recipient site.

### **pH and Electrical Conductivity Values**

The sample was strongly alkaline in reaction (pH 8.1). This pH value would be considered suitable for 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 high; however, the exchangeable sodium percentage was low, indicating low sodium risk. The source of the elevated soluble salts in this instance is likely to be from soluble potassium (see comments below).

The electrical conductivity value by CaSO<sub>4</sub> extract (2.88 mS/cm or 2880 µS/cm) was within the recommended range.

### **Organic Matter and Fertility Status**

The sample contained adequate to well supplied with organic matter and all major plant nutrients. The extractable potassium level was high.

High potassium levels such as that found in this sample can also have an antagonistic effect on other soil nutrients, particularly magnesium. This can reduce nutrient uptake, leading to plant stress, particularly for establishing specimens.

### **Potential Contaminants**

Levels of certain potentially phytotoxic heavy metals (Cd, Cu, Pb, Ni, Zn) have been assessed against the guideline thresholds indicated in *BS8616:2019 – Table 1*. For the remaining potential contaminants determined, in the absence of site-specific assessment criteria, the concentrations of potential contaminants that affect human health have been compared with the *residential with home grown 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.

## CONCLUSION

The purpose of the analysis was to determine the suitability of the material for use as an extensive lightweight substrate in a rooftop garden environment.

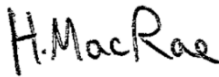
From the soil examination and laboratory analysis, the substrate was described as a strongly alkaline, non-saline, slightly calcareous material containing predominantly stone sized particles (>8mm). The saturated hydraulic conductivity was within range. The organic matter, total nitrogen, extractable phosphorus were satisfactory but the extractable potassium reserves were high. Of the potential contaminants determined, none exceeded their respective guideline values.

Based on our findings, the substrate represented by this sample appears to be a little rich on account of its high potassium content and elevated electrical conductivity. The source of the elevated potassium content could be associated with the proportion and/or the type of compost in the blend. Potassium is highly soluble, and the level is likely to fall when the material is wetted by rain or irrigation water. However, in this instance we recommend reviewing the quality and quantity of compost that has been used.

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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



**Harriet MacRae**  
BSc MSc  
Soil Scientist



**Aaron Cross**  
BSc MSc MSoilSci  
Senior Soil Scientist

For & on behalf of Tim O'Hare Associates LLP

