

06 December 2020

Report

Construction Environmental Management Plan (rev 5)

Western Way SHD Development, 36-40 Dominick Street Upper, D7

Western Way Developments Limited

securing right outcomes

LOCATION	BLOCKS	LEVELS	DISP.	REPORT NO. REV
36-40 DOMINICK STREET UPPER, DUBLIN 7	ALL	ALL (ABOVE AND BELOW GROUND)	H&SC	CEMP-DCON-RPT- 001-05

Diarmuid Condon
Managing Director

DCON Safety Consultants Limited
Suite 5, Fitzwilliam Square East,
Dublin 2
Ireland

t: +353 1 611 1556
e: diarmuid.condon@dconsafety.com
w: www.dconsafety.com

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1 Executive summary

DCON Safety Consultants has prepared this Construction Environmental Management Plan (CEMP) based on the overall Construction Management Plan (CMP). This document includes a description of the proposed works, identifies the control measures to alleviate alleviations and specifies an environmental monitoring programme. It seeks to address the following:

- Direct impacts – those alleviations associated directly with the environmental aspect, such as increased dust, noise or vibration levels;
- Indirect impacts – those alleviations associated indirectly with the environmental aspect, such as transport and disposal of waste;
- Normal situations – progress according to plan;
- Abnormal situations – the project programme not progressing as planned because of unforeseen or unpredictable circumstances; and
- Emergency situations – an unplanned or unwanted situation has occurred, such as fire, explosion or malicious damage.

The CEMP will be reviewed prior to commencement of construction. As the ultimate controlling mind for the works, Western Way Developments Limited through their Project Managers will take the lead in ensuring that there are suitable and sufficient systems and personnel in place that promote environmental control compliance.

1.1 Limitations

The CEMP has incorporated the alleviation and environmental monitoring measures typical of a development of this nature and location. These alleviation and monitoring measures are based on the application of good / best practice guidance and where relevant regulatory compliance limits. The CEMP will form the basis of the final Environmental Management Plan developed by the / each contractor yet to be appointed.

2 Project description

2.1 Development introduction

The proposed development comprises demolition of the existing warehouse buildings and no. 36 Dominick Street Upper and retention of the Hendrons Building as part of an overall redevelopment of the site to accommodate a build-to-rent shared living scheme and publicly accessible neighbourhood uses (including café/shop, gym and yoga studios). The scheme will include; 280 no. shared living rooms (281. no bedspaces), internal and external amenity space over 5 no. blocks ranging in height from 5 no. storeys to 9 no. storeys, secure bicycle parking, site-wide landscaping, ESB substation and switch-room and site development works all on the 0.3285-hectare site.

2.2 Site setting

The subject site is located at 36-40 Dominick Street Upper, Dublin 7, and is bounded by Western Way to the north and west, Palmerston Place to the east and Dominick Street Upper to the south. A portion of the north-eastern perimeter is also bounded by the gardens of neighbouring houses.

3 Construction activities

3.1 Construction schedule

3.1.1 Sequence of proposed works

- Hoarding works (in agreement with DCC and TII);
- Monitoring arrangements established (LRT LUAS, noise, dust, vibration etc.);
- Demolition works;
- Excavation and piling works. Works include the removal of inert material (and potentially non-inert material and contaminated material) from site - local slightly elevated levels of arsenic and antimony were detected along with trace levels of asbestos fibre in the Ground Investigation Ireland Limited (GII) survey and report (Rev C, December 2020) – refer to Appendix A;
- For the purposes of this plan, based on the information currently to hand, an allowance of circa 15% of the soil volume (circa 450m³) will be removed from site for disposal in a non-inert facility – refer to Section 4.4 of this plan for indicative removal methodology;
- Block construction (in consultation with TII); and
- Site works.

The Western Way SHD Development site entrance will be set up initially with access and egress from the site's original entrance on Western Way. Construction traffic will be generated for the duration of these works, with levels of vehicles movements varying throughout the construction period depending on the construction activities on-going. The project team are seeking to endeavour to protect the right of all affected stakeholders in continuing their daily lives with limited or undue interruption as far as reasonably practicable that may be caused by the construction operations. In this regard, Western Way Developments Limited have prepared an indicative strategy to deliver the Western Way SHD Development.

There are several constraints and requirements which have been carefully considered by the project team throughout the design process. It is proposed that the entire Western Way SHD Development construction phase would take place over a 18-20-month period to ensure safe construction. Remaining infrastructure and roads works will be completed (i.e., final service connections, paving, drainage etc.) in coordination with the contractor's construction programme.

4 Method statement for construction

The CMP provides a description of the construction build sequence. A detailed Environmental Management Plan and Construction Health and Safety Plan will be developed by the | each contractor. The implementation of and compliance with the principles of this CEMP will be monitored by Western Way Developments Limited as works progress.

4.1 Site preparation works

Site preparation works will include the '*site establishment*' set up by the | each contractor which will include the following:

- Setting up of access control to site areas;
- Secure compounds for the storage of all on-site machinery and materials;
- Permanent and temporary hoarding | fencing;

- Securing in place existing external 2nr. winches by scaffold means; and
- Erection of signage.

Prior to commencement of construction, the | each contractor will consult historical records | drawings and GPR survey drawings (Lenmar Surveys) and Waterman Moylan design information to establish the location of existing buried services | utilities. Where it is necessary to disconnect services | utilities during the construction works for a notable period, temporary provisions will be provided.

4.2 Construction compound

If practical, the Hendrons Building will be used as the site office during construction instead of new temporary buildings. At a minimum, offices, accommodation and welfare facilities will be serviced with electrical power, water supply and toilet facilities. Haul routes and storage | staging areas will be established within the site area. Storage | staging areas will vary, depending on Block spatial allocation and their exact locations will be decided taking proximity to LUAS and archaeology into consideration. Fuel storage areas will not be located near any surface drain | gully. Suitably robust hoarding will be erected around the perimeter of each storage| staging area; hoarding will typically be standard plywood or metal panelling to a height of 2.40m.

4.3 Excavation works

Excavations will be required throughout the site to facilitate the formation of ground beams, pile caps and ground floor slabs to all Blocks, Block A basement level, service ramp access, modifications to existing services and to facilitate construction of new services. Ground material (circa 3,000m³) will be required to be excavated on the development and will be either removed to landfill or reused. It is estimated that 15% (450m³) of the excavated total will be removed offsite to an non-inert treatment facility. Stock piling with agreement post future planning permission will only occur within the site (red line) in agreement with DCC. It is noted that the contractor will ultimately be responsible for securing agreements for acceptance of surplus materials that are required to be sent to licensed facilities in compliance with the requirements of their site-specific Construction & Demolition Waste Management Plan.

4.4 Potential for historic contamination on the site (refer also to Section 5.10)

Site investigations were carried out in July 2019 by Ground Investigations Ireland (GII). The investigations at the site consisted of the excavation of a number of trial pits to expose the various layers of soil present and to retrieve soil samples at various depths for laboratory testing. The trial pits were excavated in the open areas of the site. It was not feasible at that stage to carry out investigations in the areas of the site occupied by the existing buildings.

The findings of the site investigation established the outline sequence of strata encountered. This was consistent across the site and are generally comprised:

- Surfacing;
- Fill;
- Made ground; and
- Cohesive deposits.

Soil samples taken from the trial pits were sent for laboratory testing. A number of samples were analysed for a suite of parameters which allows for the assessment of the sampled material in terms of pollutant content and for classification of the materials as hazardous or

non-hazardous. The suite also allows for the assessment of the sampled material in terms of suitability for placement at licensed landfills (inert, stable non-reactive or hazardous).

The subsoil samples analyses indicate that the material tested is relatively free from contamination and inert with the exception of a single sample where trace levels of asbestos were encountered, and levels of arsenic and antimony were found to be slightly elevated above inert (classified as stable non-reactive). However, the possibility of contamination, not revealed by the testing undertaken, should be borne in mind particularly in the presence of the Made Ground deposits.

Based on the findings of the site investigations and bearing in mind the possibility of contaminated materials (not identified by the site investigation) being encountered during excavation, allowance has been made of up to 15% of the soil volume requiring removal from site to and disposed at a licensed non-inert disposal facility. The removal of contaminated soil from the site will result in a positive, moderate and long-term development alleviation.

4.4.1 Proposed management option

All wastes generated will be segregated on site into hazardous and non-hazardous waste streams. The non-hazardous waste will be further segregated into different categories for recycling and will be placed in suitably sized skips | receptacles located in a dedicated central Waste Storage Area. In the event there are any hazardous waste arising's they will be segregated by type and contaminant properties (i.e., oil, soil, flammable, toxic, corrosive, etc.). Hazardous wastes will be placed in the appropriate UN approved packaging (i.e., drums, Intermediate Bulk Containers (IBC's), or pallet boxes). Dedicated bunded storage containers will be provided for hazardous wastes such as waste fuels | oils, etc. if required. Permitted | licenced waste contractors will collect and transfer the non-hazardous and hazardous wastes off site for recycling | reuse recovery, as appropriate. All waste dockets used will be specific to the authorised waste collector that collected the waste load.

4.4.2 Soil | subsoil

Following demolition of the existing warehouse building s and Number 36 Dominick Street Upper, a series of further soil sample will be retrieved within the footprint s of the buildings, prior to the commencement of any excavation works on site. These samples will be tested to identify them hazardous or non-hazardous and to assess them in terms of suitability for placement at licenced landfills (inert, stable non-reactive, hazardous). This classification will facilitate development of a robust dig plan by the Contractor in which the material to be excavated can be appropriately classified in accordance with EU council decision 2003/33/EC. All hazardous material identified can be excavated and securely stored on the site to avoid cross contamination of inert material.

Made ground, soil and subsoil excavated will be retained onsite for reuse where possible. Excess inert soils and subsoils excavated that are not required for use onsite, this will be re-used | recycled off site at an approved facility. Non-inert soil removed from off-site will be disposed of by contractors with appropriate Waste Collection Permits to corresponding and appropriately permitted | licensed facilities. Should further suspected areas of hazardous material be identified during excavation the suspect material will be segregated in a bunded stockpile for further testing prior to disposal off site to the appropriate licenced facility. The stockpile will be segregated from the underlying strata with visqueen (to avoid cross contamination via leachates), covered and signposted to facilitate EU compliant disposal.



4.4.3 Tracking and documentation of offsite waste

All waste will be documented prior to leaving the site using the Waste Dispatch Log. All records will be saved on site in the Waste Management File and in a digital format for review. Waste will be weighed by the contractor (either by weighing mechanism on the truck or at the receiving facility). Waste company reports will be used to support the Site Waste Management Plan tool to provide comprehensive waste reports that show traceability of waste from generation to final processing.

All waste collection permit and waste facility permit | licence details including full copies of such documents will be filled on the web tool. Tonnage data of all waste removed from site will be entered routinely thus ensuring all waste is accounted for and the web tool also ensure that the site waste management plan is always up to date. All data can be printed from the web tool at any stage in individual report format or can be printed in the form of a current site waste management plan.

In the event of any evidence of soil contamination being found during either the excavation or the construction works, appropriate remediation measures will be employed. Any contaminated soil will be delineated, removed and stored on impervious quarantine areas pending testing to confirm appropriate removal and disposal to permitted | licensed waste facilities. Records of disposal will be retained on site for inspection by DCC.

4.5 Construction of services

4.5.1 Electrical connections

It is anticipated that power will also be required for temporary lighting and temporary signals during the works. If a connection to the existing network is not available a generator will be used on site. The location of the generator will be sited considering sensitive receptor locations.

4.5.2 Surface water | drainage system

Temporary construction surface drainage and sediment control measures, including the use of SUDS, will be provided before earthworks commence. The drainage design follows the natural topography of the site and utilises the existing storm water infrastructure within the surrounding infrastructure.

4.6 Phasing

4.6.1 Construction works

4.6.1.1 Site set up works (all Blocks)

- Site cabin delivery and placement the if the Hendrons Building cannot be used as site accommodation;
- Completion of all outstanding required surveys;
- Contractor temporary service installations etc.;
- Construction of appropriate hoarding to neighbouring properties;
- Installation of CCTV coverage or other agreed security means;
- Set up of required noise | dust | LRT LUAS vibration monitoring stations | receptors in predetermined areas closest to sensitive locations as defined by the grant of planning;
- Review environmental controls defined by statute and good practice;
- Review of pest control needs i.e., pigeons | rats (specialist contractor);
- New builder's supply main board to be installed in an appropriate determined location agreed between the M&E designer, contractor and temporary works electrician;
- Protection of protected structures from construction activities i.e., boundary wall along Western Way, the Hendrons building and 2nr. external winch gantries;
- Site-wide contractor supply and distribution will be agreed with the ESB.

4.6.1.2 Asbestos removal (refer also to Section 9.2.2 of the CMP)

- Licenced asbestos containing material removal;
- Non-licensed asbestos containing material removal; and
- Reoccupation certification will be provided for all areas prior to soft strip works being undertaken.

4.6.1.3 Protected structures – Hendrons Building and Boundary Wall along Western Way

- Appropriate temporary works as required will be installed to stabilise external walls prior to any internal remodelling taking place;
- Scaffolding will be designed to allow for all alterations to facilitate other trades cleaning or remedial works to the external façade or repointing to the boundary wall;
- Replacement windows (as required) will be fixed as the frame progresses to maintain water tightness (Hendrons Building);
- Internal Hendrons Building works will commence behind the frame erection on a rolling programme consisting of:
 - services 1st fix;
 - carpentry 1st fix;
 - services 2nd fix;
 - carpentry 2nd fix;
 - decoration;
 - floor finishes; and
 - install fitted furniture.

Refer also to the Historic Buildings Consultants Architectural Heritage Impact Assessment and Conservation Development Strategy reports in the planning application pack.

4.6.1.4 Hard demolition (non protected areas)

Hard demolition of all non-protected structures. Works include the safe removal of all building structural members, external façades and roof finishes. The | each contractor shall:

- Remove all debris and rubbish from the site area to licensed tips;
- Disposal or re-use of demolition materials will be carried out in accordance with the Construction and Demolition Waste Management Plan as prepared by AWN Consulting Engineers. Records shall be forwarded to the client project manager for information on the quantities disposed;
- Ensure, following the demolition of the buildings (or part thereof), the site shall be left in a tidy and safe condition in agreement with the client project manager;
- Ensure measures shall be taken to ensure that the existing services in the vicinity of each structure are not affected by the demolition works; and
- Seal by means of grouting all drainage within the curtilage of the site not to be removed during demolition of the buildings. Sealing shall be only be up to the last manhole within the site.

4.6.1.5 Pile and foundation construction (Block A) – refer also to Waterman Moylan drawings #18-039-S-P101-P102, P301-P302 and P310-P311 in planning application pack

The development will include a single level basement under Block A for storage, services and plant areas. Existing Hendrons Building foundations will not be undermined and remain in place. Substructure works will commence at Block A and include:

- Construction of contractor designed pile mat;
- Provision of 64nr. bored 600mm centre CFA piles down to existing rock level and socketed in to the rock;
- Various sized pile caps will be constructed;
- 900 x 900 ground beam construction;
- Insulation fitting (DPC, radon barrier etc.);
- Backfill of levels with appropriate material as per Engineers Specification;
- Blockwork build up;
- Contiguous wall pile construction around plant room area; and
- 1000x 900 Capping beam construction.

4.6.1.6 Pile and foundation construction (Blocks C, D and E) – refer also to Waterman Moylan drawings #18-039-S-P201-P202, P301-P302 and P310-P311 in planning application pack

- Construction of contractor designed pile mat;
- Provision of 103nr. bored 600mm centre CFA piles down to existing rock level and socketed in to the rock;
- Various sized pile caps will be constructed;
- 900 x 900 ground beam construction;
- Insulation fitting (DPC, radon barrier etc.);

- Backfill of levels with appropriate material as per Engineers Specification;
- Blockwork build up;
- Wall construction around 2nr. lift pit areas; and
- 1000x 900 Capping beam construction

4.6.1.7 *Superstructure construction*

- Cores are central to each block footprint. For the upper-level slabs to be completed, the core must be cast to that level. To minimise program alleviation, zones will be created to the basement or podium slab level to allow it to be cast without the core being complete to that level. The use of a e.g., proprietary vertical wall formwork system that is self-climbing to cast the core may be used;
- The core system will be supported by a tower crane for lifting of materials, an Alimak or alternative means to get men and tools to the system, and its own satellite concrete placing boom to place concrete;
- Lobby slabs, header beams and stairs will follow the core walls and will be cast as soon as practical to maintain structural stability of the core walls and provide access to cast the core slabs. When the last vertical wall elements are cast, the jump form will be removed in a strategic sequence and manner for safety reasons and to allow the lift motor rooms to be cast as early as possible to get builders lifts operating.
- Structure trades and works will be supported by tower cranes for lifting of materials, formwork hoists to lift recycled formwork, Alimaks or alternative means to transport operatives and materials to the decks, satellite placing booms to place concrete, proprietary perimeter edge screens to provide fall protection to operatives;
- The façade will be erected as soon as practical to commence waterproofing floors so that finishes and fit out can commence. The roof embellishments will commence when the structure is complete. These works will not be able to be completed until all plant has been lifted into the plant rooms and the façade has been installed to this level to complete the water tightness of the fabric;
- When slabs are cast and the formwork is stripped, the services will commence to be installed. These works will commence within the building but will not be completed till the façade to that level is complete. The façade provides edge protection for the men working near the edge and provides weatherproofing for equipment that is water sensitive. The works will be organised in several passes, with first fix services installed as applicable before the façade is installed to that level.

4.6.1.8 *Internal finishes*

- Finishes are normally commenced in earnest when the façade is installed to that floor. The services will be scheduled to be completed enough to allow finishes to commence. Equipment and materials will be lifted to the floors via several means depending on what stage the building is at. The means will be tower cranes, Alimaks or builders lift. The builders lifts will be used for "clean trades" such as services fit off, carpets, ceiling tiles and fit out, to minimise damage to the lifts. Materials that will be hoisted via the Alimaks or Builders lifts will be unloaded in the loading dock to save congestion to the material handling areas.

4.6.1.9 *Site works*

- When the fabric of the building is complete, and the tower cranes have been removed, the gantries will also be removed. This will allow the external works to be commenced and completed in a timely manner. The works will also include making good any areas that have

been affected by the construction of the project. As some of the external works will be to footpaths and roads to mesh them in with the new building, some footpath and lane closures will be required. These will be coordinated with DCC.

4.7 Materials – source and transportation

The selection and specification of construction materials will be informed by the local availability of these materials. Within the necessary constraints of performance, durability and cost, construction materials will be sourced from local suppliers and manufacturers, where possible.

4.8 Health and safety

The CMP is the overall development governance and control document that will act as the boilerplate template for all site-specific health & safety documentation complying with the relevant planning condition and other documentation required under the Safety, Health and Welfare at Work (Construction) Regulations, 2013 – 2020. The site-specific Preliminary Safety & Health and Construction Stage Health & Safety Plan will be reviewed as the development progresses. The contents of the Health and Safety Plan will comply with the requirements of the Regulations. Safety on site will be of paramount importance. During the selection of the relevant contractor and the respective subcontractors their safety records will be investigated. Only contractors with the highest safety standards will be selected.

4.9 Employment and accommodation

Office accommodation and other construction facilities will be located on the site for the construction phase. All temporary welfare units will be of a high standard in accordance with statutory regulations as a minimum and the current CIF C-19 Safe Operating Procedures. The co-ordination of people and materials on site will be one of the key activities throughout the construction of each Block. The CMP seeks to designate traffic routes, timings and parking arrangements. It is proposed that typical working hours during the construction phase will be as follows:

4.9.1 Working Hours

- Western Way Developments Limited will require the contractor to appoint a Client Liaison Officer (CLO) so that particular issues | complaints may be quickly identified and responded to. CLO details will be shared with residents;
- Working hours are determined and conditioned by the Grant of Permission - proposed working hours is 07:00 – 19:00 Monday to Friday and 08:00 – 14:00 on Saturday.
- It is recognised that there may be circumstances where the restriction on hours of work cannot be adhered to e.g., concrete pours, power floating works, works on or adjoining the LRT LUAS line outside operating hours etc. In these circumstances the | each contractor will be required to provide written agreement with DCC before any works start outside normal hours;
- Where out of hours works are noise sensitive, such exceptional events will only be permitted to be undertaken when all other alternatives have been considered and exhausted with the agreement of the Planning Authority;
- All such works above will be preceded by written approval from the Planning Authority, showing evidence of consultative communications with local residents and businesses. The | each contractor in these circumstances must ensure that appropriate notice (10 working days) is given to the CLO to update DCC and local residents;

- Deliveries will be sequenced 'just in time' to ensure that their arrival and departures time are outside high traffic interface periods. Delivery vehicles are to enter and exit the site through an agreed travel plan detailed within the CMP. The | each contractor is responsible to ensure compliance with this;
- Deliveries are not permitted to hold | temporary wait on any approach public roadway unless previously agreed with DCC Roads and Traffic Department;
- Operatives may access their site prior to 7:00 but are not permitted to operate construction machinery before 08:00; and
- No significant work will commence before 07:00 with no vehicles queuing on public roadways unless otherwise agreed with DCC Roads. Vehicle engines will be required to be turned off while onsite before 07:00.

5 Construction phase environmental alleviation measures

5.1 Introduction

The development will generate emissions during the construction phase these include emissions to air (dust, noise and vibration), construction traffic, surface water run-off or infiltration to groundwater. In addition, leaks or spills from fuel storage areas and construction plant and equipment will have the potential to alleviate on soil, surface water and groundwater quality. The CEMP includes emission limits for the various environmental media that require monitoring. They include for Trigger and Action Limits the details of which are discussed further in the relevant subsections below. Issues in relation to environmental nuisance will be addressed by the contractor's Environmental Monitoring Officer who will brief Western Way Developments Limited on the actions being taken to alleviate environmental complaints and or breeches of environmental monitoring limits.

5.2 Environmental Monitoring Officer – Contractor Appointment

An Environmental Monitoring Officer (EMO) will be appointed by the contractor. The EMO will ensure that onsite activities meet | exceed the requirement of this CEMP. The EMO will also review monitoring reports to based on the requirements specified in CEMP to ensure that the construction does not alleviate on the environment, surrounding residential occupants, public transport infrastructure and the general public. The EMO will also report on any incidents such as spills or leaks and how such incidents were dealt with to alleviate environmental impacts. These summary reports will be made available for review by DCC and interested parties. In the event of an exceedance of Trigger Limit the | each contractor will be obligated to implement the following measures

- Repeat measurement to confirm findings;
- Identify source(s) of alleviation;
- Check monitoring data, all plant, equipment and relevant Contractor's working methods; and
- Discuss alleviation measures with Western Way Developments Limited;

5.3 Noise

The construction phase will involve site clearance, excavation and the construction of buildings and structures associated with the proposed development. All non protected structures will be demolished in compliance with the controls set out in the Construction & Demolition Waste Management Plan. A variety of items of mobile plant will be in use, such as excavators, lifting

equipment, dumper trucks, compressors, generators and pile drivers. There will be vehicular movements to and from the site that will make use of the existing roads and site access points.

A number of measures will be employed by the | each contractor to minimise the potential noise and vibration disturbance in the surrounding area and to ensure compliance with the construction noise and vibration limits recommended in the Transport Infrastructure Ireland (TII) document '*Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*' 2014. BS 5228 (2009+A1:2014) *Code of practice for noise and vibration control on construction and open sites – Noise and vibration*. The measures include, but are not limited to:

- Selection of quiet plant | location of plant; plant which will have the least alleviation in term of noise will be selected;
- Plant will only be left running during works and will be switched off at all other times. Plant will not be left idling. No maintenance or repair to plant or machinery will be permitted outside of the permitted construction works hours;
- Hours of work - all construction related works, other than emergency works and security will be carried out during normal construction working hours;

The following alleviation measures are specific to the operation of an onsite mobile crusher, in accordance with measures outlined in BS5228:

- Locating any crushing plant as far from sensitive receptors as possible (minimum of 200.00m).
- The crushing plant will be fully enclosed;
- Materials should be lowered into the crusher and not dropped; and
- Plant will be maintained to minimise noise generation.

The | each contractor shall develop a noise and vibration monitoring regime for the duration of the construction works. At a minimum, the regime will include the following:

- Prior to the commencement of the site construction activities noise and vibration monitoring is to be undertaken by the | each contractor at the proposed baseline monitoring stations to monitor the alleviation of site activities on local receptors;
- Monitoring data shall be summarised and updated weekly and will be shared with relevant parties. Should construction noise limit criteria exceed the trigger limits appropriate measures shall be implemented;
- In the event that action limits are exceeded works will be suspended in the relevant area(s) until the issues causing the exceedances are identified and alleviated.
- During the construction phase monitoring will routinely be undertaken weekly but the frequency will be amended where complaints are received or where trigger limits are being exceeded.
- To assess construction noise levels measurements will be undertaken inside the hoardings. Measurements will be undertaken separately outside the hoarding to establish background noise emission levels beyond the site boundary i.e., those likely to be associated with traffic or other activities not related to the construction programme.
- Section 5.3.1. details the noise limits proposed for pre-construction and during routine construction noise monitoring. They are based on having regard for NRA Guidelines 2014. They include for Trigger and Action Limits.

5.3.1 Trigger and action noise monitoring limits

Days & times	L _{Aeq (1hr)} dB	L _{pAmax, slow} dB
Monday to Friday 07:00 to 19:00hrs Trigger	63	72
Monday to Friday 07:00 to 19:00hrs Action	70	80
Saturday 08:00 to 14:00hrs Trigger	58.5	67.5
Saturday 08:00 to 14:00hrs Action	65	75

The noise monitoring programme will include the following:

- Noise monitoring to include Tonal analysis; and
- All noise and vibration monitoring data shall be compiled into a weekly technical monitoring report by the | each contractor's Site Manager for review and approval by the Environmental Monitoring Officer. The report shall be based on BS5228 "Noise Control on Construction and Open Sites" shall be submitted.

A log will be maintained on site of all noise complaints including those actions taken where trigger limits are exceeded as outlined above. The log will include the following detail:

- Name and address of complainant;
- Time and date complaint were made;
- Date, time and duration of noise;
- Characteristics, such as rumble, clatters, intermittent, etc.;
- Likely cause or source of noise;
- Weather conditions, such as wind speed and direction; and
- Investigative and follow - up actions.

5.3.2 Noise action plan

No.	Control Measures
1.	Proposed working within the site will be restricted from Monday to Friday between 07:00Hrs and 18:00Hrs and Saturday between 08:00Hrs and 14:00Hrs unless otherwise agreed with the Planning Authority.
2.	When considering noise control at source the following elements will be considered:

	<ul style="list-style-type: none"> ▪ The noise level, and the likely duration of such noise. Noisy activities will be restricted to the appropriate part of site where possible in order to minimise local disturbance. ▪ Operations will be organised with regard to the positioning of equipment and the location of haul routes so as to minimise noise alleviations. ▪ Machines in intermittent use will be shut down in the periods between works or throttled down to a minimum. ▪ Where noisy activity will take place near a noise sensitive location the use of noise screens and abatement equipment will be used as a method of minimising disturbance.
3.	All plant and equipment used on site will be the quietest of its type for carrying out the work required and will be maintained in good condition with regard to minimising noise output (this may include the fitting of sound reduction systems). All plant and equipment will be mechanically sound and operated and maintained in accordance with the manufacturer written recommendations.
4.	Heavy construction activities will be carried out during daytime hours only and restricted to the conditions of the full planning permission. This may also be subject to agreements made with the Client and Planning Authority in consultation with local residents
5.	Any tests or procedures which are known to be potentially noisy will be carried out during daytime hours only.
6.	Construction plant and equipment will comply with, EC (Construction Plant and Equipment) (Permissible Noise Level) Regulations.
7.	Noise monitoring is to be conducted during critical periods and at sensitive locations to be agreed in consultation with DCC.

5.4 Vibration

Vibration monitoring will include the following:

Vibration monitoring stations must continually log vibration levels using the Peak Particle Velocity parameter (PPV, mm/s) in the X, Y and Z directions in accordance with BS ISO 4866:2010: Mechanical vibration and shock - Vibration of fixed structures - Guidelines for the measurement of vibrations and evaluation of their effects on structures. Vibration monitors, of both aural and visual type, with real time outputs are to be located at agreed points. Traffic light system to be in place consisting of:

- Green-vibrations below all threshold limits - OK TO PROCEED;
- Amber-vibrations exceed first threshold limit - STOP AND CHECK; and
- Red-vibrations exceed second threshold - STOP AND ACTION.

Dilapidation surveys of all properties adjoining works shall be undertaken prior to any works commencing on site. The results of these results will inform any specific requirements in terms of potential locations for vibration monitors. Allowable vibration velocity (Peak Particle Velocity) at the closest part of any sensitive property to the source of vibration at the frequencies specified in Section 5.4.1 below.

5.4.1 Vibration monitoring limits

Frequency	<10Hertz -	10-50 Hertz	50-100Hz and above
Limits Red	8mm/s;	12.5mm/s	20mm/s
Limits Amber	7mm/s	11.0mm/s	15mm/s
Limits Green	<7mm/s	<11.0mm/s	<15mm/s

5.4.2 Vibration action plan

No.	Control Measures
1.	Vibration activities (i.e., heavy demolition work including plant use) will be restricted to the appropriate part of site where possible in order to minimise local disturbance.
2.	Prior to the commencement of the site construction activities vibration monitoring is to be undertaken by United Metals at the proposed baseline monitoring stations to monitor the alleviation of site activities on local receptors.
3.	Vibration activities will be scheduled to the most appropriate times practicable, and for the shortest time possible in order to minimise local disturbance.
4.	When considering vibration control the following elements will be considered: vibration level and likely duration of such vibration.
5.	Preference will be given to fixed items of construction equipment that are electrically powered rather than diesel powered, and those that perform well in terms of reduced vibration.
6.	Optimal conditions for operation, maintenance and care of machines and tools will be maintained to avoid unnecessary bearing play causing vibration.

5.5 Dust

Dust emissions are likely to arise from the following activities during the construction works:

- Site earthworks;
- Wind blow from temporary stockpiles;
- Handling of construction materials;
- Landscaping; and
- Construction traffic movements.

The following control measures will be implemented at a minimum:

- Spraying of exposed earthwork activities and site haul roads during dry weather using mobile bowser units;
- Provision of wheel wash for all other construction site activities;
- Control of vehicle speeds and speed restrictions; and

- Sweeping of hard surface roads.

The following measures will also be implemented where construction works occur in proximity to sensitive receptors:

- Provision of hoarding of 2.40m high at a minimum;
- Covering of stockpiles and locating stockpiles away from sensitive receptors;
- Locating plant away from sensitive receptors.

The following avoidance, remedial or reductive measures will be implemented as part of the dust minimisation plan:

- Vehicle speed limits will be enforced at the construction site. Site traffic is restricted to 10 km/hr. This will help to minimise the occurrence of dust re-suspension;
- Vehicles delivering or removing materials on site will be loaded carefully to reduce the risk of spillage from the vehicles onto nearby roads;
- Exhaust emissions from vehicles operating within the site, including trucks, excavators, diesel generators or other plant equipment, will be controlled by the | each contractor through regular servicing of machinery;
- Surrounding public roads used by trucks to access to and egress from the site will be inspected regularly and cleaned, using an approved mechanical road sweeper, when required. Roads will be cleaned subject to local authority requirements. Site roads will be cleaned on a daily basis, or more regularly, as required;
- During very dry periods when dust generation is likely or during windy periods, construction areas and vehicles delivering material with dust forming potential will also be sprayed with water, as appropriate. Wheel wash facilities will be provided for all other construction activities for use by all vehicles exiting the site prior to them entering onto the surrounding public roads. These facilities will contain rumble grids to remove excess mud and other waste from wheels, ensuring that these potential dust producing materials are not released onto surrounding public roads. The wheel wash facilities will be self-contained, ensuring that wastewater discharges to nearby water bodies are not necessary. The facilities will be located away from sensitive receptors, where possible;
- Areas where materials will be handled and stockpiled will be positioned away from main site access roads. These areas will also be designed to minimise their exposure to wind – all stockpiles shall be kept to the minimum practicable height with gentle slopes;
- There shall be no long-term stockpiling on site and storage time will be minimised;
- Material drop heights from plant to plant or from plant to stockpile will be minimised;
- Daily inspections will be undertaken to monitor tidiness;
- A regular program of site tidying will be established to ensure a safe and orderly site;
- If necessary, scaffolding will have debris netting attached to prevent materials and equipment being scattered by the wind;
- Food waste will be strictly controlled on all parts of the site;
- Loaded lorries, delivery vehicles and all trucks for the movement of materials on and off site will be covered. Skips will also be covered. The | each contractor will ensure that delivery agents are compliant in this regard;
- Surrounding roads used by trucks to access to and egress from the site will be inspected regularly and cleaned, using an approved mechanical road sweeper, when required. Roads

will be cleaned subject to local authority requirements. Site roads will be cleaned on a daily basis, or more regularly, as required;

- Road edges and footpaths will be cleaned using a hand broom with controlled damping; and
- In the event of any fugitive solid waste escaping the site, it will be collected immediately and removed to storage on site, and subsequently disposed of in the normal manner.

The degree of implementation for some of the above alleviation measures (water spraying etc.) will be determined by rainfall levels on site. The use of excessive levels of water to suppress dust will be minimised when not required. This will help limit potential drainage related alleviations on site.

5.5.1 Dust monitoring

Dust deposition monitoring will be carried out at the nearest sensitive receptors to the proposed development for the duration of the construction works to ensure the effectiveness of the measures outlined above. Bergerhoff Dust Deposit Gauges will be positioned at each sensitive receptor. Results will be compared with TA Luft guidelines. The guideline dust deposition limit is 350 mg/m²/day (averaged over a 30-day period). This limit will be applied on site. This guideline limit is widely applied in Ireland to identify periods of dust nuisance.

The precise location of the dust gauges will be determined by a qualified air quality expert appointed by the | each contractor to ensure that dust gauge locations are positioned in order to best determine potential dust deposition in the vicinity of site boundaries and existing buildings. Dust monitoring will be completed monthly with the results reported to the EMO. Quarterly Monitoring reports detailing all measurement results shall be prepared and submitted to the EMO for review. Reports will be maintained on site for inspection if/when required by DCC.

Where exceedance of dust emission limits occurs on daily or weekly basis or where complaints are received an assessment will be undertaken to identify the source(s). This will include an assessment of the construction works taking place, potential off-site sources and meteorological conditions. Should the construction works taking place be identified as the primary cause of the exceedance, the | each contractor will ensure that the alleviation measures listed above are improved upon. Should exceedances of the guideline limit value continue to occur following these improvements, the | each contractor will provide alternative alleviation measures and/or will modify the construction works taking place.

5.6 Carbon emissions

The following alleviation measures will be implemented to minimise CO₂ emissions:

- Materials required for the construction works will be sourced locally where possible. Rock crushing will be undertaken on site where possible, to reduce the requirement to import crushed stone to site;
- Materials will be handled efficiently on site to minimise the waiting time for loading and unloading, thereby reducing potential emissions;
- Engines will be turned off when machinery is not in use;
- The regular maintenance of plant and equipment will be carried out;
- The | each contractor will be required to implement an Energy Management System for the duration of the works. This will include the following at a minimum:
 - Use of thermostatic controls on all heating systems in site buildings;

- The use of insulated temporary building structures;
- The use of low energy equipment and power saving functions on all computer systems;
- The use of low flow taps fittings and showers; and
- The use of solar/thermal power to heat water for the on-site welfare facilities including sinks and showers.

5.7 Land, soils and groundwater

The employment of the following good construction management practices will minimise the risk of pollution of soil and groundwater:

- Excavated material shall undergo earthworks testing in accordance with the TII Specification for Road Works (SRW) to establish its suitability for reuse as engineering fill;
- It is proposed to excavate contaminated soil and subsoil directly to haulage vehicles for removal off the site;
- Good housekeeping (daily site clean-ups, use of disposal bins, etc.) on site during construction, and the proper use, storage and disposal of substances and their containers will prevent soil contamination;
- Groundwater pollution will be minimised by the implementation of good construction practices by the | each contractor. Such practices will include adequate bunding for all potentially contaminating liquids including fuel and lubricating oils and chemicals, wheel wash and dust suppression on site roads, and regular plant maintenance;
- Materials such as, fuels, chemicals, lubricants and hydraulic fluids will be carefully handled to avoid spillages. These materials will be stored within double sealed tanks with bunds to prevent any seepage of same into the groundwater. A fuel filling point will be set-up on site with all plant to be brought to this point for filling. Potential pollutants will also be adequately secured against vandalism and will be clearly marked. Any spillages will be immediately contained, and contaminated soil removed from the site and disposed of in a licensed waste facility; and
- Local dewatering and collection of groundwater during construction may require disposal. Disposal of groundwater during construction will be to the surface water sewer system following suitable pollution control and attenuation measures. The precise measures to be used will be agreed in advance with the EMO and Project Ecologist.

5.7.1 Groundwater monitoring

The following monitoring will take place where | if required:

- Groundwater level monitoring adjacent to basement excavations and near sensitive receptors to ensure stability of any temporary slopes, retaining walls etc.

5.8 Surface water

Surface water run-off from surface construction activities has the potential to become contaminated. The main contaminants arising from surface construction activities include:

- Suspended solids: arising from ground disturbance and excavation;
- Hydrocarbons: accidental spillage from construction plant and storage depots;
- Faecal coliforms: contamination from coliforms can arise if there is inadequate containment and treatment of onsite toilet and washing facilities; and
- Concrete/cementitious products: arising from construction materials.

These pollutants pose a temporary risk to surface water quality for the duration of construction if not properly contained and managed. Suspended solids, which can include silt, affect surface water turbidity and are considered to be the most significant risk to surface water quality from construction activities. Suspended solids can also reduce light penetration, visually alleviate the receiving water and damage the ecosystem. Potential construction activities that could generate suspended solids include:

- Water removal from surface excavations as a result of rainfall or groundwater seepage;
- Wash water;
- Runoff from exposed work areas and excavated material storage areas; and
- Cement washdown areas: the potential for cement to increase the pH of water above a neutral range.

Potential activities that could generate the other pollutants listed above include:

- Inappropriate handling and storage;
- Leakage of temporary foul water services; and
- Solid wastes being disposed or blown into drainage systems.

5.8.1 Surface water alleviation measures

- An Emergency Response Plan detailing the procedures to be undertaken in the event of flooding, a spill of chemical, fuel or other hazardous wastes, a fire, or a non-compliance incident will be prepared. This plan will contain the following information:
 - Containment measures;
 - List of appropriate equipment and clean-up materials;
 - Maintenance schedule for equipment;
 - Details of trained staff, location, and provision for 24-hour cover;
 - Details of staff responsibilities;
 - Notification procedures to inform the relevant environmental authorities;
 - Audit and review schedule;
 - Telephone numbers of DCC Drainage and Pollution Control Divisions;
 - List of specialist pollution clean-up companies and their telephone numbers.
 - Ensure site staff are trained in the implementation of the Emergency Response
 - Plan and the use of any spill control equipment as necessary;
 - Prepare method statements for the control, treatment and disposal of potentially contaminated surface water;
 - A procedure for the location and maintenance of soil stockpiles generated during the construction programme;
 - Prepare a site plan showing the location of all surface water drainage lines and proposed infiltration areas/discharge to combined sewer. This shall include the location of all existing and proposed surface water protection measures, including monitoring points and treatment facilities; and
 - Ensure that all appropriate licences required for construction are obtained from the relevant authorities.

The following alleviation measures will be used to control the interaction of wash down water from concrete and cementitious material with surface water:

- Use of wet cement is a requirement during construction. Run-off water from recent cemented areas will result in highly alkaline water with high pH. As this would only occur during particular phases of work this is again considered as a single short-term event rather than an ongoing event. If concrete mixing is carried out on site, the mixing plant will be sited in a designated area with an impervious surface.

Process water used during construction will be disposed of appropriately. Rainwater will also accumulate on the site during construction. This water will be discharged directly via suitable pollution control and attenuation measures either directly to ground within the site or to foul sewer systems via portions of the DCC sewer network.

Where available proposed permanent connections to the public sewer systems required for the operational phase will be used temporarily for the construction phase, to optimise efficiencies and avoid the creation of new outfalls for temporary construction only.

De-watering operations and surface water run-off discharge on the site, during construction and prior to completion will be controlled and discharged only to the existing sewerage system at an agreed rate of flow in consultation with Irish Water, DCC Environment Division and Pollution Control Section.

On-site treatment measures will be installed to treat surface water run-off from the site prior to discharge to the receiving surface water sewer. This treatment will be achieved by the construction of filter strips, settlement tanks, the installation of proprietary surface water treatment systems including Class 1 full retention petrol interceptors and spill protection control measures. All measures will be approved prior to commencement with the Pollution Section of DCC. Carbon dioxide is accepted "best practice" within the Construction Industry as a neutralising agent due to its environmental and health and safety benefits. It is self-buffering and is virtually impossible to acidify the water through overdosing. The by-products of neutralising the water with CO₂ are non-hazardous thereby reducing the alleviation on the receiving system.

5.8.2 Proposed surface water monitoring programme during construction

Parameter	Guide limit	Mandatory limit	Frequency and Manner of Sampling
Temperature		1.5 °C	Weekly, and at appropriate intervals where the works activities associated with the scheme have the potential to alter the temperature of the waters.
Dissolved oxygen	50% of samples ≥ 9 (mg/l O ₂) 100% of samples ≥ 7(mg/l O ₂)		Weekly, minimum one sample representative of low oxygen conditions of the day of sampling.
pH		6-9	Weekly

Nitrites	≤ 0.01 (mg/l NO ₂)		Monthly
Suspended Solids	≤ 25 (mg/l)		Monthly
BOD5	≤ 3 (mg/l)		Monthly
Phenolic Compounds			Monthly where the presence of phenolic compounds is presumed (An examination by taste)
Petroleum Hydrocarbons	5(mg/l)		Monthly (visual)
Non-Ionized Ammonia	≤ 0.005 (mg/l NH ₃)		Monthly
Total Ammonium	≤ 0.004 (mg/l NH ₄)		Monthly
Total Residual Chlorine		≤ 0.005 (mg/l HOCl)	At appropriate intervals where works activities associated with the scheme have the potential to alter the Total Residual Chlorine of the waters
Electrical Conductivity			Weekly

The monitoring parameters will be discussed and agreed with DCC.

5.9 Landscape and visual

During the construction phase, all site areas within view of any local dwelling will be enclosed with robust and visually impermeable hoarding to a minimum height of 2.40m.

5.10 Waste management

The recommended waste management alleviation for the construction phase of the proposed development is included in the Construction and Demolition Waste Management Plan (C&DWMP) prepared by AWN Consulting which meets the requirements of the '*Best Practice Guidelines on the Preparation of Waste Management Plans for Construction & Demolition Projects* (DoEHLG, 2006)'. Implementation of the Plan will ensure effective waste management and minimisation, reuse, recycling, recovery and disposal of waste material generated during the construction phase of the project.

5.10.1 Hazardous waste

The following statutory restrictions apply with regard to the collection and handling of hazardous waste in Ireland and were complied with during all works associated with the Western Way SHD Development works:

- Hazardous wastes, as defined by the EWC Codes, will be collected and transported from the works by a contractor who holds a current Waste Collection Permit for the vehicle used to collect the waste, the type of waste being collected and permitted permission to take the

material to the designated facility, in accordance with the Waste Management (Collection Permit) (amend) Regulations 2007 / 2008, 2015 & 2016;

- Hazardous waste will only be taken to a permitted or licensed facility as per current waste management legal and regulatory requirements;
- All waste management documentation will be verified and validated by the Contractor's Environmental Manager prior to any material being removed from the works;
- Hazardous waste removed from the works will be accompanied by a Waste Transfer Form (WTF). A copy of the WTF will be obtained from the Waste Contractor and copies retained on file with the contractor; and
- Records of all hazardous waste movements will be retained for a minimum period of ten years at the contractor's head office.

5.10.2 General mixed hazardous waste materials

These materials shall be placed in a designated UN approved receptacle(s) until works have been complete and then will be removed off site by a permitted contractor to a licensed facility.

5.10.3 Asbestos management

Asbestos material will be managed by a licensed contractor. This will include dismantling, monitoring, packaging and removal of asbestos containing material off site to a licensed facility. The asbestos contractor is responsible for all relevant notifications, waste management documentation and handover of a report to the contractor to state all asbestos material as listed on the report has been handled by trained and competent persons, removed and disposed in accordance with current EHS legal and regulatory requirements.

5.10.4 Hazardous soil & stone

Hazardous soil and stone identified in the WAC tests requires contractor will notify DCC Environmental Enforcement Section, and provide a Hazardous/Contaminated Soil Management Plan, to include estimated tonnages, description of location, any relevant alleviation, destination for authorised disposal/treatment, in addition to information on the authorised waste collector(s). All hazardous waste will be moved off site accompanied by a Waste Transfer Form as per current waste management legal and regulatory requirements. Waste management practices and the associated records will be included within the scope of all environmental inspections carried out by the contractor.

5.10.4.1 Hazardous | contaminated material excavation methodology

Under the requirements of the European Waste Directive all waste needs to be pre-treated prior to disposal. The pre-treatment process will be physical, thermal, chemical or biological, including sorting. Treatment must change the characteristics of the waste in order to reduce its volume, hazardous nature, facilitate handling or enhance recovery. Treatment will be carried out by an approved contractor.

- The proposed method of remediation is through bulk excavation of the contaminated soil;
- The remedial works will be monitored and validated by a suitably qualified geo-environmental engineer and the base and sides of the contaminated excavation will be tested for a range of metal contaminants along with, speciated hydrocarbons, total cyanide, phenols, BTEX compounds, volatile organic compounds (VOCs), semi volatile organic compounds (SVOCs) and asbestos. If, at any time, areas of previously unidentified

contamination are encountered, no further development will be carried out until a report indicating the nature of the contamination and how it will be dealt with is prepared.

- Contaminated soil removed from site will be disposed of at a licensed tip and copies of all waste transfer documentation will be included in the verification report;
- All contaminated and potentially contaminated spoil will be stockpiled if not immediately removed post excavation on a bunded, impermeable surface, covered to prevent wind blow and potential erosion;
- Control measures will be implemented immediately to divert surface runoff away from contaminated land and to capture and manage any surface runoff contaminated by exposure to contaminated land;
- Specific control measures will be followed for contaminated material works including:
 - The contractor will mark out extent of identified contamination;
 - The excavator will dig down in layers with the formation of each layer and sides of the excavation being visually inspected by the contractor. The material will be placed directly into wagons for disposal;
 - Wagons will reverse into position as instructed by the contractor to avoid entering contaminated areas - when the wagon has come to a complete stop and the driver has signalled, he has engaged his handbrake the loading will begin;
 - As the excavation deepens it will be necessary to ensure the wagons keep a safe distance from the edge of the excavations;
 - The wagon will only be loaded to 90% capacity to avoid any spillages while in transit, the wagons sheet must be in place before leaving site;
 - The area will then be checked for any spillages, any spillages will be placed in the next wagon. The above process will be repeated until all contaminated material has been removed;
 - Where material cannot be fully excavated an appropriate barrier membrane and bund will be installed to avoid the material transferring to other areas of the site;
 - All plant, tools and equipment used during the process will be cleaned under the supervision of the contractor; this will simply be done with brushes and shovels, any contaminated material will be placed in the last wagon to leave site; and
 - All excavations that take place will be made safe at the end of every working day, all sides of the excavations will be battered to a safe angle of repose to allow pedestrian (walking) access in and out of the excavations, unless backfill has been specified this will be achieved by taking scrapes from other areas of site.

5.10.5 Construction waste (refer also to the AWN prepared Construction & Demolition Waste Management Plan)

5.10.6 Consultation with relevant bodies

DCC will be consulted throughout the construction phase to ensure that all available waste reduction, reuse and recycling options are being explored and utilised and that compliant Waste Management is being carried out at the site. Specialist companies, wherever required, will be contacted to determine their suitability and each company's record reviewed to ensure relevant current collection permits / licenses are held. Companies will also be contacted to gather information regarding treatment of hazardous materials, if required (although not anticipated for this site), costs of handling and the best methods of transportation for recycling or reuse when hauling off site.

5.10.7 Pest control

The | each contractor will be required to adopt an Integrated Pest Management Plan as part of the works. This plan will establish a sustainable approach to managing pests in order to minimise health and environmental risks throughout the construction works and is to be prepared in accordance with the guidelines set out in the '*Rodent Control for Construction Industry*' information leaflet as issued by the Health Service Executive, Environmental Health Service, 2009. The | each contractor will be responsible for ascertaining if the proposed lands are currently infested rodents and other pests. If so, any lands will be required to be disinfested by a pest control specialist, as is reasonably possible given the nature of the site. Throughout the works, the | each contractor will be responsible for ensuring that a good standard of hygiene is maintained to limit the attraction of rodents and other pests to the site. Measures are to include, but are not limited to the following:

- Waste food, empty food tins, and other waste to be stored in bins with sealed lids;
- Accumulations of construction debris which may provide harbourage for rodents are to be cleared away regularly and in a timely manner; and
- Stocks of building material are to be neatly stored.

The | each contractor shall implement measures to prevent infestations during the proposed works. This will include infestation of existing and proposed drains, sewers, ducts and nearby properties. Measures are to include, but are not limited to the following:

- Removal of all existing refuse from site; and
- During the laying of new drains, the sewers, open pipe ends, and manholes are to be protected against entry by rodents when work is not in progress – particularly at night time.

A finalised Pest Control Management Plan is required to be submitted by the | each contractor to Western Way Developments Limited prior to commencement of works.

6 Environmental emergency response plan

Emergency response preparedness will be addressed in detail by the selected contractor. Environmental emergencies at the site requiring intervention will include:

- Discovery of a fire within the site boundary;
- Uncontained spillage | leak | loss of containment incident; and
- Discovery of material of archaeological interest.

A list of site emergency contact numbers and the general emergency response actions will be compiled by the | each contractor and posted at strategic locations throughout the site, such as the main site entrance, safety stop-boards and contractor cabins. The emergency contact number list will be updated by the | each contractor to include their safety representative contact name and telephone number.

An example of emergency response actions is as follows for action to be taken in the event of a spillage:

- IF SAFE, stop the source of the spill and raise the alarm to alert people working in the vicinity of any potential dangers;
- IF SAFE (USE PPE), contain the spill using the absorbent spills material provided. Do not spread or flush away the spill;

- Cover or bund-off any vulnerable areas where appropriate;
- If possible, clean up as much as possible using the absorbent spills materials;
- Do not hose the spillage down or use any detergents;
- Contain any used absorbent material so that further contamination is limited;
- Note: This material is a waste and must be treated as such. The Safety Data Sheet (SDS) for the material will determine whether the spill material is hazardous or non-hazardous and will need to be disposed of accordingly;
- Notify Western Way Developments Limited at the earliest opportunity; and
- An incident investigation will be performed in accordance with procedures and the report sent to the Western Way Developments Limited Project Manager.

The | each contractor will ensure that fully detailed records are maintained of any 'incident | event' likely to cause harm to the environment. Contractors who report an incident will ensure details are identified and recorded.

Environmental incidents will be recorded on an appropriate form.

Complaints and Follow up Actions on the construction site will be managed by the Contractor's Contracts Manger in liaison with the Project Manager and contractors will ensure that all complaints are recorded according to Client requirements. A complaints log will be kept and any complaint from interested parties will be actioned and recorded.

The | each contractor will be responsible for ensuring that a full record and copy of all Safety Data Sheets (SDS) pertaining to their works is kept on file and up to date in their site offices. The | each contractor will also retain a duplicate copy of all SDSs held.

Western Way Developments Limited
Western Way SHD Development, 36-40 Dominick Street Upper, D7

Appendix A - Ground Investigation Ireland (GII) survey and report (Rev C, December 2020)



GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
Co. Dublin.
D22 YD52

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

Ground Investigations Ireland

36-40 Dominick Street Upper, Dublin 7

Waterman Moylan

Ground Investigation Report

October 2020



GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
Co. Dublin.
D22 YD52

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

DOCUMENT CONTROL SHEET

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C	Final	R O'Toole	B Sexton	B Sexton	Dublin	7 December 2020

Ground Investigations Ireland Ltd. present the results of the fieldworks and laboratory testing in accordance with the specification and related documents provided by or on behalf of the client. The possibility of variation in the ground and/or groundwater conditions between or below exploratory locations or due to the investigation techniques employed must be taken into account when this report and the appendices inform designs or decisions where such variation may be considered relevant. Ground and/or groundwater conditions may vary due to seasonal, man-made or other activities not apparent during the fieldworks and no responsibility can be taken for such variation. The data presented and the recommendations included in this report and associated appendices are intended for the use of the client and the client's geotechnical representative only and any duty of care to others is excluded unless approved in writing.



GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
Co. Dublin.
D22 YD52

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

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APPENDICES

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1.0 Preamble

On the instructions of Waterman Moylan Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., in July 2019 at the site of the proposed development on Constitution Hill, Dublin 7.

2.0 Overview

2.1. Background

The proposed development comprises demolition of the existing warehouse buildings and no. 36 Dominick Street Upper and retention of the Hendrons Building as part of an overall redevelopment of the site to accommodate a build-to-rent shared living scheme and publicly accessible neighbourhood uses (including café/shop, gym and yoga studios). The scheme will include; 280 no. shared living rooms (281. no bedspaces), internal and external amenity space over 5 no. blocks ranging in height from 5 no. storeys to 9 no. storeys, secure bicycle parking, site-wide landscaping, ESB substation and switch-room and site development works all on the 0.3285 hectare site. The site at the time of the investigation was occupied by commercial buildings and was situated on Constitution Hill, Dublin 7. The proposed construction is envisaged to consist of conventional pad or piled foundations and pavement make up with some local excavations for services and plant.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 5 No. Trial Pits to a maximum depth of 3.00m BGL
- Carry out 3 No. Foundation Inspection Pits to determine existing foundation details
- Carry out 2 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

3.0 Limitations

Samples were collected for chemical analysis. These samples were collected in order to be as representative of the subsurface conditions and subsoils quality as possible at the site investigation locations. The collection of sufficient sample numbers to be truly representative of the subsoil quality across the site was not possible due the limitations on site access. Access was limited due to the presence of buildings on the site.

4.0 Subsurface Exploration

4.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.

The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

4.2. Trial Pits

The trial pits were excavated using a JCB 3CX excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by an Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

4.3. Foundation Pits

The foundation inspection pits were excavated at the locations shown in the exploratory hole location plan in Appendix 1. The exposed foundations were logged and sketched prior to backfilling and reinstatement. The logs and sketches are provided in Appendix 3 of this Report.

4.4. Soakaway Testing

The soakaway testing was carried out in selected trial pits at the locations shown in the exploratory hole location plan in Appendix 1. These pits were carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pits were allowed to drain and the drop in water level was recorded over time as required by BRE Digest 365. The pits were logged prior to completing the soakaway test and were backfilled with arising's upon completion. The soakaway test results are provided in Appendix 4 of this Report.

4.5. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.

Environmental testing, including Waste Acceptance Criteria (WAC), pH and sulphate testing was carried out by Element Materials Technology in the UK.

Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD) (Pending), and California Bearing Ratio CBR tests were carried out in NMTL's Geotechnical Laboratory in Carlow.

The results of the laboratory testing are included in Appendix 5 of this Report.

5.0 Ground Conditions

5.1. General

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were consistent across the site and are generally comprised;

- Surfacing
- Fill
- Made Ground
- Cohesive Deposits

SURFACING: Tarmac surfacing was present in SA02, FP01, FP02 and FP03 typically to a depth of 0.10m BGL. Concrete surfacing was present in SA01, TP04 and TP05 typically to a depth of 0.10m BGL.

FILL: Fill deposits were encountered beneath the surfacing and in all exploratory holes to a consistent between 0.10m to 1.10m BGL. These deposits were described in SA01 as *brown grey sandy gravelly Clay with occasional rounded to sub angular cobbles*. In SA02, FP01, FP02, FP03, TP04 and TP05 the deposits were described as *Grey slightly clayey sandy fine to coarse sub angular to sub rounded Gravel with frequent angular to sub angular cobbles*.

MADE GROUND: Made Ground deposits were encountered beneath the Fill deposits in FP02, FP03 and TP04 and was present to a relatively consistent depth of between 0.20m and 3.00m BGL. These deposits were described generally as *brown sandy gravelly CLAY with frequent cobbles and boulders and contained occasional fragments of concrete, red brick, wire, aluminium, glass and plastic*.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Made Ground and were described typically as *brown grey sandy gravelly CLAY with occasional cobbles and boulders overlying a stiff black sandy gravelly CLAY with occasional cobbles and boulders*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

5.2. Groundwater

No groundwater was noted during the investigation however we would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and

groundwater levels would be expected to vary with the time of year, rainfall, nearby construction and other factors.

5.3. Laboratory Testing

The pH and sulphate testing carried out indicate that pH results are near neutral and that the water soluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The samples tested classify the soil as a Design Sulphate Level DS-1.

A number of samples were analysed for a suite of parameters which allows for the assessment of the sampled material in terms of total pollutant content for classification of materials as *hazardous* or *non-hazardous*. The suite also allows for the assessment of the sampled material in terms of suitability for placement at licenced landfills (inert, stable non-reactive, hazardous etc.). The parameter list for the suite includes analysis of the solid samples for arsenic, barium, cadmium, chromium, copper, cyanide, lead, nickel, mercury, zinc, speciated aliphatic and aromatic petroleum hydrocarbons, pH, sulphate, sulphide, moisture content, soil organic matter and an asbestos screen.

The suite also includes those parameters specified in the EU Council Decision establishing criteria for the acceptance of waste at Landfills (Council Decision 2003/33/EC), which for the solid samples are total organic carbon (TOC), speciated aliphatic and aromatic petroleum hydrocarbons, BTEX, phenol, polychlorinated biphenyls (PCB) and PAH.

As part of the suite a leachate is generated from the solid sample which is analysed for antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, chloride, fluoride, soluble sulphate, sulphide, phenols, dissolved organic carbon (DOC) and total dissolved solids (TDS).

While the laboratory report provides a comparison with the waste acceptance criteria limits it does not provide a waste classification of the material sampled nor does it comment on any potentially hazardous properties of the materials tested. The possibility for contamination, not revealed by the testing undertaken should be borne in mind particularly where Made Ground deposits are present or the previous site use or location indicate a risk of environmental variation.

In total there were four samples collected for chemical analysis. Three were taken from the first three metres of made ground deposits in T-03 and the fourth from the made ground at 1m below ground level in TP-04.

The samples collected from TP-03 are inert and do not indicate any significant contamination.

The sample collected from TP-04 indicates that there are trace levels of asbestos fibres present in the sample. The levels of arsenic and antimony in the sample also exceed the inert criteria. Asbestos containing materials (ACMs) were not detected however indicating that the level of asbestos is potentially low. The level of asbestos has not been quantified.

The two sampling locations are limited to the south eastern section of the site adjacent to the wall of the neighbouring building.

The results from the completed laboratory testing is included in Appendix 5 of this report.

6.0 Recommendations & Conclusions

6.1. General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided at the ground investigation stage and any designs based on the recommendations or conclusions should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory hole logs.

6.2. Subsoil Quality

The subsoil samples analysed indicate that the material tested is relatively free from contamination and inert with the exception of the sample where trace levels of asbestos were encountered.

However, based on the limited number and geographic distribution of the samples collected on site for chemical analysis it is not possible to make an assessment of the subsoil quality across the entire site. It is not possible to rule out the presence of potentially contained subsoils underlying the site.

In order to fully assess the potential for the presence of contaminated material underlying the site it is recommended series of window sample boreholes be carried out across the site to allow a visual assessment of the subsoil and the collection of samples for chemical analysis.

6.3. Foundations

A full analysis of achievable allowable bearing capacity with depth was not possible as cable percussion boreholes were not included in the site investigation at this stage.

The pH and sulphate testing carried out indicate that pH results are near neutral and that the water soluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The samples tested classify the soil as a Design Sulphate Level DS-1.

6.4. Excavations

Short term temporary excavations in the cohesive deposits will remain stable for a limited time only and will require to be appropriately battered or the sides supported if the excavation is below 1.25m BGL or is required to permit man entry.

Excavations in the Made Ground or soft Cohesive Deposits will require to be appropriately battered or the sides supported due to the low strength of these deposits.

The groundwater and stability noted on the trial pit logs should be consulted when determining the most appropriate construction methods for excavations.

6.5. Soakaway Design

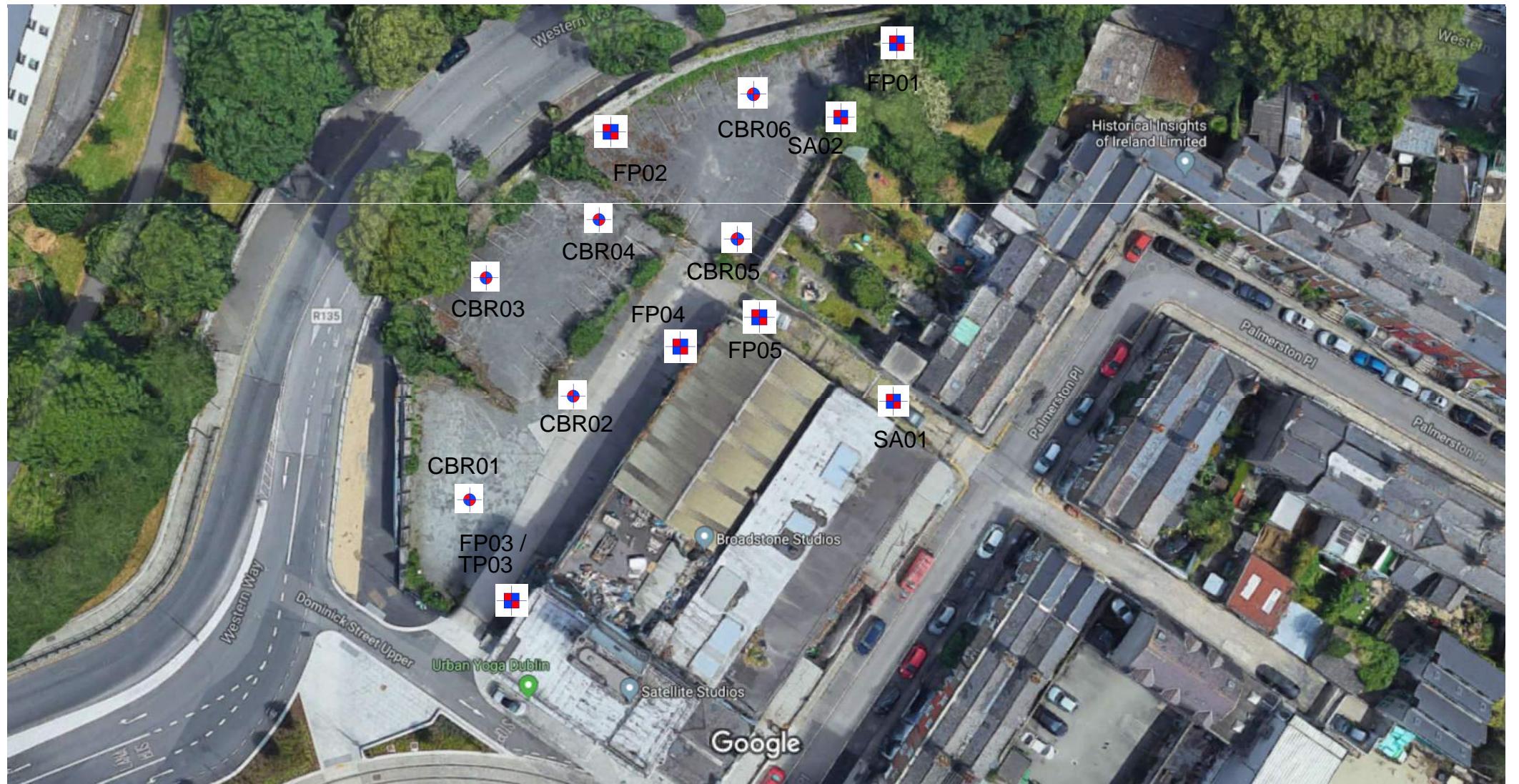
Infiltration rates of 8.04×10^{-6} and 6.34×10^{-6} m/s respectively were calculated for the soakaway locations SA01 and SA02.

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.

APPENDIX 1 - Site Location Plan



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APPENDIX 2 – Trial Pit Records



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Site
Constitution Hill

Trial Pit Number
FP01

Machine : JCB 3CX Method : Trial Pit		Dimensions		Ground Level (mOD)		Client		Job Number		
						Waterman Moylan		8855-06-19		
		Location		Dates	18/07/2019	Engineer		Sheet 1/1		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend Water		
0.70	B				0.05 (0.25)	TARMACADAM				
					0.30 (0.90)	FILL: Grey sandy fine to coarse angular Gravel with frequent sub rounded cobbles.				
					1.20	Soft brown grey sandy gravelly CLAY with occasional rounded to sub rounded cobbles. Gravel fine to coarse sub angular to sub rounded.				
						Complete at 1.20m				
Plan					Remarks					
					FP terminated at 1.20m BGL Sidewalls Stable No water observed in TP TP backfilled on completion of soakaway					
					Scale (approx)	Logged By	Figure No.			
					1:25	RO'T	8855-06-19.FP01			



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Site
Constitution Hill

Trial Pit
FP02

Machine : JCB 3CX Method : Trial Pit		Dimensions		Ground Level (mOD)		Client Waterman Moylan		Job Number 8855-06-19
		Location		Dates 18/07/2019		Engineer Ground Investigations Ireland		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend
1.50	B				0.05 (0.15) 0.20	TARMACADAM FILL: Grey sandy fine to coarse angular Gravel with frequent sub rounded cobbles.	MADE GROUND: Grey sandy gravelly Clay with occasional sub rounded cobbles. Gravel fine to coarse sub angular to sub rounded with fragments of red brick	
					0.90			
					1.10 (0.40)	Soft brown grey sandy gravelly CLAY with occasional rounded to sub rounded cobbles. Gravel fine to coarse sub angular to sub rounded.		
					1.50	Complete at 1.50m		
Plan					Remarks			
					FP terminated at 1.50m BGL Sidewalls Stable No water observed in TP TP backfilled on completion of soakaway			
					Scale (approx)	Logged By	Figure No.	
					1:25	RO'T	8855-06-19.FP02	



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Site
Constitution Hill

Trial Pit Number
SA01

Machine : JCB 3CX Method : Trial Pit		Dimensions (L x W x D) 2.50m x 0.40m x 2.00m	Ground Level (mOD)		Client Waterman Moylan	Job Number 8855-06-19		
		Location	Dates 18/07/2019	Engineer Ground Investigations Ireland		Sheet 1/1		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.10) 0.10	CONCRETE		
					(0.50)	FILL: Brown grey sandy gravelly Clay with occasional rounded to sub angular cobbles. Gravel is fine to coarse sub angular to sub rounded with fragments of red brick		
					0.60	Soft to firm brown slightly sandy gravelly CLAY with occasional rounded to sub rounded cobbles. Gravel fine to coarse sub angular to sub rounded		
					(1.40)			
					2.00	Complete at 2.00m		
Plan					Remarks			
					TP terminated at 2.00m BGL to conduct soakaway test. Sidewalls Stable No water observed in TP TP backfilled on completion of soakaway			
					Scale (approx) 1:25	Logged By RO'T	Figure No. 8855-06-19.SA01	



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Site
Constitution Hill

Trial Pit
Number
SA02

Machine : JCB 3CX Method : Trial Pit		Dimensions (L x W x D) 2.50m x 0.40m x 2.00m	Ground Level (mOD)		Client Waterman Moylan		Job Number 8855-06-19
		Location	Dates 18/07/2019		Engineer Ground Investigations Ireland		Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
					0.05 0.10 (1.90)	TARMACADAM FILL: Grey sandy fine to coarse angular Gravel Soft brown grey sandy gravelly CLAYwith occasional sub angular to sub rounded cobbles. Gravel fine to coarse sub angular to sub rounded.	
					2.00	Complete at 2.00m	
Plan				Remarks			
				TP terminated at 2.00m BGL to conduct soakaway test. Sidewalls Stable No water observed in TP TP backfilled on completion of soakaway			
				Scale (approx)	Logged By	Figure No.	
				1:25	RO'T	8855-06-19.SA02	



Ground Investigations Ireland Ltd

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Trial Pit Number
TP03 / FP03

Machine : JCB 3CX Method : Trial Pit				Dimensions (L x W x D) 2.70 x 0.70 x 3.00		Ground Level (mOD)		Site Constitution Hill		Client Waterman Moylan		Job Number 8855-06-19	
Depth (m)		Sample / Tests		Location		Dates 18/07/2019		Engineer Ground Investigations Ireland		Sheet 1/1			
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description				Legend	Water		
1.00	B				(0.10) 0.10	TARMACADAM FILL: Grey sandy clayey fine to coarse sub angular to sub rounded Gravel with frequent angular to sub angular cobbles with fragments of concrete, red brick, wood, glass and plastic.							
2.00	B				(1.00) 1.10	MADE GROUND: Brown gey sandy gravelly Clay with occasional sub rounded cobbles. Gravel fine to coarse sub angular to sub rounded with fragments of red brick							
3.00	B				(1.30) 2.40 (0.60) 3.00	MADE GROUND: Brown sandy gravelly silty Clay with occasional sub angular to sub rounded cobbles. Gravel fine to coarase sub angular to sub rounded Complete at 3.00m							
Plan						Remarks TP / FP terminated at 3.00m BGL Sidewalls unstable No water observed in TP TP backfilled on completion of soakaway							
						Scale (approx) 1:25		Logged By RO'T		Figure No.			



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Trial Pit
Number
TP04

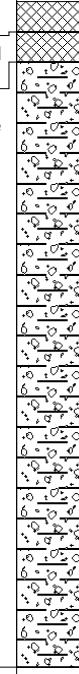
Machine : JCB 3CX Method : Trial Pit				Dimensions (L x W x D) 2.70 x 0.70 x 2.50	Ground Level (mOD)	Site Constitution Hill	Trial Pit Number TP04
		Location	Dates 18/07/2019	Client Waterman Moylan	Job Number 8855-06-19		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
1.00	B				(0.10) 0.10 (0.20) 0.30 (1.20)	CONCRETE FILL: Grey sandy fine to coarse sub angular to sub rounded Gravel with frequent angular to sub angular cobbles MADE GROUND: Brown sandy gravelly Clay with occasional sub rounded cobbles. Gravel fine to coarse sub angular to sub rounded with fragments of red brick, concrete, wire, alluminium, glass	
2.00	B				1.50 (1.00)	Firm Brown sandy gravelly CLAY with occasional sub angular to sub rounded cobbles. Gravel fine to coarse sub angular to sub rounded	
					2.50	Complete at 2.50m	
Plan				Remarks			
				TP terminated at 2.50m BGL Sidewalls stable No water observed in TP TP backfilled on completion of soakaway			
				Scale (approx)	Logged By	Figure No.	
				1:25	RO'T	8855-06-19.TP04	



Ground Investigations Ireland Ltd

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Trial Pit
Number
TP05

Machine : JCB 3CX Method : Trial Pit				Dimensions (L x W x D) 2.70 x 0.70 x 2.20	Ground Level (mOD)	Site Constitution Hill	Trial Pit Number TP05
				Location	Dates 18/07/2019	Client Waterman Moylan	Job Number 8855-06-19
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
1.00	B				(0.10) 0.10 (0.10) 0.20	CONCRETE FILL: Grey sandy fine to coarse sub angular to sub rounded Gravel with frequent angular to sub angular cobbles Firm Brown slightly sandy slightly gravelly CLAY with occasional sub angular to sub rounded cobbles. Gravel fine to coarse sub angular to sub rounded	
2.00	B				(2.00)		
					2.20	Complete at 2.20m	
Plan				Remarks			
				TP terminated at 2.20m BGL Sidewalls stable No water observed in TP TP backfilled on completion of soakaway			
				Scale (approx)	Logged By	Figure No.	
				1:25	RO'T	8855-06-19.TP05	

Constitution Hill

FP01









FP02







FP03 / TP03

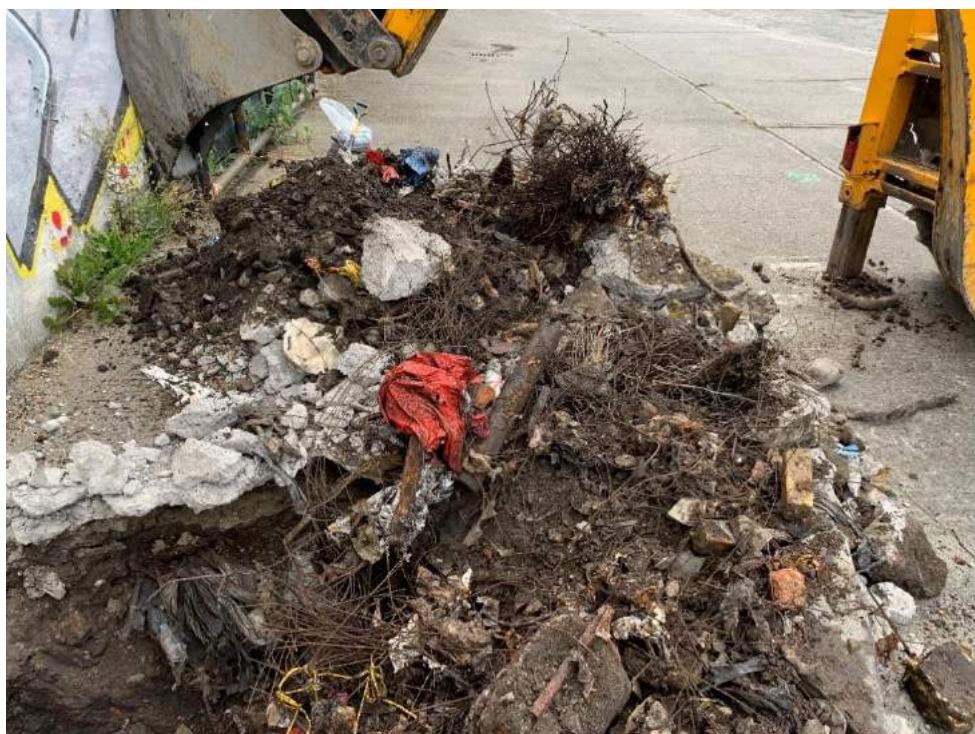








TP04









TP05





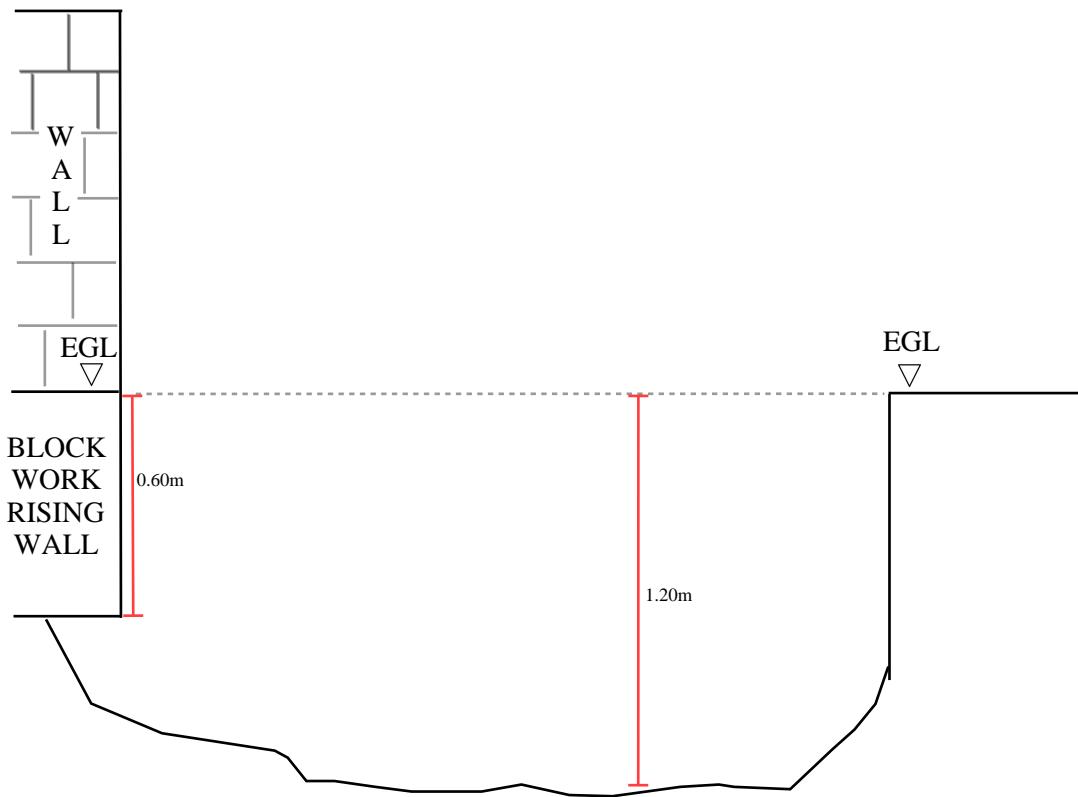


APPENDIX 3 - Foundation Pit Records



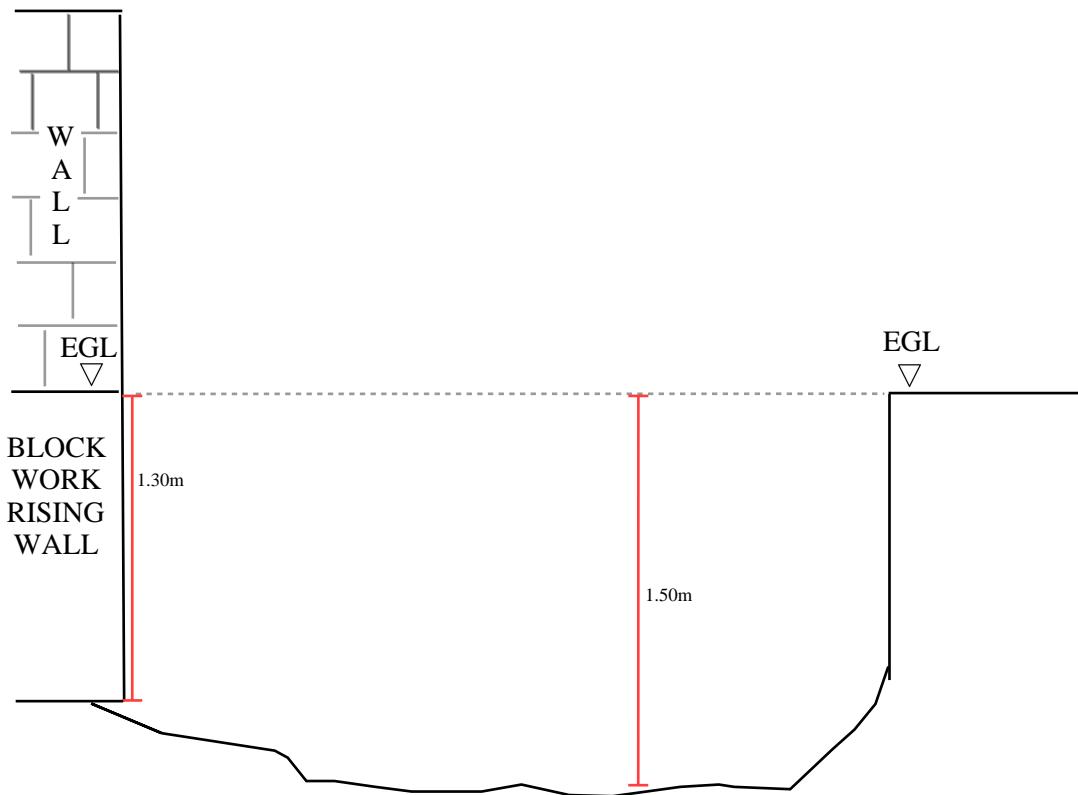
www.gii.ie

Foundation Pit



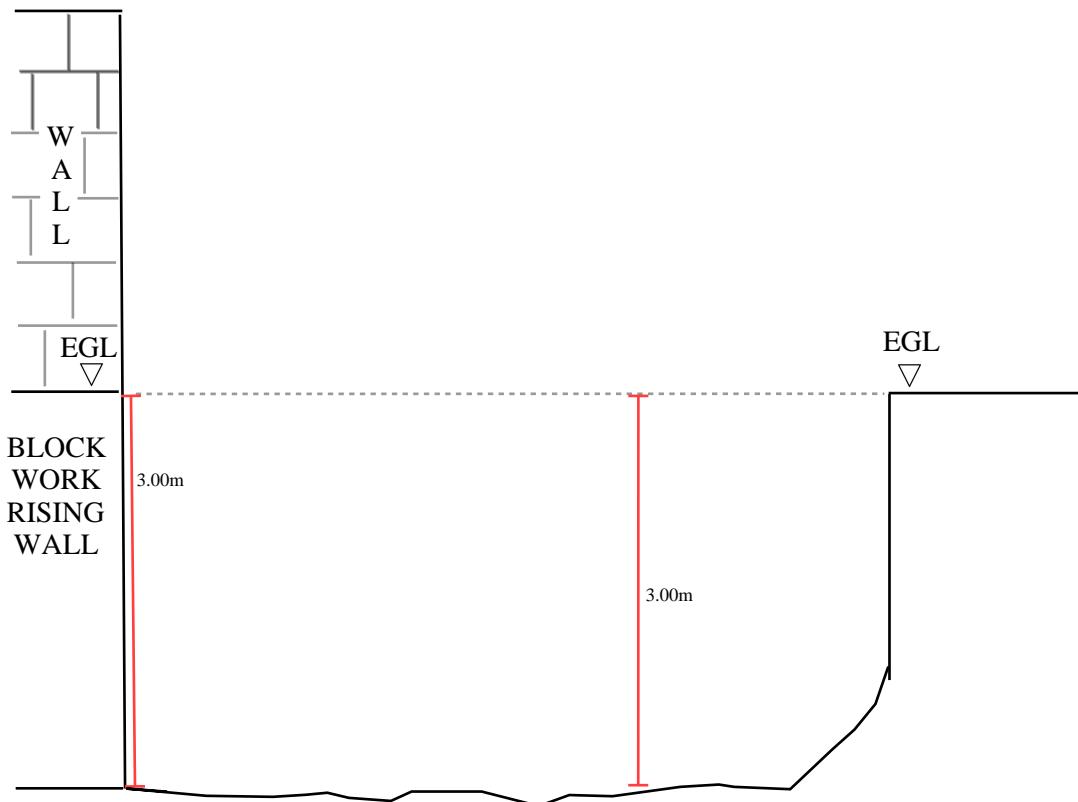
Project:	Constitution Hill	TP01 / FP01
Client:	Waterman Moylan	
Contractor:	Ground Investigations Ireland	Date 18/07/19

Foundation Pit



Project:	Constitution Hill	TP02 / FP02
Client:	Waterman Moylan	
Contractor:	Ground Investigations Ireland	Date 18/07/19

Foundation Pit



Project:	Constitution Hill	TP03 / FP03
Client:	Waterman Moylan	
Contractor:	Ground Investigations Ireland	Date 18/07/19

Constitution Hill

FP01









FP02







FP03 / TP03

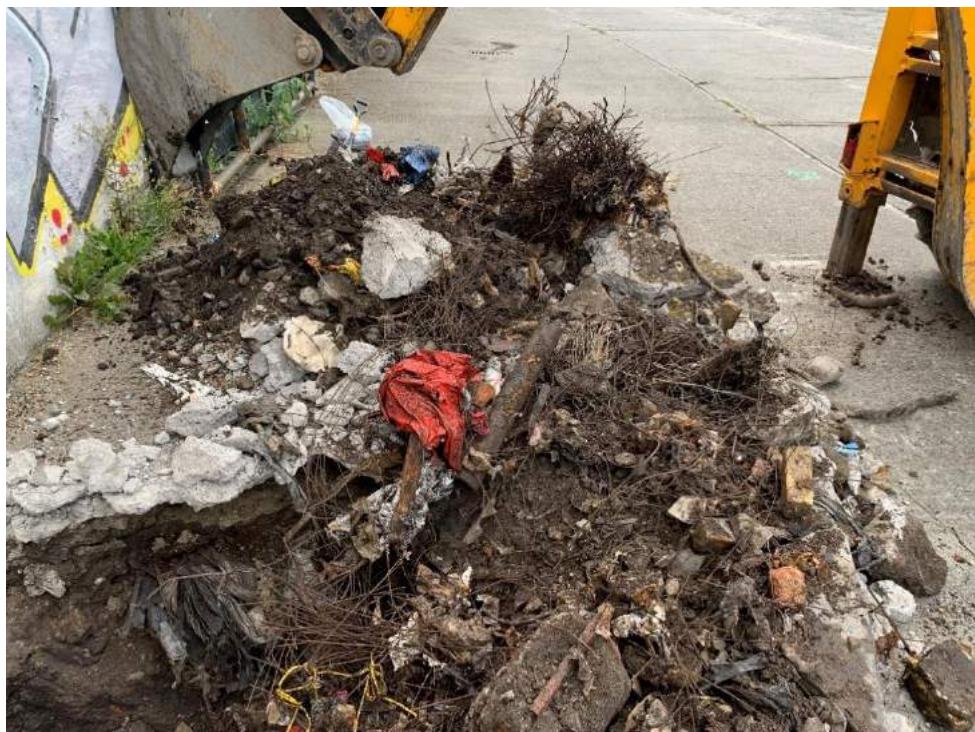








TP04









TP05







APPENDIX 4 – Soakaway Records



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SA01
Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.50 x 0.40m x 2.00m (L x W x D)



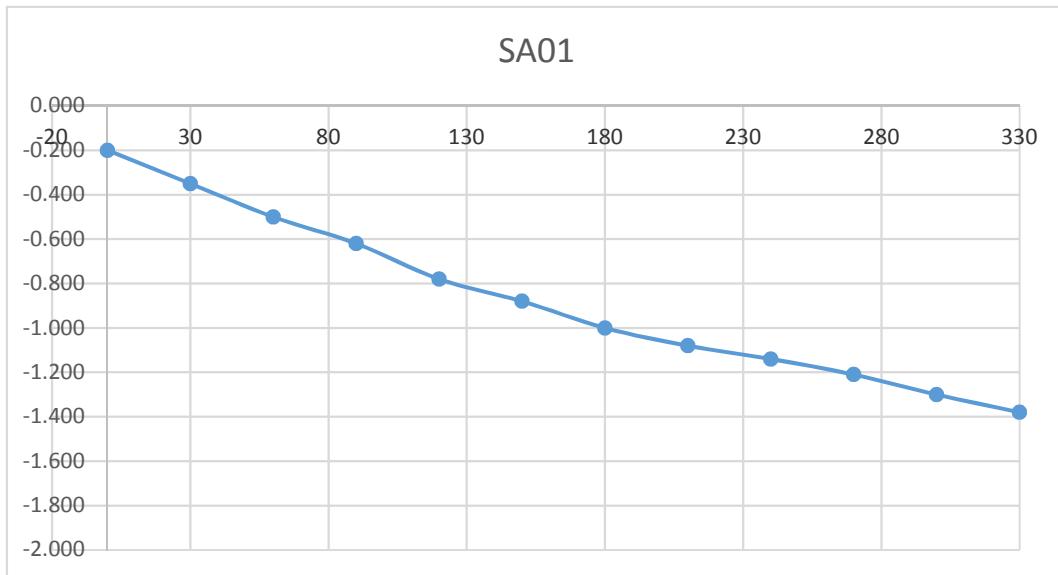
Date	Time	Water level (m bgl)
04/10/2018	0	-0.200
04/10/2018	30	-0.350
04/10/2018	60	-0.500
04/10/2018	90	-0.620
04/10/2018	120	-0.780
04/10/2018	150	-0.880
04/10/2018	180	-1.000
04/10/2018	210	-1.080
04/10/2018	240	-1.140
04/10/2018	270	-1.210
04/10/2018	300	-1.300
04/10/2018	330	-1.380

Start depth 0.20	Depth of Pit 2.000	Diff 1.800	75% full 0.65	25%full 1.55
----------------------------	------------------------------	----------------------	-------------------------	------------------------

Length of pit (m) 2.500	Width of pit (m) 0.400	75-25Ht (m) 0.900	Vp75-25 (m3) 0.90
-----------------------------------	----------------------------------	-----------------------------	-----------------------------

Tp75-25 (from graph) (s) 18000	50% Eff Depth 0.900	ap50 (m2) 6.22
--	-------------------------------	--------------------------

f = 8.039E-06 m/s



SA02**Soakaway Test to BRE Digest 365****Trial Pit Dimensions: 2.50 x 0.40m x 2.00m (L x W x D)**

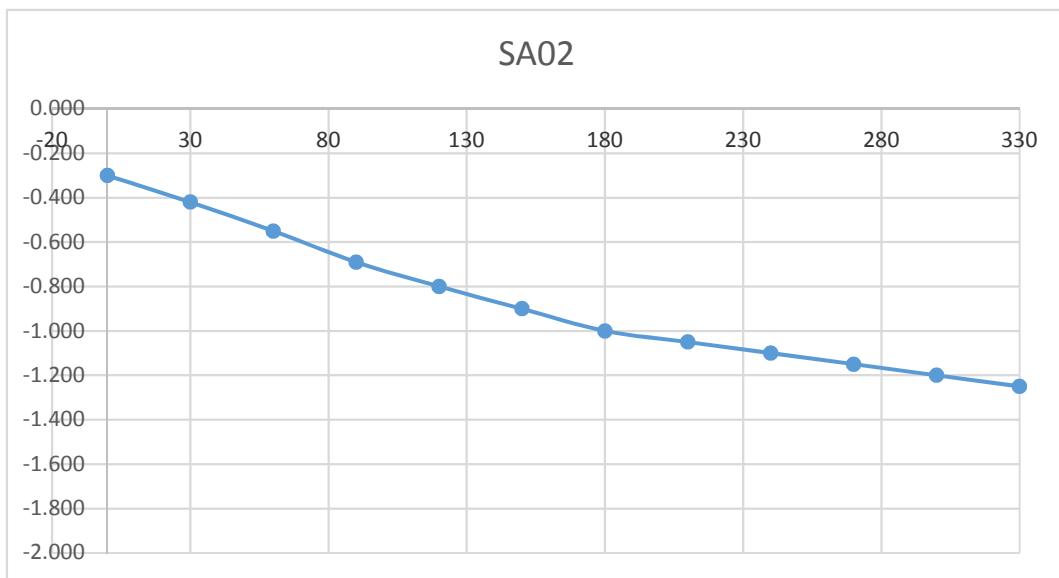
Date	Time	Water level (m bgl)
04/10/2018	0	-0.300
04/10/2018	30	-0.420
04/10/2018	60	-0.550
04/10/2018	90	-0.690
04/10/2018	120	-0.800
04/10/2018	150	-0.900
04/10/2018	180	-1.000
04/10/2018	210	-1.050
04/10/2018	240	-1.100
04/10/2018	270	-1.150
04/10/2018	300	-1.200
04/10/2018	330	-1.250

Start depth 0.30	Depth of Pit 2.000	Diff 1.700	75% full 0.725	25%full 1.575
---------------------	-----------------------	---------------	-------------------	------------------

Length of pit (m) 2.500	Width of pit (m) 0.400	75-25Ht (m) 0.850	Vp75-25 (m3) 0.85
----------------------------	---------------------------	----------------------	----------------------

Tp75-25 (from graph) (s) 22620	50% Eff Depth 0.850	ap50 (m2) 5.93
--	------------------------	-------------------

f = 6.337E-06 m/s

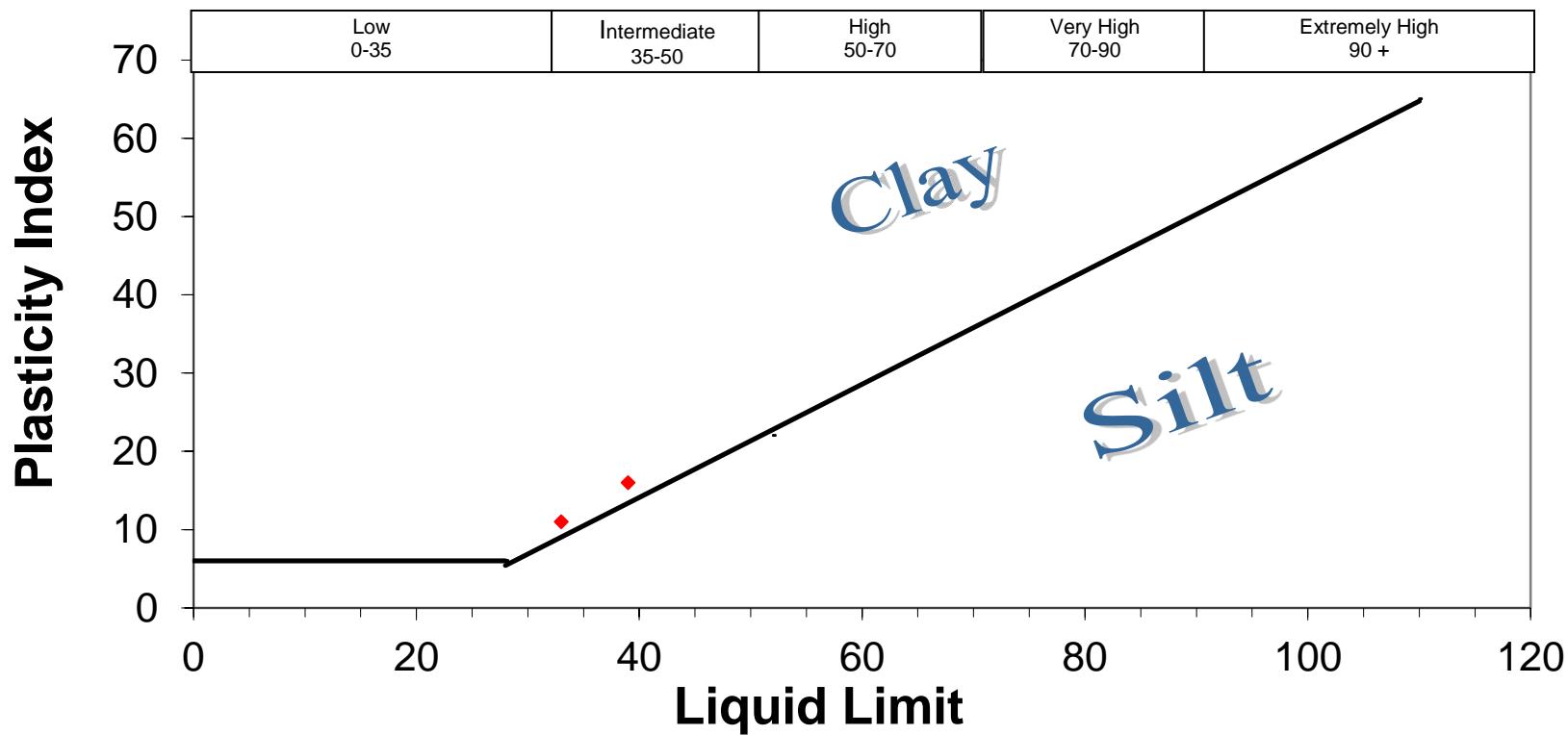


APPENDIX 5 – Laboratory Testing

National Materials Testing Laboratory Ltd.**SUMMARY OF TEST RESULTS**

BH/TP No	Depth m	Sample No.	Moisture %	Particle Density Mg/m ³	<425um %	Index Properties		Bulk Density Mg/m ³	Cell Pressure kPa	Undrained Triaxial Tests		Lab Vane kPa	Remarks
						LL	PL	PI		Compressive Stress kPa	Strain at Failure %		
TP04	2.00	B	17.5		55.3	33	22	11					
TP05	1.00	B	30.1		66.3	39	23	16					
NMTL		Notes : 1. All BS tests carried out using preferred (definitive) method unless otherwise stated.								Job ref No.	NMTL 2997	GII Project ID:	8855-06-19
										Location	Constitution Hill		

NMTL LTD Unit 18c, Tullow Industrial Estate Tullow County Carlow Tel: 00353 59 9180822 Mob: 00353 872575508 billa@nmtl.ie	Contract: Constitution Hill Client: Ground Investigations Ireland Ltd Engineer: Conor Finnerty GII Project ID 8855-06-19 Date: 29/08/2019 Tested By: Tzr Checked: Bc Job ref No. NMTL 2997
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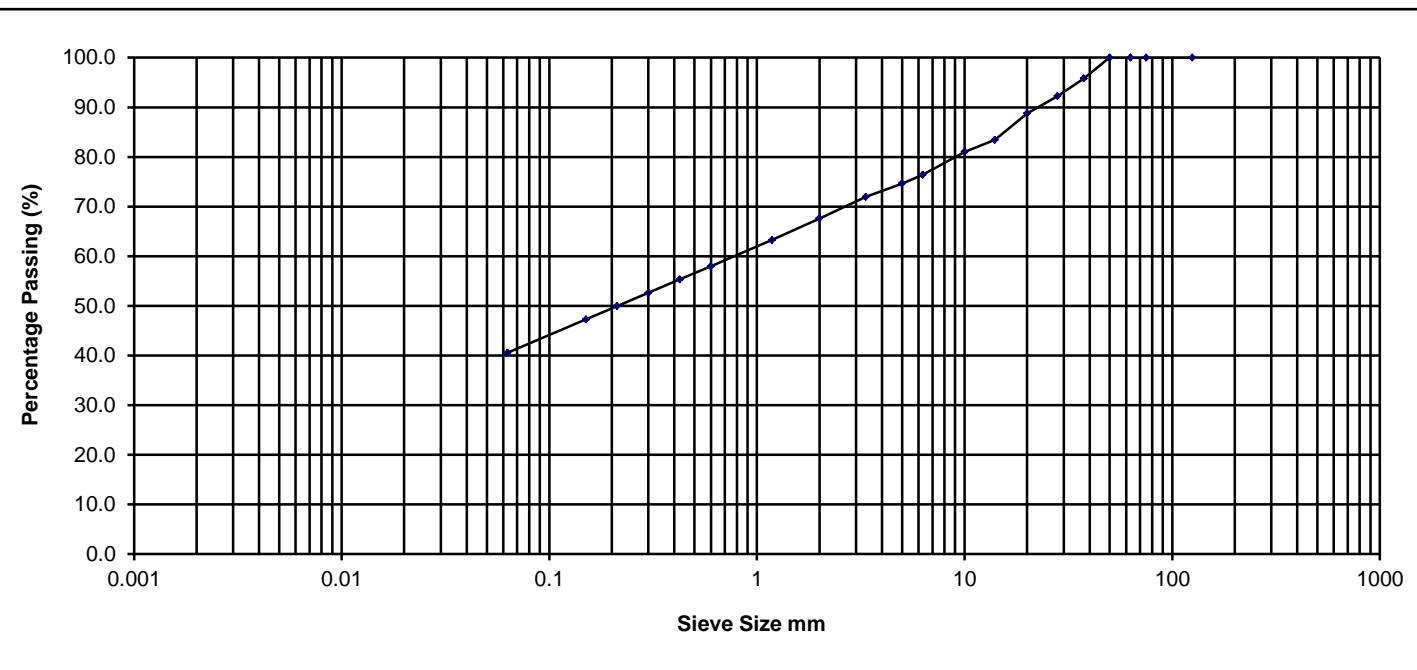


NMTL Ltd

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	95.8
28.000	92.2
20.000	88.8
14.000	83.4
10.000	81.0
6.300	76.4
5.000	74.6
3.350	72.0
2.000	67.6
1.180	63.3
0.600	58.0
0.425	55.3
0.300	52.6
0.212	49.9
0.150	47.3
0.063	40.6

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt	Sand	Gravel								
	40.6	27.0	32.4							0.0	0.0

Sample Description Brown and dark grey slightly sandy slightly gravelly silty CLAY.

Project No.

NMTL 2997

BH/TP No.

TP04

Project Constitution Hill

GII PROJECT ID: 8855-06-19 Sample No.

B

NM
TL
Ltd

Operator Tzr Checked Nc Approved Bc Date sample tested 23/08/2019 Depth

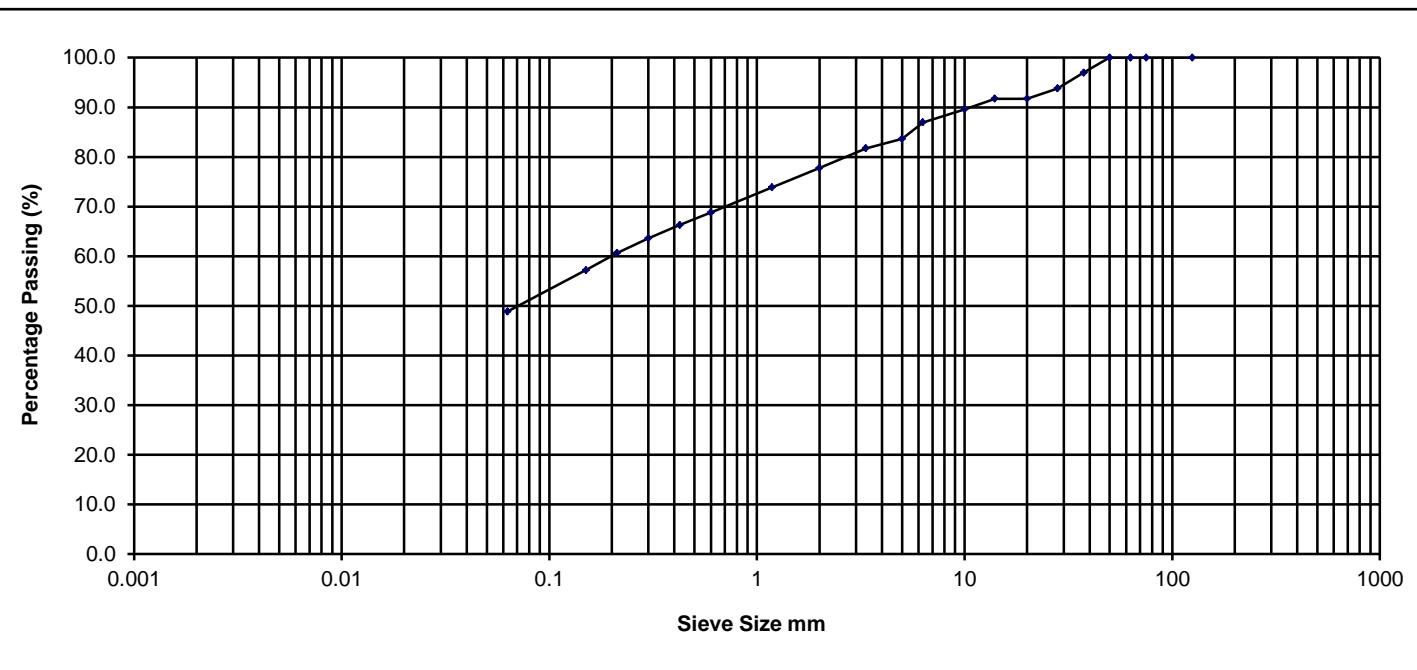
2.00m

NMTL Ltd

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	97.0
28.000	93.8
20.000	91.7
14.000	91.7
10.000	89.6
6.300	86.9
5.000	83.6
3.350	81.7
2.000	77.8
1.180	73.9
0.600	68.8
0.425	66.3
0.300	63.6
0.212	60.7
0.150	57.2
0.063	48.9

Determination of Particle Size Distribution

BS 1377 : 1990 : Part 2 : Clauses 9.2 & 9.5



Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	Cobbles	Boulder
	Silt	Sand		Gravel							
	48.9				28.9		22.2			0.0	0.0

Sample Description Brown slightly gravelly slightly sandy silty CLAY.

Project No.

NMTL 2997

BH/TP No.

TP05

Project Constitution Hill

GII PROJECT ID: 8855-06-19 Sample No.

B

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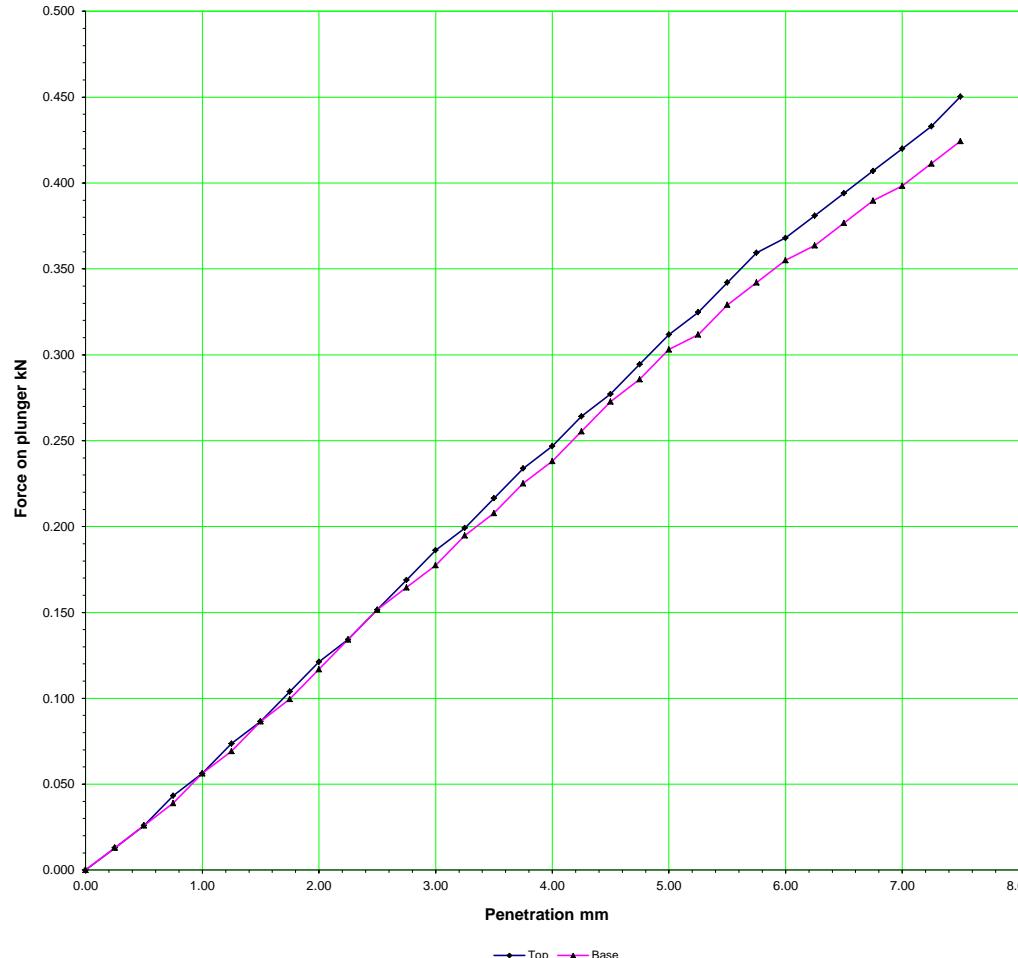
Operator Tzr Checked Nc Approved Bc Date sample tested 23/08/2019 Depth

1.00m

NATIONAL MATERIALS TESTING LABORATORY LTD.

DETERMINATION OF THE CALIFORNIA BEARING RATIO TEST
BS 1377 : PART 4 : CLAUSE 7 : 1990

Soil Description	Dark grey brown slightly sandy slightly gravelly SILT/CLAY				Date	26-Jul-19
Test Method	BS 1377: Part 4 : 1990 :7.4					
Force Measuring Device	VJT-08211				Test 1	
Preparative	Remoulded with 2.5 kg rammer at natural moisture content					
Surcharge	10 kPa	Mean Calibration	4.33	N/Div		
Penetration	Force Gauge	Force on plunger	4.33	N/Div		
of plunger mm	reading divisions				California Bearing Ratio Results	
	Top	Bottom	Top	Bottom	Top	%
0.00	0.0	0.0	0.000	0.000		
0.25	3.0	3.0	0.013	0.013		
0.50	6.0	6.0	0.026	0.026		
0.75	10.0	9.0	0.043	0.039		
1.00	13.0	13.0	0.056	0.056		
1.25	17.0	16.0	0.074	0.069		
1.50	20.0	20.0	0.087	0.087		
1.75	24.0	23.0	0.104	0.100		
2.00	28.0	27.0	0.121	0.117		
2.25	31.0	31.0	0.134	0.134		
2.50	35.0	35.0	0.152	0.152	1.15	1.15
2.75	39.0	38.0	0.169	0.165		
3.00	43.0	41.0	0.186	0.178		
3.25	46.0	45.0	0.199	0.195		
3.50	50.0	48.0	0.217	0.208		
3.75	54.0	52.0	0.234	0.225		
4.00	57.0	55.0	0.247	0.238		
4.25	61.0	59.0	0.264	0.255		
4.50	64.0	63.0	0.277	0.273		
4.75	68.0	66.0	0.294	0.286		
5.00	72.0	70.0	0.312	0.303	1.56	1.52
5.25	75.0	72.0	0.325	0.312		
5.50	79.0	76.0	0.342	0.329		
5.75	83.0	79.0	0.359	0.342		
6.00	85.0	82.0	0.368	0.355		
6.25	88.0	84.0	0.381	0.364		
6.50	91.0	87.0	0.394	0.377		
6.75	94.0	90.0	0.407	0.390		
7.00	97.0	92.0	0.420	0.398		
7.25	100.0	95.0	0.433	0.411		
7.50	104.0	98.0	0.450	0.424		
Moisture content after test	Top	Middle	Base	Specimen wt g	4980	
Container No.	Tray	Tray	Tray	Diameter mm	152	
Mass of wet soil + container	g	1795.2	2031.4	1645.0	Length mm	127.0
Mass of dry soil + container	g	1577.9	1781.5	1451.4		
Weight of container	g	147.2	165.9	183.9		
Mass of moisture	g	217.3	250.0	193.6	Average MC %	15.31
Dry weight	g	1430.7	1615.6	1267.6	Density Mg/m ³	2.16
Moisture content	%	15.2	15.5	15.3	Dry Density Mg/m ³	1.87



NM TL Ltd	Project: Constitution Hill GII Project ID: 8855-06-19				Date	Project No.	NMTL2974	
					Operator	Tch	26-Jul-19	
					Checked	Nc	Sample No.	CBR01
					Approved	Bc	Depth	B 2.50m

NATIONAL MATERIALS TESTING LABORATORY LTD.

DETERMINATION OF THE CALIFORNIA BEARING RATIO TEST
BS 1377 : PART 4 : CLAUSE 7 : 1990

Soil Description Brown slightly sandy slightly gravelly SILT/CLAY

Test Method BS 1377: Part 4 : 1990 : 7.4

Force Measuring Device VJT-08211

Preparative Remoulded with 2.5 kg rammer at natural moisture content

Surcharge 10 kPa

Penetration Force Gauge

of plunger reading

mm divisions

Top Bottom

0.00 0.0 0.0

0.25 5.0 5.0

0.50 10.0 11.0

0.75 16.0 17.0

1.00 23.0 23.0

1.25 30.0 30.0

1.50 38.0 36.0

1.75 45.0 43.0

2.00 52.0 49.0

2.25 59.0 56.0

2.50 67.0 63.0

2.75 74.0 70.0

3.00 82.0 77.0

3.25 90.0 83.0

3.50 98.0 89.0

3.75 106.0 96.0

4.00 114.0 102.0

4.25 121.0 108.0

4.50 129.0 114.0

4.75 136.0 120.0

5.00 144.0 125.0

5.25 151.0 131.0

5.50 159.0 137.0

5.75 166.0 143.0

6.00 173.0 147.0

6.25 180.0 152.0

6.50 186.0 157.0

6.75 193.0 162.0

7.00 200.0 167.0

7.25 206.0 170.0

7.50 213.0 175.0

Moisture content after test

Container No.

Mass of wet soil + container

Mass of dry soil + container

Weight of container

Mass of moisture

Dry weight

Moisture content

Date 26-Jul-19

Test 1

Mean Calibration

4.33

N/Div

Force on

4.33

N/Div

plunger

California Bearing Ratio Results

kN

%

Top

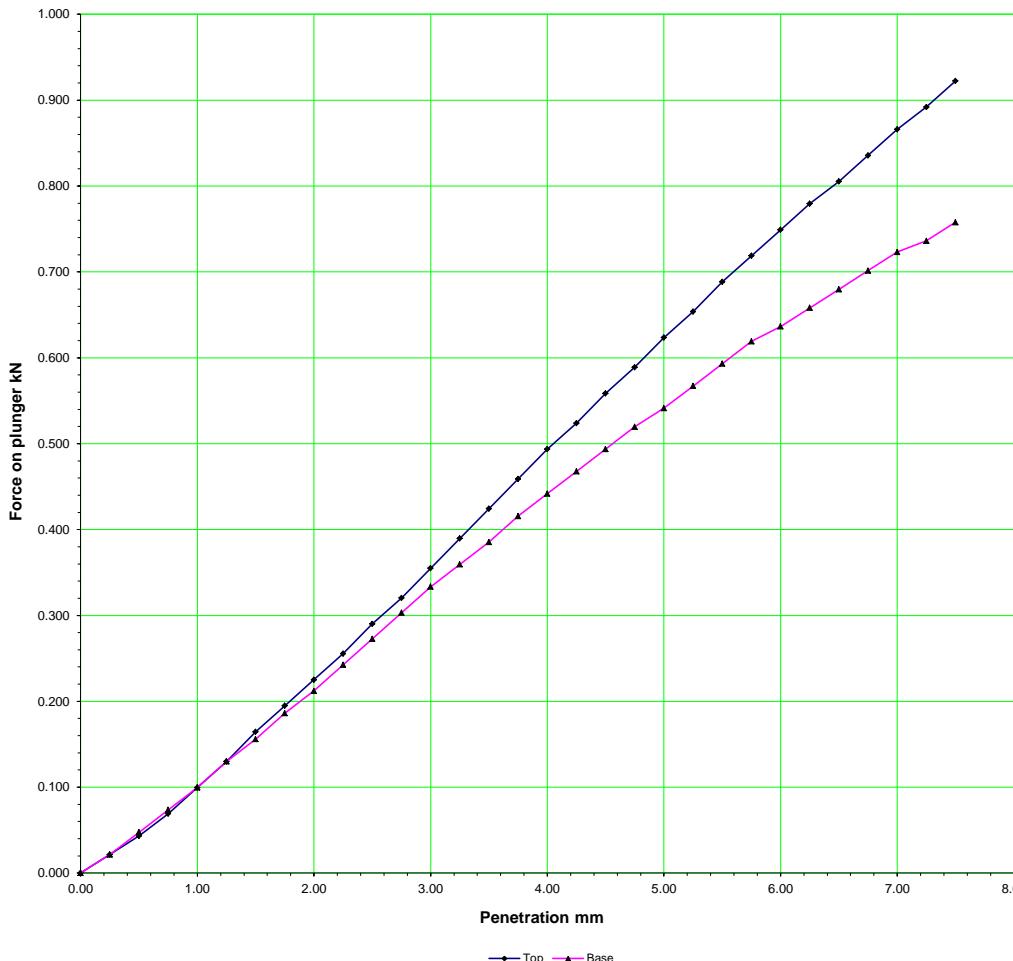
Base

2.20

2.07

3.12

2.71



NM

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Project: Constitution Hill

GII Project ID: 8855-06-19

Date

Tch

26-Jul-19

Project No.

CBR02

NMTL2974

Trial Pit No.

B

8855-06-19

Sample No.

Bc

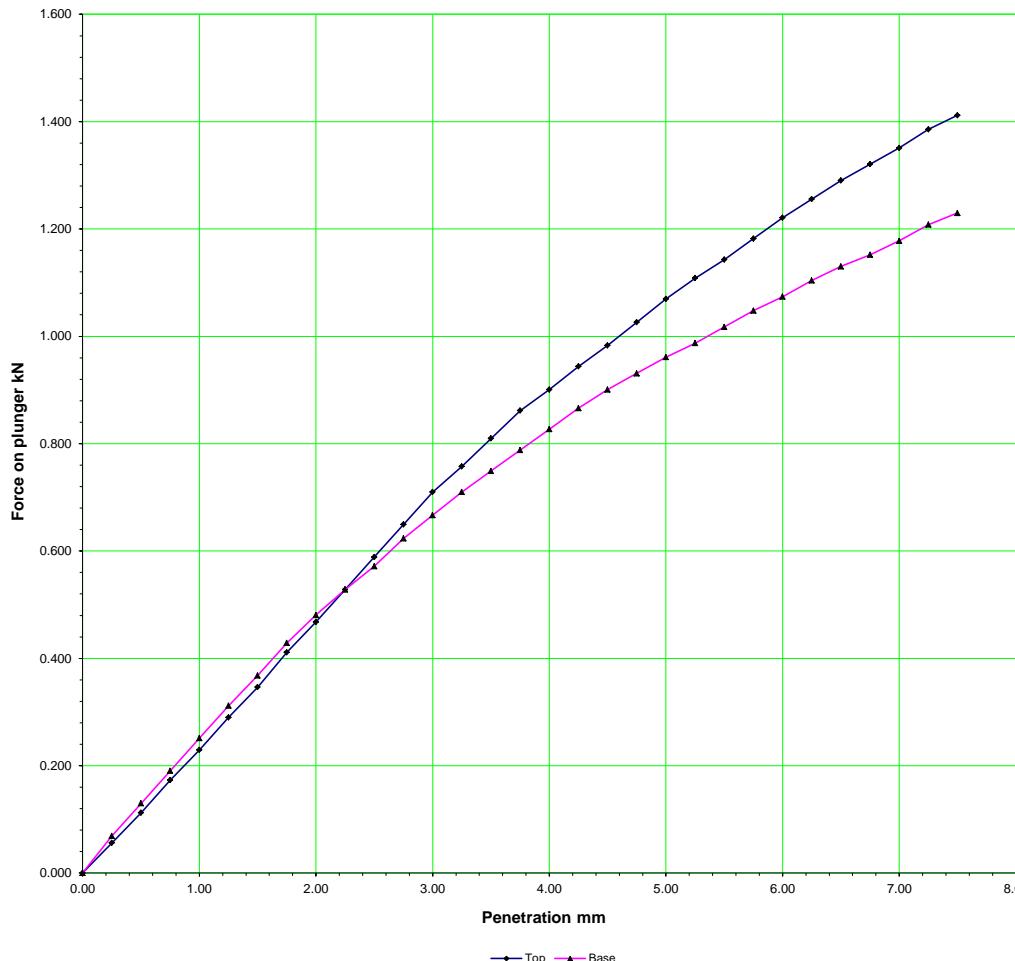
1.70m

Approved

NATIONAL MATERIALS TESTING LABORATORY LTD.

DETERMINATION OF THE CALIFORNIA BEARING RATIO TEST
BS 1377 : PART 4 : CLAUSE 7 : 1990

Soil Description	Brown/grey slightly sandy slightly gravelly SILT/CLAY				Date	26-Jul-19
Test Method	BS 1377: Part 4 : 1990 : 7.4				Test 1	
Force Measuring Device	VJT-08211					
Preparative	Remoulded with 2.5 kg rammer at natural moisture content					
Surcharge	10 kPa	Mean Calibration	4.33	N/Div		
Penetration	Force Gauge	Force on plunger	4.33	N/Div		
of plunger mm	reading divisions				California Bearing Ratio Results	
	Top	Bottom	Top	Bottom	Top	%
0.00	0.0	0.0	0.000	0.000		
0.25	13.0	16.0	0.056	0.069		
0.50	26.0	30.0	0.113	0.130		
0.75	40.0	44.0	0.173	0.191		
1.00	53.0	58.0	0.229	0.251		
1.25	67.0	72.0	0.290	0.312		
1.50	80.0	85.0	0.346	0.368		
1.75	95.0	99.0	0.411	0.429		
2.00	108.0	111.0	0.468	0.481		
2.25	122.0	122.0	0.528	0.528		
2.50	136.0	132.0	0.589	0.572	4.46	4.33
2.75	150.0	144.0	0.650	0.624		
3.00	164.0	154.0	0.710	0.667		
3.25	175.0	164.0	0.758	0.710		
3.50	187.0	173.0	0.810	0.749		
3.75	199.0	182.0	0.862	0.788		
4.00	208.0	191.0	0.901	0.827		
4.25	218.0	200.0	0.944	0.866		
4.50	227.0	208.0	0.983	0.901		
4.75	237.0	215.0	1.026	0.931		
5.00	247.0	222.0	1.070	0.961	5.35	4.81
5.25	256.0	228.0	1.108	0.987		
5.50	264.0	235.0	1.143	1.018		
5.75	273.0	242.0	1.182	1.048		
6.00	282.0	248.0	1.221	1.074		
6.25	290.0	255.0	1.256	1.104		
6.50	298.0	261.0	1.290	1.130		
6.75	305.0	266.0	1.321	1.152		
7.00	312.0	272.0	1.351	1.178		
7.25	320.0	279.0	1.386	1.208		
7.50	326.0	284.0	1.412	1.230		
Moisture content after test	Top	Middle	Base	Specimen wt g	4620	
Container No.	Tray	Tray	Tray	Diameter mm	152	
Mass of wet soil + container	g	1667.5	1910.8	1505.5	Length mm	127.0
Mass of dry soil + container	g	1420.0	1625.0	1292.0		
Weight of container	g	143.0	143.9	182.8		
Mass of moisture	g	247.5	285.8	213.5	Average MC %	19.31
Dry weight	g	1277.0	1481.1	1109.2	Density Mg/m ³	2.00
Moisture content	%	19.4	19.3	19.2	Dry Density Mg/m ³	1.68

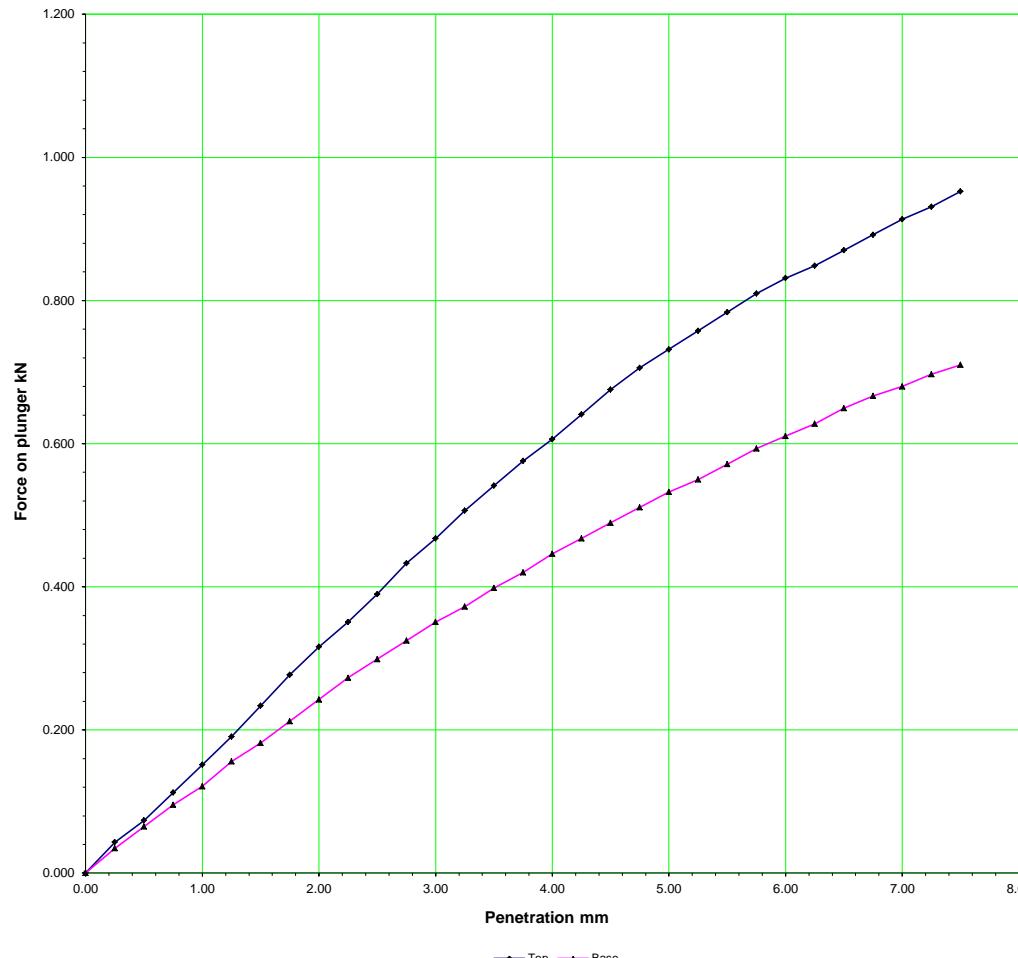


NM TL Ltd	Project: Constitution Hill	GII Project ID: 8855-06-19	Date	Project No.	NMTL2974
			Operator	Tch	26-Jul-19
			Checked	Nc	Sample No.
			Approved	Bc	Depth
					CBR03
					B
					1.30m

NATIONAL MATERIALS TESTING LABORATORY LTD.

DETERMINATION OF THE CALIFORNIA BEARING RATIO TEST
BS 1377 : PART 4 : CLAUSE 7 : 1990

Soil Description	Brown/dark grey slightly sandy slightly gravelly SILT/CLAY			
Test Method	BS 1377: Part 4 : 1990 : 7.4		Date	26-Jul-19
Force Measuring Device	VJT-08211		Test 1	
Preparative	Remoulded with 2.5 kg rammer at natural moisture content			
Surcharge	10 kPa	Mean Calibration	4.33	N/Div
Penetration	Force Gauge	Force on plunger	4.33	N/Div
of plunger mm	reading divisions			
	Top	Bottom	California Bearing Ratio Results	
			kN	%
			Top	Base
0.00	0.0	0.0	0.000	0.000
0.25	10.0	8.0	0.043	0.035
0.50	17.0	15.0	0.074	0.065
0.75	26.0	22.0	0.113	0.095
1.00	35.0	28.0	0.152	0.121
1.25	44.0	36.0	0.191	0.156
1.50	54.0	42.0	0.234	0.182
1.75	64.0	49.0	0.277	0.212
2.00	73.0	56.0	0.316	0.242
2.25	81.0	63.0	0.351	0.273
2.50	90.0	69.0	0.390	0.299
			2.95	2.26
2.75	100.0	75.0	0.433	0.325
3.00	108.0	81.0	0.468	0.351
3.25	117.0	86.0	0.507	0.372
3.50	125.0	92.0	0.541	0.398
3.75	133.0	97.0	0.576	0.420
4.00	140.0	103.0	0.606	0.446
4.25	148.0	108.0	0.641	0.468
4.50	156.0	113.0	0.675	0.489
4.75	163.0	118.0	0.706	0.511
5.00	169.0	123.0	0.732	0.533
5.25	175.0	127.0	0.758	0.550
5.50	181.0	132.0	0.784	0.572
5.75	187.0	137.0	0.810	0.593
6.00	192.0	141.0	0.831	0.611
6.25	196.0	145.0	0.849	0.628
6.50	201.0	150.0	0.870	0.650
6.75	206.0	154.0	0.892	0.667
7.00	211.0	157.0	0.914	0.680
7.25	215.0	161.0	0.931	0.697
7.50	220.0	164.0	0.953	0.710
Moisture content after test	Top	Middle	Base	Specimen wt g
Container No.	Tray	Tray	Tray	4775
Mass of wet soil + container	g	1292.0	2052.5	Diameter mm
Mass of dry soil + container	g	1112.9	1760.9	Length mm
Weight of container	g	139.0	188.4	1640.9
Mass of moisture	g	179.2	291.7	127.0
Dry weight	g	973.8	1572.5	Average MC %
Moisture content	%	18.4	18.5	18.7
				Density Mg/m ³
				2.07
				Dry Density Mg/m ³
				1.75



NM	Tch	Date	Project No.	NMTL2974
TL	26-Jul-19	Trial Pit No.	CBR04	
Ltd		Checked	Nc	Sample No.
		Approved	Bc	Depth
				1.20m

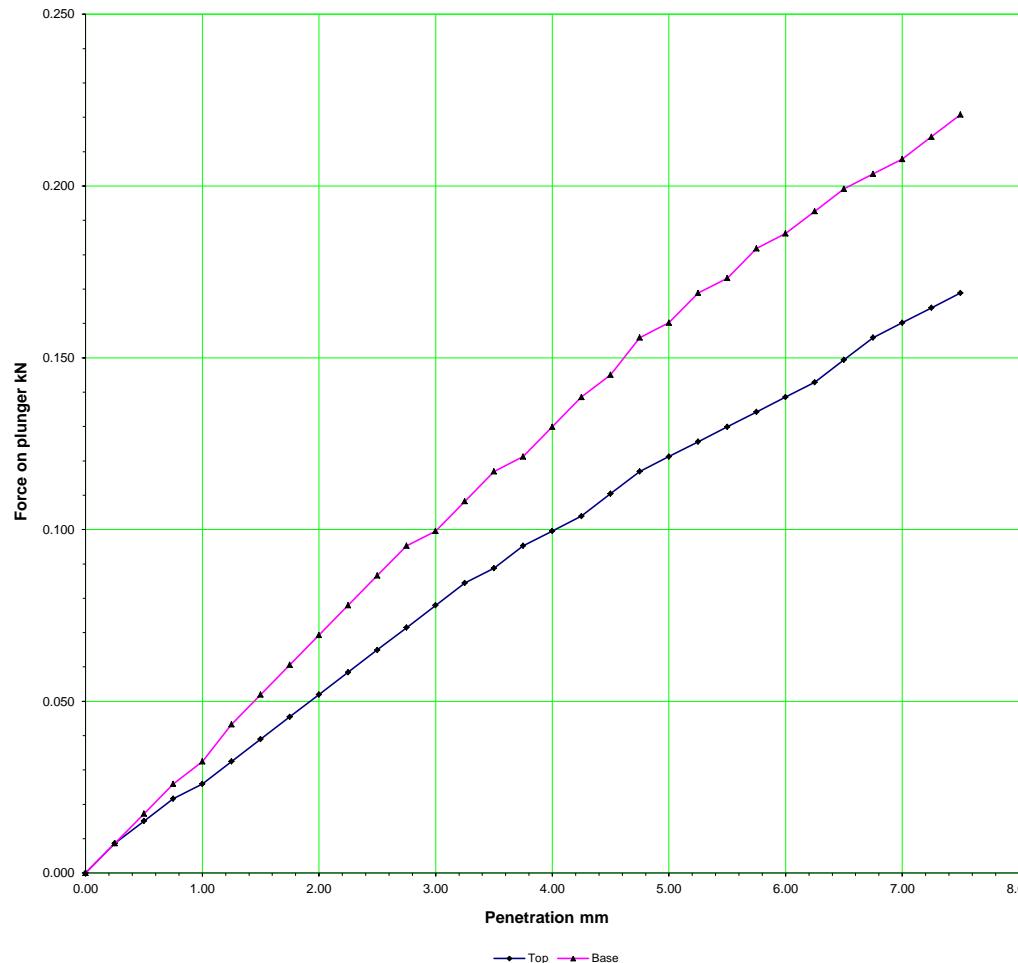
Project: Constitution Hill

GII Project ID: 8855-06-19

NATIONAL MATERIALS TESTING LABORATORY LTD.

DETERMINATION OF THE CALIFORNIA BEARING RATIO TEST
BS 1377 : PART 4 : CLAUSE 7 : 1990

Soil Description	Light brown/ brown slightly sandy slightly gravelly SILT/CLAY				Date	26-Jul-19
Test Method	BS 1377: Part 4 : 1990 :7.4				Test 1	
Force Measuring Device	VJT-08211					
Preparative	Remoulded with 2.5 kg rammer at natural moisture content					
Surcharge	10 kPa	Mean Calibration	4.33	N/Div		
Penetration	Force Gauge	Force on plunger	4.33	N/Div		
of plunger mm	reading divisions				California Bearing Ratio Results	
	Top	Bottom	Top	Bottom	Top	%
0.00	0.0	0.0	0.000	0.000		
0.25	2.0	2.0	0.009	0.009		
0.50	3.5	4.0	0.015	0.017		
0.75	5.0	6.0	0.022	0.026		
1.00	6.0	7.5	0.026	0.032		
1.25	7.5	10.0	0.032	0.043		
1.50	9.0	12.0	0.039	0.052		
1.75	10.5	14.0	0.045	0.061		
2.00	12.0	16.0	0.052	0.069		
2.25	13.5	18.0	0.058	0.078		
2.50	15.0	20.0	0.065	0.087	0.49	0.66
2.75	16.5	22.0	0.071	0.095		
3.00	18.0	23.0	0.078	0.100		
3.25	19.5	25.0	0.084	0.108		
3.50	20.5	27.0	0.089	0.117		
3.75	22.0	28.0	0.095	0.121		
4.00	23.0	30.0	0.100	0.130		
4.25	24.0	32.0	0.104	0.139		
4.50	25.5	33.5	0.110	0.145		
4.75	27.0	36.0	0.117	0.156		
5.00	28.0	37.0	0.121	0.160	0.61	0.80
5.25	29.0	39.0	0.126	0.169		
5.50	30.0	40.0	0.130	0.173		
5.75	31.0	42.0	0.134	0.182		
6.00	32.0	43.0	0.139	0.186		
6.25	33.0	44.5	0.143	0.193		
6.50	34.5	46.0	0.149	0.199		
6.75	36.0	47.0	0.156	0.204		
7.00	37.0	48.0	0.160	0.208		
7.25	38.0	49.5	0.165	0.214		
7.50	39.0	51.0	0.169	0.221		
Moisture content after test	Top	Middle	Base	Specimen wt g	4580	
Container No.	Tray	Tray	Tray	Diameter mm	152	
Mass of wet soil + container	g	1772.8	1726.3	1524.3	Length mm	127.0
Mass of dry soil + container	g	1464.7	1426.8	1263.4		
Weight of container	g	161.7	145.1	144.1		
Mass of moisture	g	308.1	299.5	261.0	Average MC %	23.44
Dry weight	g	1302.9	1281.7	1119.2	Density Mg/m ³	1.99
Moisture content	%	23.6	23.4	23.3	Dry Density Mg/m ³	1.61

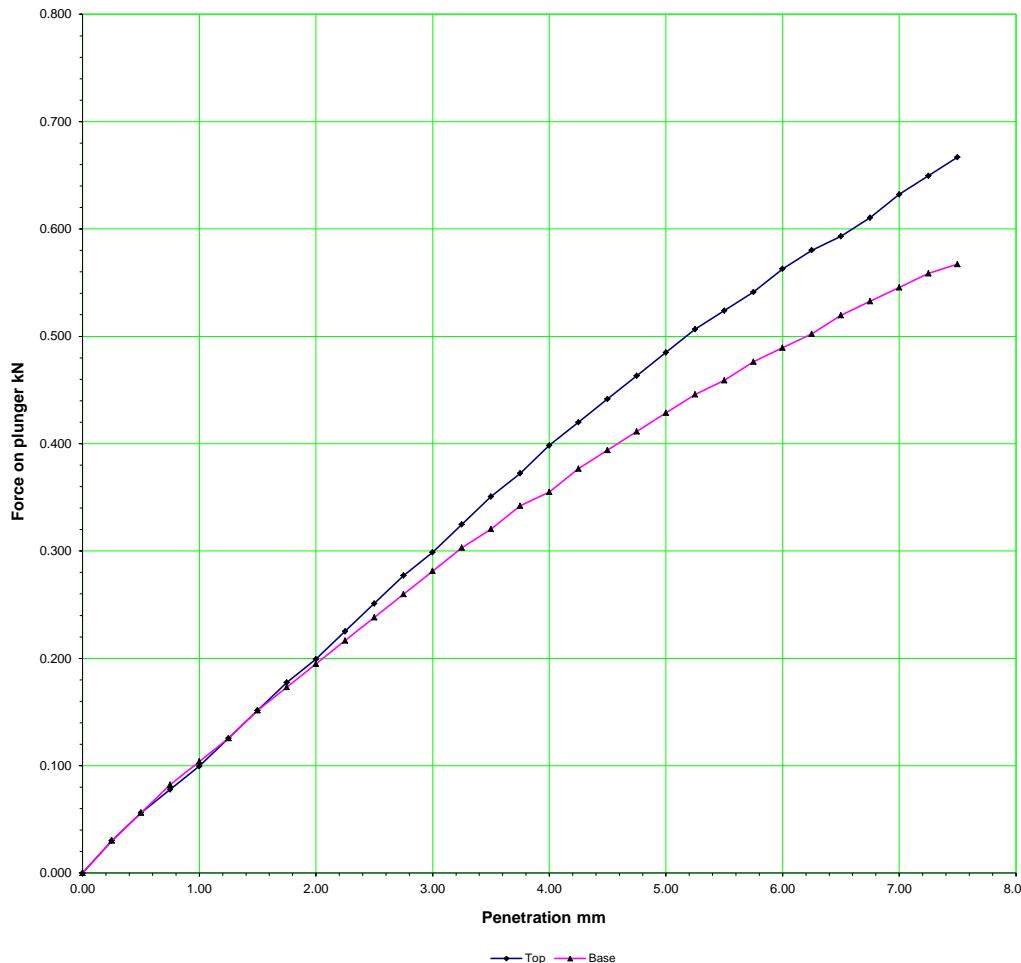


NM TL Ltd	Project: Constitution Hill					GII Project ID: 8855-06-19	Date	Project No.	NMTL2974	
							Operator	Tch	26-Jul-19	
							Checked	Nc	Trial Pit No.	CBR05
							Approved	Bc	Sample No.	B
									Depth	1.00m

NATIONAL MATERIALS TESTING LABORATORY LTD.

**DETERMINATION OF THE CALIFORNIA BEARING RATIO TEST
BS 1377 : PART 4 : CLAUSE 7 : 1990**

Soil Description	Light brown slightly sandy slightly gravelly SILT/CLAY					Date	26-Jul-19
Test Method	BS 1377: Part 4 : 1990 :7.4						
Force Measuring Device	VJT-08211					Test 1	
Preperatic Remoulded with 2.5 kg rammer at natural moisture content							
Surcharge	10 kPa	Mean Calibration			4.33	N/Div	
Penetration	Force Gauge	Force on plunger			4.33	N/Div	
of plunger mm	reading divisions	kN			California Bearing Ratio Results %		
		Top	Bottom	Top	Bottom	Top	Base
0.00	0.0	0.0	0.000	0.000			
0.25	7.0	7.0	0.030	0.030			
0.50	13.0	13.0	0.056	0.056			
0.75	18.0	19.0	0.078	0.082			
1.00	23.0	24.0	0.100	0.104			
1.25	29.0	29.0	0.126	0.126			
1.50	35.0	35.0	0.152	0.152			
1.75	41.0	40.0	0.178	0.173			
2.00	46.0	45.0	0.199	0.195			
2.25	52.0	50.0	0.225	0.217			
2.50	58.0	55.0	0.251	0.238	1.90	1.80	
2.75	64.0	60.0	0.277	0.260			
3.00	69.0	65.0	0.299	0.281			
3.25	75.0	70.0	0.325	0.303			
3.50	81.0	74.0	0.351	0.320			
3.75	86.0	79.0	0.372	0.342			
4.00	92.0	82.0	0.398	0.355			
4.25	97.0	87.0	0.420	0.377			
4.50	102.0	91.0	0.442	0.394			
4.75	107.0	95.0	0.463	0.411			
5.00	112.0	99.0	0.485	0.429	2.42	2.14	
5.25	117.0	103.0	0.507	0.446			
5.50	121.0	106.0	0.524	0.459			
5.75	125.0	110.0	0.541	0.476			
6.00	130.0	113.0	0.563	0.489			
6.25	134.0	116.0	0.580	0.502			
6.50	137.0	120.0	0.593	0.520			
6.75	141.0	123.0	0.611	0.533			
7.00	146.0	126.0	0.632	0.546			
7.25	150.0	129.0	0.650	0.559			
7.50	154.0	131.0	0.667	0.567			
Moisture content after test		Top	Middle	Base	Specimen wt g	4570	
Container No.		Tray	Tray	Tray	Diameter mm	152	
Mass of wet soil + container	g	1838.9	1735.2	1421.2	Length mm	127.0	
Mass of dry soil + container	g	1525.5	1441.7	1184.4			
Weight of container	g	143.6	143.3	146.5			
Mass of moisture	g	313.4	293.5	236.8	Average MC %	22.70	
Dry weight	g	1382.0	1298.4	1037.9	Density Mg/m3	1.98	
Moisture content	%	22.7	22.6	22.8	Dry Density Mg/m3	1.62	



NM
TL
Lt

Project: Constitution Hill

GII Project ID: 8855-06-19

		Date	Project No.	NMTL2974
Operator	Tch	26-Jul-19	Trial Pit No.	CBR06
Checked	Nc		Sample No.	B
Approved	Bc		Depth	1.00m

Ground Investigations Ireland
Catherinstown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland



Attention : Conor Finnerty
Date : 8th August, 2019
Your reference : 8855-06-19
Our reference : Test Report 19/12025 Batch 1
Location : Constitution Hill
Date samples received : 25th July, 2019
Status : Final report
Issue : 1

Four samples were received for analysis on 25th July, 2019 of which four were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Where Waste Acceptance Criteria Suite (EC Decision of 19 December 2002 (2003/33/EC)) has been requested, all analyses have been performed using the relevant EN methods where they exist.

Authorised By:



Lucas Halliwell
Project Co-ordinator

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 8855-06-19
Location: Constitution Hill
Contact: Conor Finnerty
EMT Job No: 19/12025

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	4-6	7-9	10-12								
Sample ID	TP03	TP03	TP03	TP04								
Depth	1.00	2.00	3.00	1.00								
COC No / misc												
Containers	V J T	V J T	V J T	V J T								
Sample Date	<>	<>	<>	<>								
Sample Type	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1								
Date of Receipt	25/07/2019	25/07/2019	25/07/2019	25/07/2019								
										LOD/LOR	Units	Method No.
Antimony	2	2	2	-						<1	mg/kg	TM30/PM15
Arsenic [#]	25.1	15.2	13.1	-						<0.5	mg/kg	TM30/PM15
Barium [#]	17	80	52	-						<1	mg/kg	TM30/PM15
Cadmium [#]	<0.1	3.0	1.1	-						<0.1	mg/kg	TM30/PM15
Chromium [#]	100.4	34.5	50.4	-						<0.5	mg/kg	TM30/PM15
Copper [#]	52	58	33	-						<1	mg/kg	TM30/PM15
Lead [#]	11	132	51	-						<5	mg/kg	TM30/PM15
Mercury [#]	<0.1	<0.1	<0.1	-						<0.1	mg/kg	TM30/PM15
Molybdenum [#]	0.4	4.1	2.9	-						<0.1	mg/kg	TM30/PM15
Nickel [#]	47.3	38.1	34.8	-						<0.7	mg/kg	TM30/PM15
Selenium [#]	1	2	<1	-						<1	mg/kg	TM30/PM15
Zinc [#]	149	113	105	-						<5	mg/kg	TM30/PM15
Antimony	-	-	-	10						<1	mg/kg	TM30/PM62
Arsenic	-	-	-	77.6						<0.5	mg/kg	TM30/PM62
Barium	-	-	-	604						<1	mg/kg	TM30/PM62
Cadmium	-	-	-	1.3						<0.1	mg/kg	TM30/PM62
Chromium	-	-	-	60.6						<0.5	mg/kg	TM30/PM62
Copper	-	-	-	159						<1	mg/kg	TM30/PM62
Lead	-	-	-	410						<5	mg/kg	TM30/PM62
Mercury	-	-	-	0.3						<0.1	mg/kg	TM30/PM62
Molybdenum	-	-	-	7.9						<0.1	mg/kg	TM30/PM62
Nickel	-	-	-	62.6						<0.7	mg/kg	TM30/PM62
Selenium	-	-	-	1						<1	mg/kg	TM30/PM62
Zinc	-	-	-	871						<5	mg/kg	TM30/PM62

Please see attached notes for all abbreviations and acronyms

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Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 8855-06-19
Location: Constitution Hill
Contact: Conor Finnerty
EMT Job No: 19/12025

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	4-6	7-9	10-12													LOD/LOR	Units	Method No.
Sample ID	TP03	TP03	TP03	TP04													Please see attached notes for all abbreviations and acronyms		
Depth	1.00	2.00	3.00	1.00															
COC No / misc																			
Containers	V J T	V J T	V J T	V J T															
Sample Date	<>	<>	<>	<>															
Sample Type	Soil	Soil	Soil	Soil															
Batch Number	1	1	1	1															
Date of Receipt	25/07/2019	25/07/2019	25/07/2019	25/07/2019															
PAH MS																			
Naphthalene #	<0.04	<0.04	<0.04	0.35													<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	0.19													<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	0.71													<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	0.56													<0.04	mg/kg	TM4/PM8
Phenanthrene #	0.05	<0.03	<0.03	6.68													<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	1.19													<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.08	<0.03	<0.03	8.32													<0.03	mg/kg	TM4/PM8
Pyrene #	0.08	<0.03	<0.03	7.23													<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.07	<0.06	<0.06	3.35													<0.06	mg/kg	TM4/PM8
Chrysene #	0.06	<0.02	<0.02	3.86													<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	0.11	<0.07	<0.07	6.64													<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.05	<0.04	<0.04	3.55													<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	0.04	<0.04	<0.04	2.20													<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	0.57													<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.05	<0.04	<0.04	2.43													<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	0.48													<0.04	mg/kg	TM4/PM8
PAH 6 Total #	0.33	<0.22	<0.22	23.14													<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	48.31													<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.08	<0.05	<0.05	4.78													<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.03	<0.02	<0.02	1.86													<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	1													<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	101	100	127	89													<0	%	TM4/PM8
Mineral Oil (C10-C40)	<30	<30	<30	69													<30	mg/kg	TM5/PM8/PM16
TPH CWG																			
Aliphatics																			
>C5-C6 #	<0.1	<0.1	<0.1	<0.1	SV												<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1	<0.1	<0.1	<0.1	SV												<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1	SV												<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	<0.2	<0.2	<0.2													<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 #	<4	<4	<4	12													<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7	<7	14													<7	mg/kg	TM5/PM8/PM16
>C21-C35 #	<7	<7	<7	43													<7	mg/kg	TM5/PM8/PM16
>C35-C40	<7	<7	<7	<7													<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	<26	<26	<26	69													<26	mg/kg	TM5/PM8/PM16
>C6-C10	<0.1	<0.1	<0.1	<0.1	SV												<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10													<10	mg/kg	TM5/PM8/PM16
>C25-C35	<10	<10	<10	40													<10	mg/kg	TM5/PM8/PM16

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Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 8855-06-19
Location: Constitution Hill
Contact: Conor Finnerty
EMT Job No: 19/12025

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	10-12														LOD/LOR	Units	Method No.
Sample ID	TP03	TP03	TP03	TP04																
Depth	1.00	2.00	3.00	1.00																
COC No / misc																				
Containers	V J T	V J T	V J T	V J T																
Sample Date	<>	<>	<>	<>																
Sample Type	Soil	Soil	Soil	Soil																
Batch Number	1	1	1	1																
Date of Receipt	25/07/2019	25/07/2019	25/07/2019	25/07/2019																
TPH CWG																				
Aromatics																				
>C5-EC7 #	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}												<0.1	mg/kg	TM36/PM12	
>EC7-EC8 #	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}												<0.1	mg/kg	TM36/PM12	
>EC8-EC10 #	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}												<0.1	mg/kg	TM36/PM12	
>EC10-EC12 #	<0.2	<0.2	<0.2 ^{SV}	1.8													<0.2	mg/kg	TM5/PM8/PM16	
>EC12-EC16 #	<4	<4	<4 ^{SV}	13													<4	mg/kg	TM5/PM8/PM16	
>EC16-EC21 #	<7	<7	<7 ^{SV}	54													<7	mg/kg	TM5/PM8/PM16	
>EC21-EC35 #	<7	<7	<7 ^{SV}	304													<7	mg/kg	TM5/PM8/PM16	
>EC35-EC40	<7	<7	<7 ^{SV}	72													<7	mg/kg	TM5/PM8/PM16	
Total aromatics C5-40	<26	<26	<26 ^{SV}	445													<26	mg/kg	TM5/PM8/PM16/PM12/PM11	
Total aliphatics and aromatics(C5-40)	<52	<52	<52 ^{SV}	514													<52	mg/kg	TM5/PM8/PM16/PM12/PM11	
>EC6-EC10 #	<0.1	<0.1	<0.1	<0.1 ^{SV}													<0.1	mg/kg	TM36/PM12	
>EC10-EC25	<10	<10	<10 ^{SV}	119													<10	mg/kg	TM5/PM8/PM16	
>EC25-EC35	<10	<10	<10 ^{SV}	203													<10	mg/kg	TM5/PM8/PM16	
MTBE #	<5	<5	<5	<5 ^{SV}													<5	ug/kg	TM31/PM12	
Benzene #	<5	<5	<5	<5 ^{SV}													<5	ug/kg	TM31/PM12	
Toluene #	<5	<5	<5	<5 ^{SV}													<5	ug/kg	TM31/PM12	
Ethylbenzene #	<5	<5	<5	<5 ^{SV}													<5	ug/kg	TM31/PM12	
m/p-Xylene #	<5	<5	<5	<5 ^{SV}													<5	ug/kg	TM31/PM12	
o-Xylene #	<5	<5	<5	<5 ^{SV}													<5	ug/kg	TM31/PM12	
PCB 28 #	<5	<5	<5	<5													<5	ug/kg	TM17/PM8	
PCB 52 #	<5	<5	<5	<5													<5	ug/kg	TM17/PM8	
PCB 101 #	<5	<5	<5	<5													<5	ug/kg	TM17/PM8	
PCB 118 #	<5	<5	<5	<5													<5	ug/kg	TM17/PM8	
PCB 138 #	<5	<5	<5	<5													<5	ug/kg	TM17/PM8	
PCB 153 #	<5	<5	<5	<5													<5	ug/kg	TM17/PM8	
PCB 180 #	<5	<5	<5	<5													<5	ug/kg	TM17/PM8	
Total 7 PCBs #	<35	<35	<35	<35													<35	ug/kg	TM17/PM8	
Natural Moisture Content	5.4	16.1	19.9	29.4													<0.1	%	PM4/PM0	
Moisture Content (% Wet Weight)	5.1	13.8	16.6	22.7													<0.1	%	PM4/PM0	
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3													<0.3	mg/kg	TM38/PM20	
Sulphate as SO4 (2:1 Ext) #	0.0082	0.0216	0.0161	-													<0.0015	g/l	TM38/PM20	
Sulphate as SO4 (2:1 Ext)	-	-	-	0.0805												<0.0015	g/l	TM38/PM60		
Chromium III	100.4	34.5	50.4	NDP												<0.5	mg/kg	NONE/NONE		
Chromium III	-	-	-	60.6												<0.5	mg/kg	NONE/NONE		
Total Organic Carbon #	0.11	2.56	0.85	NDP												<0.02	%	TM21/PM24		
pH #	9.02	8.80	8.89	9.62												<0.01	pH units	TM73/PM11		

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Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 8855-06-19
Location: Constitution Hill
Contact: Conor Finnerty
EMT Job No: 19/12025

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	4-6	7-9	10-12							
Sample ID	TP03	TP03	TP03	TP04							
Depth	1.00	2.00	3.00	1.00							
COC No / misc											Please see attached notes for all abbreviations and acronyms
Containers	V J T	V J T	V J T	V J T							
Sample Date	<>	<>	<>	<>							
Sample Type	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1							
Date of Receipt	25/07/2019	25/07/2019	25/07/2019	25/07/2019							
Mass of raw test portion	0.0959	0.1104	0.1031	0.1055						kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09						kg	NONE/PM17

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Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 8855-06-19
Location: Constitution Hill
Contact: Conor Finnerty
EMT Job No: 19/12025

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	4-6	7-9	10-12								
Sample ID	TP03	TP03	TP03	TP04								
Depth	1.00	2.00	3.00	1.00								
COC No / misc												
Containers	V J T	V J T	V J T	V J T								
Sample Date	<>	<>	<>	<>								
Sample Type	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1								
Date of Receipt	25/07/2019	25/07/2019	25/07/2019	25/07/2019								
										LOD/LOR	Units	Method No.
Dissolved Antimony [#]	<0.002	<0.002	<0.002	0.011						<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) [#]	<0.02	<0.02	<0.02	0.11						<0.02	mg/kg	TM30/PM17
Dissolved Arsenic [#]	0.0273	0.0120	0.0101	0.0726						<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) [#]	0.273	0.120	0.101	0.726						<0.025	mg/kg	TM30/PM17
Dissolved Barium [#]	<0.003	0.003	<0.003	0.005						<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) [#]	<0.03	<0.03	<0.03	0.05						<0.03	mg/kg	TM30/PM17
Dissolved Cadmium [#]	<0.0005	<0.0005	<0.0005	<0.0005						<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) [#]	<0.005	<0.005	<0.005	<0.005						<0.005	mg/kg	TM30/PM17
Dissolved Chromium [#]	<0.0015	<0.0015	<0.0015	0.0136						<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) [#]	<0.015	<0.015	<0.015	0.136						<0.015	mg/kg	TM30/PM17
Dissolved Copper [#]	<0.007	<0.007	<0.007	0.024						<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) [#]	<0.07	<0.07	<0.07	0.24						<0.07	mg/kg	TM30/PM17
Dissolved Lead [#]	<0.005	<0.005	<0.005	<0.005						<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) [#]	<0.05	<0.05	<0.05	<0.05						<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum [#]	<0.002	0.004	0.013	0.011						<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) [#]	<0.02	0.04	0.13	0.11						<0.02	mg/kg	TM30/PM17
Dissolved Nickel [#]	<0.002	<0.002	<0.002	0.002						<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) [#]	<0.02	<0.02	<0.02	0.02						<0.02	mg/kg	TM30/PM17
Dissolved Selenium [#]	<0.003	<0.003	<0.003	<0.003						<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) [#]	<0.03	<0.03	<0.03	<0.03						<0.03	mg/kg	TM30/PM17
Dissolved Zinc [#]	<0.003	0.003	<0.003	0.011						<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) [#]	<0.03	<0.03	<0.03	0.11						<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF [#]	<0.00001	<0.00001	<0.00001	0.00003						<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF [#]	<0.0001	<0.0001	<0.0001	0.0003						<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01	<0.01						<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1						<0.1	mg/kg	TM26/PM0
Fluoride	<0.3	<0.3	<0.3	<0.3						<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3						<3	mg/kg	TM173/PM0
Sulphate as SO ₄ [#]	2.0	4.1	3.0	19.8						<0.5	mg/l	TM38/PM0
Sulphate as SO ₄ [#]	20	41	30	198						<5	mg/kg	TM38/PM0
Chloride [#]	<0.3	0.8	<0.3	1.0						<0.3	mg/l	TM38/PM0
Chloride [#]	<3	8	<3	10						<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	3	3	3	7						<2	mg/l	TM60/PM0
Dissolved Organic Carbon	30	30	30	70						<20	mg/kg	TM60/PM0
pH	8.21	8.16	8.17	10.36						<0.01	pH units	TM73/PM0
Total Dissolved Solids [#]	35	58	56	141						<35	mg/l	TM20/PM0
Total Dissolved Solids [#]	350	580	560	1410						<350	mg/kg	TM20/PM0

Please see attached notes for all abbreviations and acronyms

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 8855-06-19
Location: Constitution Hill
Contact: Conor Finnerty
EMT Job No: 19/12025

Report : EN12457_2

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	10-12																		
Sample ID	TP03	TP03	TP03	TP04																		
Depth	1.00	2.00	3.00	1.00																		
COC No / misc																						
Containers	V J T	V J T	V J T	V J T																		
Sample Date	<>	<>	<>	<>																		
Sample Type	Soil	Soil	Soil	Soil																		
Batch Number	1	1	1	1																		
Date of Receipt	25/07/2019	25/07/2019	25/07/2019	25/07/2019																		
Solid Waste Analysis																						
Total Organic Carbon [#]	0.11	2.56	0.85	NDP																%	TM21/PM24	
Sum of BTEX	<0.025	<0.025	<0.025	<0.025 ^{SV}																mg/kg	TM31/PM12	
Sum of 7 PCBs [#]	<0.035	<0.035	<0.035	<0.035																mg/kg	TM17/PM8	
Mineral Oil	<30	<30	<30	69																mg/kg	TM3/PM8/PM16	
PAH Sum of 6 [#]	0.33	<0.22	<0.22	23.14																mg/kg	TM4/PM8	
PAH Sum of 17	<0.64	<0.64	<0.64	48.31																mg/kg	TM4/PM8	
CEN 10:1 Leachate																						
Arsenic [#]	0.273	0.120	0.101	0.726																mg/kg	TM30/PM17	
Barium [#]	<0.03	<0.03	<0.03	0.05																mg/kg	TM30/PM17	
Cadmium [#]	<0.005	<0.005	<0.005	<0.005																mg/kg	TM30/PM17	
Chromium [#]	<0.015	<0.015	<0.015	0.136																mg/kg	TM30/PM17	
Copper [#]	<0.07	<0.07	<0.07	0.24																mg/kg	TM30/PM17	
Mercury [#]	<0.0001	<0.0001	<0.0001	0.0003																mg/kg	TM61/PM0	
Molybdenum [#]	<0.02	0.04	0.13	0.11																mg/kg	TM30/PM17	
Nickel [#]	<0.02	<0.02	<0.02	0.02																mg/kg	TM30/PM17	
Lead [#]	<0.05	<0.05	<0.05	<0.05																mg/kg	TM30/PM17	
Antimony [#]	<0.02	<0.02	<0.02	0.11																mg/kg	TM30/PM17	
Selenium [#]	<0.03	<0.03	<0.03	<0.03																mg/kg	TM30/PM17	
Zinc [#]	<0.03	<0.03	<0.03	0.11																mg/kg	TM30/PM17	
Total Dissolved Solids [#]	350	580	560	1410																mg/kg	TM20/PM0	
Dissolved Organic Carbon	30	30	30	70																mg/kg	TM60/PM0	
Mass of raw test portion	0.0959	0.1104	0.1031	0.1055																kg	NONE/PM17	
Dry Matter Content Ratio	93.6	81.8	87.1	85.5																%	NONE/PM4	
Leachant Volume	0.894	0.88	0.887	0.885																I	NONE/PM17	
Eluate Volume	0.8	0.8	0.8	0.8																I	NONE/PM17	
pH [#]	9.02	8.80	8.89	9.62																pH units	TM73/PM11	
Phenol	<0.1	<0.1	<0.1	<0.1																mg/kg	TM26/PM0	
Fluoride	<3	<3	<3	<3																mg/kg	TM173/PM0	
Sulphate as SO ₄ [#]	20	41	30	198																mg/kg	TM38/PM0	
Chloride [#]	<3	8	<3	10																mg/kg	TM38/PM0	

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Element Materials Technology

EPH Interpretation Report

Client Name: Ground Investigations Ireland
Reference: 8855-06-19
Location: Constitution Hill
Contact: Conor Finnerty

Matrix : Solid

Client Name: Ground Investigations Ireland
Reference: 19/06/8855
Location: Constitution Hill
Contact: Conor Finnerty

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

Signed on behalf of Element Materials Technology:

Ryan Butterworth
Asbestos Team Leader

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
19/12025	1	TP03	1.00	2	30/07/2019	General Description (Bulk Analysis)	soil.stones
					30/07/2019	Asbestos Fibres	NAD
					30/07/2019	Asbestos ACM	NAD
					30/07/2019	Asbestos Type	NAD
					30/07/2019	Asbestos Level Screen	NAD
19/12025	1	TP03	2.00	5	30/07/2019	General Description (Bulk Analysis)	soil.stones
					30/07/2019	Asbestos Fibres	NAD
					30/07/2019	Asbestos ACM	NAD
					30/07/2019	Asbestos Type	NAD
					30/07/2019	Asbestos Level Screen	NAD
19/12025	1	TP03	3.00	8	30/07/2019	General Description (Bulk Analysis)	soil.stones
					30/07/2019	Asbestos Fibres	NAD
					30/07/2019	Asbestos ACM	NAD
					30/07/2019	Asbestos Type	NAD
					30/07/2019	Asbestos Level Screen	NAD
19/12025	1	TP04	1.00	11	30/07/2019	General Description (Bulk Analysis)	soil.stones
					30/07/2019	Asbestos Fibres	Fibre Bundles
					30/07/2019	Asbestos ACM	NAD
					30/07/2019	Asbestos Type	Chrysotile
					30/07/2019	Asbestos Level Screen	less than 0.1%

Client Name: Ground Investigations Ireland
Reference: 8855-06-19
Location: Constitution Hill
Contact: Conor Finnerty

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Method No.	NDP Reason
19/12025	1	TP04	1.00	10-12	NONE/NONE	Asbestos detected in sample
19/12025	1	TP04	1.00	10-12	TM21/PM24	Asbestos detected in sample

Element Materials Technology

Notification of Deviating Samples

Client Name: Ground Investigations Ireland
Reference: 8855-06-19
Location: Constitution Hill
Contact: Conor Finnerty

Matrix : Solid

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 19/12025

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at $35^{\circ}\text{C} \pm 5^{\circ}\text{C}$ unless otherwise stated. Moisture content for CEN Leachate tests are dried at $105^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overestimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

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All solid results are expressed on a dry weight basis unless stated otherwise.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

Appendix - Methods used for WAC (2003/33/EC)

EMT Job No: 19/12025

Leachate tests	
10l/kg; 4mm	I.S. EN 12457-2:2002 Specified particle size; water added to L/S ratio; capped; agitated for 24 ± 0.5 hours; eluate settled and filtered over 0.45 µm membrane filter.
Eluate analysis	
As	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ba	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cd	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cr total	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cu	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Hg	I.S. EN 13370 rec. EN 1483 (CVAAS)
Mo	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ni	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Pb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Sb	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Se	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Zn	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Chloride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Fluoride	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Sulphate	I.S. EN 12506 rec. EN ISO 10304-part 1 (liquid chromatography of ions)
Phenol index	I.S. EN 13370 rec. ISO 6439 (4-Aminoantipyrine spectrometric methods after distillation)* (BY HPLC - EMT)
DOC	I.S. EN 1484
TDS	I.S. EN 15216
Compositional analysis	
TOC	I.S. EN 13137 Method B: carbonates removed with acid; TOC by combustion.
BTEX	GC-FID
PCB7**	I.S. EN 15308 analysis by GC-ECD.
Mineral oil	I.S. EN 14039 C10 to C40 analysis by GC-FID.
PAH17***	I.S. EN 15527 PAH17 analysis by GC-MS
Metals	I.S. EN 13657 - Aqua regia digestion: EN ISO 11885 (ICP-OES)
Other	
Dry matter	I.S. EN 14346 sample is dried to a constant mass in an oven at 105 ± 3 °C; Method B Water content by direct Karl-Fischer titration and either volumetric or coulometric detection.
LOI	I.S. EN 15169 Difference in mass after heating in a furnace up to 550 ± 25 °C.
ANC	CEN/TS 15364 Determined by amounts of acid or base needed to cover the pH range
Notes:	
*If not suitable due to LOD, precision, etc., any other suitable method can be used, e.g. AFS, ICP-MS	
**PCB-28, PCB-52, PCB-101, PCB-118, PCB-138, PCB-153 and PCB-180	
***Naphthalene, Acenaphthylene, Acenaphthene, Anthracene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(g,h,i)perylene, Benzo(a)pyrene, Chrysene, Coronene, Dibenz(a,h)anthracene, Fluorene, Fluoranthene, Indeno(1,2,3-c,d)pyrene, Phenanthrene and Pyrene.	

EMT Job No: 19/12025

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270 method for the solvent extraction and determination of 16 PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5	Modified 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3: 1990/USEPA 160.3 Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO ₂ generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes

EMT Job No: 19/12025

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM17	Modified method BS EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM30	Determination of Trace Metal elements by ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry). Modified US EPA Method 200.7, 6010B and BS EN ISO 11885 2009	PM62	Acid digestion of as received solid samples using Aqua Regia refluxed at 112.5 °C.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM31	Modified USEPA 8015B. Determination of Methyltertbutylether, Benzene, Toluene, Ethylbenzene and Xylene by headspace GC-FID.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GC/FID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results can be confirmed using GCMS.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM0	No preparation is required.	Yes		AR	Yes

EMT Job No: 19/12025

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods 325.2 (Chloride), 375.4 (Sulphate), 365.2 (o-Phosphate), 353.1 (TON), 354.1 (Nitrite), 350.1 (NH4+) comparable to BS ISO 15923-1, 7196A (Hex Cr)	PM60	As received solid samples are extracted with deionised water in a 2:1 ratio of water to solid.			AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060, APHA Standard Methods for Examination of Water and Wastewater 5310B, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Modified US EPA methods 245.7 and 200.7. Determination of Mercury by Cold Vapour Atomic Fluorescence.	PM0	No preparation is required.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248.	PM42	Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 and 9045D and BS1377:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 340.2	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes

EMT Job No: 19/12025

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
NONE	No Method Code	NONE	No Method Code			AR	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method BS EN12457-2 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.			AR	