



**GROUND  
INVESTIGATIONS  
IRELAND**

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# Ground Investigations Ireland

## Stillorgan Library

## Ground Investigation Report

### ***DOCUMENT CONTROL SHEET***

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## **1.0 Preamble**

On the instructions of Hayes Higgins Partnership, a site investigation was carried out by Ground Investigations Ireland Ltd., in December 2017 at the site of the proposed development in Stillorgan, Co. Dublin.

## **2.0 Overview**

### **2.1. Background**

It is proposed to construct a mixed used development with associated services, access roads and car parking at the proposed site. The site is currently occupied by Stillorgan Library and St Laurence's residential development and is situated adjacent to the N11 close to the Stillorgan Shopping Centre. The proposed construction is envisaged to consist of conventional 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. Cable Percussion boreholes to a maximum depth of 6.0m BGL
- Carry out 5 No. Rotary Core Boreholes to a maximum depth of 11.40m BGL
- Installation of 2 No. Groundwater monitoring wells
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

## **3.0 Subsurface Exploration**

### **3.1. 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.

### **3.2. Cable Percussion Boreholes**

The Cable Percussion Boreholes were drilled using a Dando 2000 drilling rig with regular in-situ testing and sampling undertaken to facilitate the production of geotechnical logs and laboratory testing.

The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason, thin lenses of granular material may not be noticed. Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata. Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 60° cone. The Standard Penetration Test number referred to as the 'N' value is the number of blows required to drive the tube 300mm, after an initial penetration of 150mm. The number gives a guide to the consistency of the soil and can also be used to estimate the relative strength/density at the depth of the test and also to estimate the bearing capacity and compressibility of the soil. The cable percussion borehole logs are provided in Appendix 2 of this Report.

### **3.3. Rotary Boreholes**

The rotary coring was carried out by a track mounted T47 Beretta rig at the locations shown on the location plan in Appendix 1. The rotary boreholes were completed from the ground surface or alternatively, where noted on the individual borehole log, from the base of the cable percussion borehole where a temporary liner was installed to facilitate follow-on rotary coring.

The T47 Beretta is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The T47 Beretta utilises a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small diameter wire rope or line attached to the "overshoot" recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or water flush is passed from the surface through hollow drill rods to the drill bit, and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids.

It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring. The recovery achieved, where required is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 2 of this Report.

### **3.4. Surveying**

The exploratory hole locations have been recorded using a Trimble R10 GNSS System which records the coordinates and elevation of the locations to ITM or Irish National Grid as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

### **3.5. Groundwater Monitoring Installations**

Groundwater Monitoring Installation were installed upon the completion of the boreholes to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consists of a 50mm HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the Engineers specification. Where required the standpipe is sealed with a gas tap and finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of this Report.

### **3.6. 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 Jones Environmental Laboratory in the UK. Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD) tests were carried out in NMML's Geotechnical Laboratory in Carlow. Rock strength testing including Point Load ( $Is_{50}$ ) testing was carried out in Trinity College Dublin's Geotechnical Laboratory. The results of the laboratory testing are included in Appendix 3 of this Report.

## 4.0 Ground Conditions

### 4.1. 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;

- Topsoil
- Made Ground
- Granular Deposits
- Cohesive Deposits
- Bedrock

**TOPSOIL:** Topsoil was encountered in all the exploratory holes and was present to a maximum depth of 0.5m BGL.

**MADE GROUND:** Made Ground deposits were encountered beneath the Topsoil and was present to a depth of 1.1m BGL in BH05. These deposits were described as *dark brown sandy gravelly CLAY with frequent cobbles and contained occasional fragments of wood*.

**COHESIVE DEPOSITS:** Cohesive deposits were encountered beneath the Made Ground and were described typically as *brown slightly sandy gravelly CLAY with occasional cobbles* 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. The strength of the cohesive deposits was soft or soft to firm and became stiff below 3.0m BGL in the majority of the exploratory holes with the exception of BH03 and BH04 where the soft to firm deposits were present to the top of the weathered rock. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

**BEDROCK:** The rotary core boreholes recovered weak strong to medium strong light brown mottled grey medium to coarse grained micaceous GRANITE. The depth to rock varies from 3.7m BGL in BH04 to a maximum of 6.7m BGL in BH03. The total core recovery is good, typically 100% with some of the uppermost runs dropping to 70 or 80%. The SCR and RQD both are relatively poor throughout due to the amount of weathering, often recovered as non-intact. The point load testing indicates that the granite is very weak to strong where tested.

### 4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible drilling was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. 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 tide, time of year, rainfall, nearby construction and other factors. For this reason, standpipes were installed in BH02 and BH05 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 4 of this Report.

### **4.3. Laboratory Testing**

The geotechnical testing carried out on soil samples recovered generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be a CLAY of low to intermediate plasticity. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging between 21% and 33% generally with fines contents of 37 to 45%.

The pH and sulphate testing carried out indicate that pH results are near neutral (7.87 – 8.59) 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.

The results of the Waste Acceptance Criterial Test Suite are presented with the individual parameter limits for “Inert” “Non Hazardous” and “Hazardous” as outlined within European Council Directive 1999 131/EC Article 16 Annex II, “Criteria and procedures for the acceptance of waste at landfills”. The intended disposal site should be consulted to ensure compliance with their specific requirements.

The results indicate that the results are below the inert limits, all spoil disposed of off-site should be sent to a suitably licenced facility. 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.

The results from the completed laboratory testing is included in Appendix 3 of this report.

## **5.0 Recommendations & Conclusions**

### **5.1. 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.

### **5.2. Foundations**

An allowable bearing capacity of 100 kN/m<sup>2</sup> is recommended for conventional strip or pad foundations on the firm to stiff cohesive deposits at a depth of 3.0m BGL with the exception of BH04 where the foundations should be brought down to the medium strong Granite at 3.7m BGL due to the presence of soft to firm deposits to this depth. The underlying Granite bedrock is at depths of between 3.7m and 6.7m BGL and a higher allowable bearing capacity of 750 kN/m<sup>2</sup> is recommended on this stratum. If high loading is anticipated from the proposed development, piled foundation may be more economically advantageous. The type, size and depth of the pile foundations should be confirmed by a specialist piling contractor based on the loading from the proposed building.

In any part of the site, should part of the foundation be on rock we would recommend that all the foundations of the unit in question be lowered to the competent rock stratum to avoid differential settlement.

The possibility for variation in the depth of the soft to firm cohesive deposits in the vicinity of these foundations should be considered and foundation inspections should be carried out. Any soft spots encountered at the proposed foundation depths should be excavated and replaced with lean mix concrete. The pH and sulphate testing completed on samples recovered from the trial pits indicates the pH results are near neutral and the sulphate results are low, when compared to the guideline values from BRE Special Digest 1:2005. No special precautions are required for concrete foundations to prevent sulphate attack.

### **5.3. Excavations**

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. 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.

Any excavations which penetrate the weathered rock/granular deposits will require to be appropriately battered or the sides supported and are likely to require dewatering due to the groundwater seepages noted in the exploratory hole logs in the Appendices of this Report. Any material to be removed off site should be disposed of to a suitably licenced landfill.

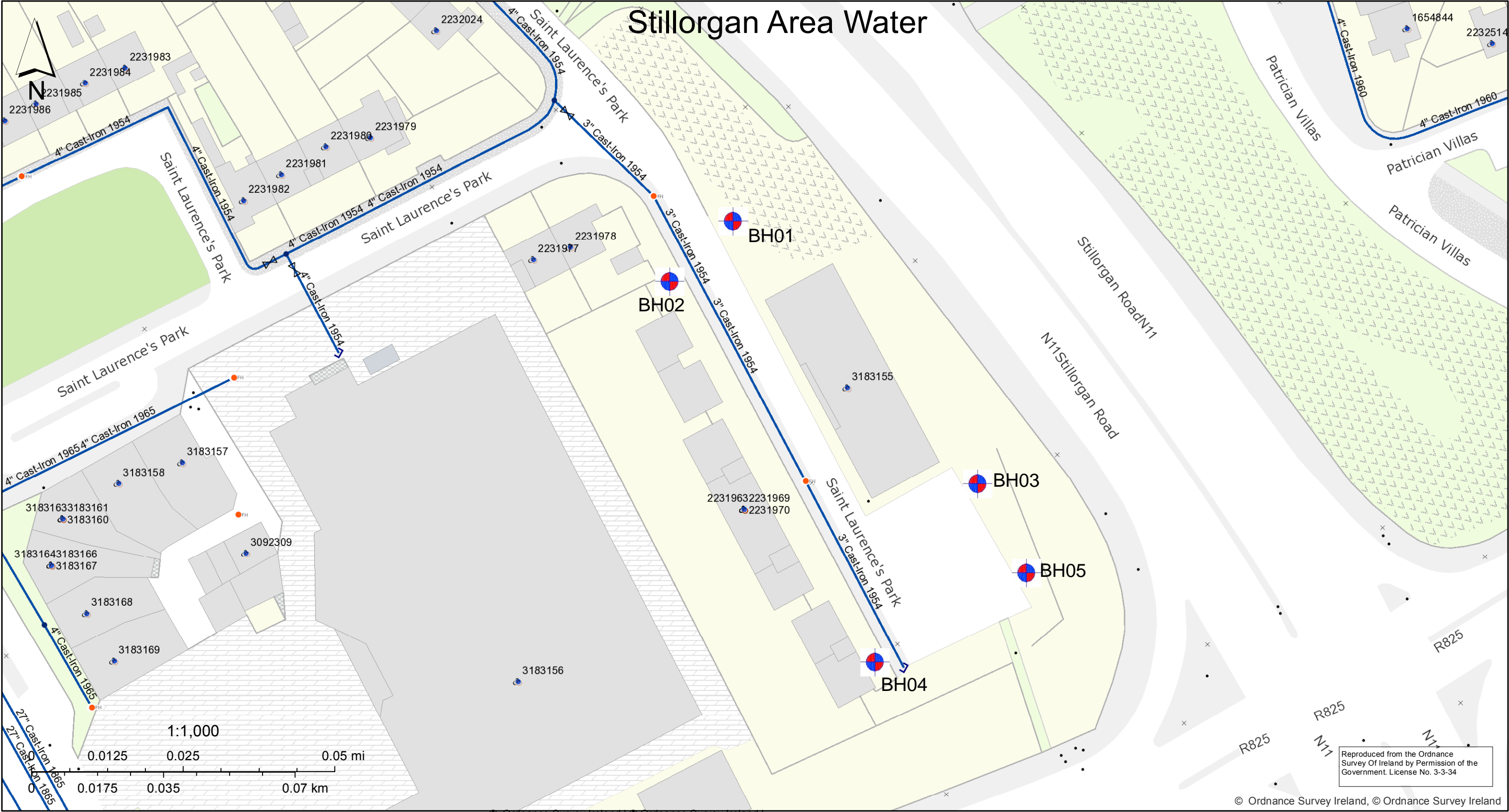
Excavations in the upper cohesive and weathered rock deposits are expected to be excavatable with conventional excavation equipment, with zones of more intact bedrock below this depth requiring rock



breaking techniques. Based on the fracture spacing, the rock strength testing and Pettifer & Fookes (1994) Revised Excavatability Graph, the granite bedrock ranges from hard digging to hard ripping, however the zones recovered as non-intact should be easy to hard digging. The point load strength testing is variable and zones of stronger unweathered bedrock may be encountered.

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**



November 21, 2017

### Legend

**Flow Control Valves**

- Non-return
- Hydro
- Orifice Plate
- PRV
- PSV
- Other

**Non Boundary Valves**

- Open

**Boundary Valves**

- Open

**Non Boundary Meter**

- Meter
- Group Scheme
- Source

**Boundary Meter**

- District (Boundary Meter)

**Water Hydrants**

- Fire Hydrant
- Fire Hydrant/Washout

**Reservoir**

- Potable
- Raw Water
- Pump Stations
- Water Network Structures
- Abstraction Point
- Kisok

**Water Fittings**

- Cap
- Other Fitting
- Water Distribution Chambers
- Pressure Monitoring Point

**Water Mains(Irish Water Owned)**

- Untreated
- Potable Water

**Water Mains(Non Irish Water Owned)**

- Untreated
- Potable Water

**Water Lateral Lines**

- Irish Water
- Non IW
- Water Abandoned Lines

Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland. It should not be relied upon in the event of excavations or other works being carried out in the vicinity of the network. The onus is on the parties carrying out the works to ensure the exact location of the network is identified prior to mechanical works being carried out. Service pipes are not generally shown but their presence should be anticipated. © Irish Water

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## **APPENDIX 2 – Cable Percussion Borehole and Rotary Core Records**



# Ground Investigations Ireland Ltd

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**Site**  
Stillorgan Library

**Borehole Number**  
BH01

<b>Machine</b> : Dando 2000 and Beretta T47S	<b>Casing Diameter</b> 200mm cased to 5.50m	<b>Ground Level (mOD)</b> 49.05	<b>Client</b> Hayes Higgins	<b>Job Number</b> 7289-12-17
<b>Method</b> : Cable Percussion and Rotary core follow on	<b>Location</b> 320288.3 E 228125.6 N	<b>Dates</b> 18/12/2017-18/01/2018	<b>Project Contractor</b> Ground Investigations Ireland	<b>Sheet</b> 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00	B				48.75	(0.30)	Dark brown sandy gravelly TOPSOIL		
1.20-1.65	SPT N=7			1,1/2,2,1,2		0.30	Soft to firm brown slightly sandy gravelly CLAY with some sub angular cobbles and occasional boulders		
2.00	B					(2.70)			
2.00-2.45	SPT N=6			2,2/1,1,2,2					
3.00	B				46.05	3.00	Stiff brown slightly sandy gravelly CLAY with some sub angular cobbles and occasional boulders		
3.00-3.45	SPT N=15			2,3/4,4,3,4		(0.70)			
4.00	B				45.35	3.70	Very stiff black slightly sandy gravelly CLAY with some sub rounded cobbles and occasional boulders		
4.00-4.45	SPT N=36			3,5/7,7,10,12		(1.30)			
5.00	B				44.05	5.00	Light brown micaceous GRANITE recovered as light brown clayey very sandy fine to coarse angular cobbles of granite, highly weathered		▽1
5.00-5.17	SPT 50/15			10,15/15,17,18		(1.00)			▽1
6.00	TCR	SCR	RQD	FI	43.05	6.00	Weak to medium strong brownish orange coarse grained micaceous GRANITE which is highly weathered		
6.00	14								
6.90-7.11									
6.90	80	29	11						
8.40				10		(5.40)	(6.90m-9.90m) Fractures are 50-70 degrees rough undulating close to medium spacing with sandy clay infill		
	100	45	33						
9.90									

<b>Remarks</b> Hand Pit dug to 1.2m BGL Cable percussion to 6.00m BGL with follow on rotary coring to 11.40m BGL. Chiselling from 2.30m to 2.60m for 1 hour.	<b>Scale (approx)</b> 1:50	<b>Logged By</b> GK
<b>Figure No.</b> 7289-12-17.BH01		



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**Site**  
Stillorgan Library

**Borehole Number**  
**BH01**

<b>Machine</b> : Dando 2000 and Beretta T47S <b>Flush</b> : <b>Core Dia</b> : mm <b>Method</b> : Cable Percussion and Rotary core follow on	<b>Casing Diameter</b> 200mm cased to 5.50m <b>Location</b> 320288.3 E 228125.6 N	<b>Ground Level (mOD)</b> 49.05 <b>Dates</b> 18/12/2017-18/01/2018	<b>Client</b> Hayes Higgins <b>Project Contractor</b> Ground Investigations Ireland	<b>Job Number</b> 7289-12-17 <b>Sheet</b> 2/2
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Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
11.40	83	13	0	NI		37.65	11.40	(9.90m-11.4m) Non intact		
								Complete at 11.40m		

<b>Remarks</b>	<b>Scale (approx)</b> 1:50	<b>Logged By</b> GK
	<b>Figure No.</b> 7289-12-17.BH01	



# Ground Investigations Ireland Ltd

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**Site**  
Stillorgan Library

**Borehole Number**  
**BH02**

**Machine** : Dando 2000 and BerettaT47S  
**Method** : Cable Percussion with rotary core follow on

**Casing Diameter**  
200mm cased to 5.20m

**Ground Level (mOD)**  
49.37

**Client**  
Hayes Higgins

**Job Number**  
7289-12-17

**Location**  
320278.6 E 228118.5 N

**Dates**  
19/12/2017-09/01/2018

**Project Contractor**  
Ground Investigations Ireland

**Sheet**  
1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
1.00	B					(0.50)	Dark brown sandy gravelly TOPSOIL			
1.20-1.65	SPT N=6			1,2/0,1,3,2	48.87	0.50	Soft brown sandy gravelly CLAY with some sub angular cobbles			
2.00	B				48.37	1.00	Firm brown slightly sandy gravelly CLAY with some sub angular cobbles and occasional boulders			
2.00-2.45	SPT N=9			2,2/3,2,2,2		(2.00)				
3.00	B				46.37	3.00	Stiff brown slightly sandy gravelly CLAY with some sub angular cobbles and occasional boulders			
3.00-3.45	SPT N=16			3,2/4,4,4,4		(0.80)				
4.00	B				45.57	3.80	Very stiff black slightly sandy gravelly CLAY with some sub rounded cobbles and occasional boulders			
4.00-4.45	SPT N=42			6,8/8,8,14,12		(0.80)				
5.00	B				44.77	4.60	Weak to medium strong brown medium to coarse grained micaceous GRANITE recovered as light brown clayey very sandy fine to coarse angular cobbles of Granite			
5.00-5.17	SPT 50/15			Water strike(1) at 4.60m, no rise after 20 mins. 8,11/50	44.17	5.20	Medium strong light grey medium to coarse micaceous GRANITE, highly weathered			
5.50	TCR	SCR	RQD	FI	43.87	5.50	Medium strong brown coarse micaceous GRANITE that is highly weathered			
6.90	71	17	17				(5.5m-9.0m) Non intact			
8.40	100	23	15	NI		(4.40)				
9.00	100	45	20				(9.0m-9.9m) Fractures are 60-80 degrees rough undulating, medium to closely spaced with sandy clay along fracture surfaces			
9.90					39.47	9.90				

**Remarks**  
Hand Pit dug to 1.2m BGL  
Cable percussion to 5.20m BGL with follow on rotary coring to 9.90m BGL.  
50mm slotted standpipe installed from 0.9m to 9.9m BGL with pea gravel surround. Plain pipe installed from 0.9m to groundlevel with bentonite surround.

**Scale (approx)**  
1:50  
**Logged By**  
GK

**Figure No.**  
7289-12-17.BH01





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**Site**  
Stillorgan Library

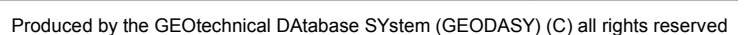
**Borehole Number**  
**BH03**



















<b>Machine</b> : Dando 2000 and Beratte T47S	<b>Casing Diameter</b> 200mm cased to 4.50m	<b>Ground Level (mOD)</b> 49.03	<b>Client</b> Hayes Higgins	<b>Job Number</b> 7289-12-17
<b>Method</b> : Cable Percussion and rotary core follow on	<b>Location</b> 320326.3 E 228087.8 N	<b>Dates</b> 19/12/2017-08/01/2018	<b>Project Contractor</b> Ground Investigations Ireland	<b>Sheet</b> 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00	B					(0.50)	Dark brown sandy gravelly TOPSOIL		
1.20-1.65	SPT N=3			0,0/0,1,1,1	48.53	0.50	Very soft brown sandy gravelly CLAY with some sub angular cobbles		
					47.83	1.20	Soft becoming firm brown slightly sandy gravelly CLAY with sub angular and occasional boulders		
2.00	B			1,1/2,2,1,1		(1.80)			
2.00-2.45	SPT N=6								
3.00	B			4,3/3,3,3,2	46.03	3.00	Firm brown slightly sandy gravelly CLAY with some sub angular cobbles and occasional boulders		
3.00-3.45	SPT N=11					(1.10)			
4.00	B			Water strike(1) at 4.00m, rose to 3.10m in 20 mins.	44.93	4.10	Obstruction. Drillers notes pushing boulder 4.1m to 4.5m BGL.		
	TCR	SCR	RQD	FI	44.53	(0.40)	Driller Notes: GRAVEL, Returns of meduim dense light brown sandy subangular coarse GRAVEL		
4.50	20	0	0			4.50			
5.40-5.85				3,2/3,4,5,5		(2.20)			
5.40	15	15	15						
					42.33	6.70	Weak to Meduim strong yellowish brown coarse grained GRANITE that is distinctly weathered (5.40m-8.10m) Two fracture: F1 close to medium spaced 0-20 degrees undulating rough with some oxidation visible in fractures, F2 medium spaced 70-80 degrees undulating rough open with some oxidation in the fractures		
6.90	82	57	39			(2.80)			
8.10				NI					
8.40	72	20	20						
9.50				4	39.53	9.50	Weak to meduim strong yellowish brown fine to medium grained GRANITE that is distinctly weathered (9.50m-9.90m) Two fracture: F1 closely spaced 0-30 degrees undulating rough, F2 closely spaced 45		
9.90						(0.70)			

<b>Remarks</b> Hand Pit dug to 1.2m BGL Chiselling from 4.10m to 4.50m for 1 hour.	<b>Scale (approx)</b> 1:50	<b>Logged By</b> GK
	<b>Figure No.</b> 7289-12-17.BH01	





<div></div> <div>Ground Investigations Ireland Ltd www.gii.ie</div>							Site Stillorgan Library		Borehole Number BH04	
Machine : Dando 2000 and Beretta T47S		Casing Diameter 200mm cased to 3.90m		Ground Level (mOD) 49.51		Client Hayes Higgins		Job Number 7289-12-17		
Method : Cable Percussion with rotary core follow on		Location 320313.3 E 228059.3 N		Dates 15/12/2017-09/01/2018		Project Contractor Ground Investigations Ireland		Sheet 1/1		
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
1.00	B			1,2/1,2,2,1  Water strike(1) at 1.50m, no rise after 20 mins.		(0.50)	Dark brown sandy gravelly TOPSOIL			
1.20-1.65	SPT N=6				49.01	0.50	Soft brown sandy gravelly CLAY with some sub angular cobbles			
2.00	B				48.51	1.00	Very soft brown slightly sandy gravelly CLAY with some sub angular cobbles and occasional boulders			
2.00-2.45	SPT N=2			0,1/1,1,0,0	47.51	2.00	Soft to firm brown slightly sandy gravelly CLAY with some sub angular cobbles and occasional boulders			
3.00	B			3,2/2,1,2,2  25/50 B SPT N=50		(1.70)				
3.00-3.45	SPT N=7									
3.90	TCR	SCR	RQD							
3.90-4.45	100				45.81	3.70	Medium strong grey brown micaceous medium to coarse GRANITE, distinctly weathered			
3.60										
3.70										
3.90	87	67	44	8		(2.10)	(3.9m - 5.8m) Two Fracture sets. F1) Fractures are 20 - 30 degrees, rough, stepped, undulose, close to medium spaced with some clay infill. F2) Fractures are 70 - 80 degrees, rough, stepped, undulose, medium spaced with staining on the fracture surfaces			
5.40										
5.80				NI	43.71	5.80	Weak white grey micaceous medium GRANITE, distinctly weathered			
6.30	100	67	21		43.21	6.30	Medium strength grey mottled brown micaceous medium to coarse GRANITE, distinctly weathered			
6.90				6						
7.40	100	53	23	NI		(2.10)	(6.3m - 7.4m) Two Fracture sets. F1) Fractures are 20 - 30 degrees, rough, stepped, undulose, close to medium spaced with some staining on the fracture surfaces. F2) Fractures are 70 - 80 degrees, rough, stepped, undulose, medium spaced with staining on the fracture surfaces			
8.00										
8.40					41.11	8.40	Complete at 8.40m			
Remarks Hand Pit dug to 1.2m BGL Smell of sewage noted on drillers log from 1.5m BGL Shelling stopped at 3.9m BGL due to risk of exposing drill crew to sewage. Follow on rotary from 3.9m BGL								Scale (approx) 1:50	Logged By GK	
								Figure No. 7289-12-17.BH01		



# Ground Investigations Ireland Ltd

www.gii.ie




**Site**  
Stillorgan Library

**Borehole Number**  
**BH05**

<b>Machine :</b> Dando 2000 and Beretta T47S  <b>Method :</b> Cable Percussion and Rotary core follow on	<b>Casing Diameter</b> 200mm cased to 5.50m	<b>Ground Level (mOD)</b> 49.17	<b>Client</b> Hayes Higgins	<b>Job Number</b> 7289-12-17
	<b>Location</b> 320332.9 E 228075.4 N	<b>Dates</b> 20/10/2017-08/01/2018	<b>Project Contractor</b> Ground Investigations Ireland	<b>Sheet</b> 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
1.00	B						MADE GROUND consisting of dark brown sand gravelly Clay with some sub rounded cobbles and fragments of wood			
1.20-1.65	SPT N=4			1,1/2,1,0,1	48.07	1.10	Firm becoming stiff brown slightly sandy gravelly CLAY with some sub angular cobbles			
2.00	B									
2.00-2.45	SPT N=50			2,2/50		(2.80)				
3.00	B									
3.00-3.45	SPT N=12			3,4/3,3,4,2						
4.00	B				45.27	3.90	Very stiff black slightly sandy gravelly CLAY with some sub rounded cobbles and occasional boulders			
4.00-4.45	SPT N=20			3,5/6,4,5,5		(0.80)				
5.00	B				44.47	4.70	Possible weathered GRANITE recovered as light brown clayey very sandy fine to coarse angular cobbles of Granite			
5.00-5.17	SPT 37/15			Water strike(1) at 4.60m, no rise after 20 mins. 5,7/6,9,11,11		(0.80)				
5.50	TCR	SCR	RQD	FI	43.67	5.50	Weak to medium strong brown medium to coarse grained micaceous GRANITE that is highly weathered (5.5m-6.2m) Fractures are 0-20 degrees rough undulating close to medium spacing with clay and sand infill			
6.20	100	53	37	5			(6.2m-6.9m) Non intact			
6.90				NI		(2.90)				
7.40	100	71	33	4			(6.9m-7.4m) Fractures are 0-20 degrees rough undulating close to medium spacing with clay and sand infill			
8.40				14	40.77	8.40	Weak brown coarse micaceous GRANITE that is highly weathered			
	80	7	0	NI		(1.50)	(8.2m-9.9m) Fractures are 20-50 degrees rough undulating closely spaced with occasional clay infill			
9.90					39.27	9.90				

<b>Remarks</b> Hand Pit dug to 1.2m BGL Cable percussion to 5.50m BGL with follow on rotary coring to 10.70m BGL. 50mm slotted standpipe installed from 1.7m to 10.7m BGL with pea gravel surround. Plain pipe installed from 1.7m to ground level with benonite surround. Chiselling from 2.30m to 2.60m for 1 hour.	<b>Scale (approx)</b> 1:50	<b>Logged By</b> GK
	<b>Figure No.</b> 7289-12-17.BH01	

		<b>Ground Investigations Ireland Ltd</b> www.gii.ie						<b>Site</b> Stillorgan Library		<b>Borehole Number</b> <b>BH05</b>	
<b>Machine :</b> Dando 2000 and Beretta T47S <b>Flush :</b> <b>Core Dia:</b> mm <b>Method :</b> Cable Percussion and Rotary core follow on		<b>Casing Diameter</b> 200mm cased to 5.50m		<b>Ground Level (mOD)</b> 49.17		<b>Client</b> Hayes Higgins		<b>Job Number</b> 7289-12-17			
		<b>Location</b> 320332.9 E 228075.4 N		<b>Dates</b> 20/10/2017-08/01/2018		<b>Project Contractor</b> Ground Investigations Ireland		<b>Sheet</b> 2/2			
<b>Depth (m)</b>	<b>TCR</b>	<b>SCR</b>	<b>RQD</b>	<b>FI</b>	<b>Field Records</b>	<b>Level (mOD)</b>	<b>Depth (m) (Thickness)</b>	<b>Description</b>	<b>Legend</b>	<b>Water</b>	<b>Instr</b>
10.70	100	100	100	0		38.47	(0.80)	Medium strong light brown mottled white coarse micaceous GRANITE that is weathered (9.9m-10.7m) No Fractures			
								Complete at 10.70m			
<b>Remarks</b>									<b>Scale (approx)</b> 1:50	<b>Logged By</b> GK	
									<b>Figure No.</b> 7289-12-17.BH01		

## Stillorgan Library – Rotary Core Photographs

RC01



RC01



RC02





RC02



RC03



RC03



RC04



RC04



RC05



RC05





## **APPENDIX 3 – Laboratory Testing**



# Exova Jones Environmental

Registered Address : Exova (UK) Ltd, Lochend Industrial Estate, Newbridge, Midlothian, EH28 8PL

Unit 3 Deeside Point  
Zone 3  
Deeside Industrial Park  
Deeside  
CH5 2UA

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

Tel: +44 (0) 1244 833780

Fax: +44 (0) 1244 833781



<b>Attention :</b>	Conor Finnerty
<b>Date :</b>	24th January, 2018
<b>Your reference :</b>	7289-12-17
<b>Our reference :</b>	Test Report 18/486 Batch 1
<b>Location :</b>	Stillorgan Library
<b>Date samples received :</b>	15th January, 2018
<b>Status :</b>	Final report
<b>Issue :</b>	1

Six samples were received for analysis on 15th January, 2018 of which six 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.

**Compiled By:**

**Phil Sommerton BSc**  
**Project Manager**

Please see attached notes for all abbreviations and acronyms

**Client Name:** Ground Investigations Ireland  
**Reference:** 7289-12-17  
**Location:** Stillorgan Library  
**Contact:** Conor Finnerty  
**JE Job No.:** 18/486

**Report : Solid**

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

J E Sample No.	1-4	5-7	8-10	11-13	14-16	17					Please see attached notes for all abbreviations and acronyms		
Sample ID	BH01	BH02	BH04	BH04	BH05	BH05							
Depth	1.00	1.00	1.00	3.00	1.00	3.00							
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T	T							
Sample Date	11/01/2018	11/01/2018	11/01/2018	11/01/2018	11/01/2018	11/01/2018							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1							
Date of Receipt	15/01/2018	15/01/2018	15/01/2018	15/01/2018	15/01/2018	15/01/2018					LOD/LOR	Units	Method No.
TPH CWG													
<b>Aliphatics</b>													
>C5-C6 #	<0.1	<0.1	<0.1	<0.1	<0.1	-					<0.1	mg/kg	TM36/PM12
>C6-C8 #	<0.1	<0.1	<0.1	<0.1	<0.1	-					<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1	<0.1	-					<0.1	mg/kg	TM36/PM12
>C10-C12 #	<0.2	<0.2	<0.2	<0.2	<0.2	-					<0.2	mg/kg	TM5/PM16
>C12-C16 #	<4	<4	<4	<4	<4	-					<4	mg/kg	TM5/PM16
>C16-C21 #	<7	<7	<7	<7	<7	-					<7	mg/kg	TM5/PM16
>C21-C35 #	<7	<7	<7	<7	<7	-					<7	mg/kg	TM5/PM16
>C35-C40	<7	<7	<7	<7	<7	-					<7	mg/kg	TM5/PM16
Total aliphatics C5-40	<26	<26	<26	<26	<26	-					<26	mg/kg	TM5/PM16
>C6-C10	<0.1	<0.1	<0.1	<0.1	<0.1	-					<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10	<10	-					<10	mg/kg	TM5/PM16
>C25-C35	<10	<10	<10	<10	<10	-					<10	mg/kg	TM5/PM16
<b>Aromatics</b>													
>C5-EC7 #	<0.1	<0.1	<0.1	<0.1	<0.1	-					<0.1	mg/kg	TM36/PM12
>EC7-EC8 #	<0.1	<0.1	<0.1	<0.1	<0.1	-					<0.1	mg/kg	TM36/PM12
>EC8-EC10 #	<0.1	<0.1	<0.1	<0.1	<0.1	-					<0.1	mg/kg	TM36/PM12
>EC10-EC12 #	<0.2	<0.2	<0.2	<0.2	<0.2	-					<0.2	mg/kg	TM5/PM16
>EC12-EC16 #	<4	<4	<4	<4	<4	-					<4	mg/kg	TM5/PM16
>EC16-EC21 #	<7	<7	<7	<7	<7	-					<7	mg/kg	TM5/PM16
>EC21-EC35 #	<7	<7	<7	<7	<7	-					<7	mg/kg	TM5/PM16
>EC35-EC40	<7	<7	<7	<7	<7	-					<7	mg/kg	TM5/PM16
Total aromatics C5-40	<26	<26	<26	<26	<26	-					<26	mg/kg	TM5/PM16
Total aliphatics and aromatics(C5-40)	<52	<52	<52	<52	<52	-					<52	mg/kg	TM5/PM16
>EC6-EC10 #	<0.1	<0.1	<0.1	<0.1	<0.1	-					<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	<10	<10	<10	-					<10	mg/kg	TM5/PM16
>EC25-EC35	<10	<10	<10	<10	<10	-					<10	mg/kg	TM5/PM16
MTBE #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM31/PM12
Benzene #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM31/PM12
Toluene #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM31/PM12
Ethylbenzene #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM31/PM12
m/p-Xylene #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM31/PM12
o-Xylene #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM31/PM12
PCB 28 #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM17/PM8
PCB 52 #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM17/PM8
PCB 118 #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM17/PM8
PCB 138 #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5	<5	-					<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35	<35	<35	<35	-					<35	ug/kg	TM17/PM8

Please see attached notes for all abbreviations and acronyms

**Client Name:** Ground Investigations Ireland  
**Reference:** 7289-12-17  
**Location:** Stillorgan Library  
**Contact:** Conor Finnerty  
**JE Job No.:** 18/486

**Report :** CEN 10:1 1 Batch

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

J E Sample No.	1-4	5-7	8-10	11-13	14-16						Please see attached notes for all abbreviations and acronyms		
Sample ID	BH01	BH02	BH04	BH04	BH05								
Depth	1.00	1.00	1.00	3.00	1.00								
COC No / misc													
Containers	V J T	V J T	V J T	V J T	V J T								
Sample Date	11/01/2018	11/01/2018	11/01/2018	11/01/2018	11/01/2018								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	15/01/2018	15/01/2018	15/01/2018	15/01/2018	15/01/2018						LOD/LOR	Units	Method No.
Dissolved Antimony #	0.002	<0.002	0.003	0.004	<0.002						<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	0.03	0.04	<0.02						<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	0.0267	0.0044	<0.0025						<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	0.267	0.044	<0.025						<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	<0.003	0.005	<0.003	<0.003						<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	<0.03	0.05	<0.03	<0.03						<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<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						<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015						<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	<0.015						<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007	<0.007						<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07	<0.07						<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<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						<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.005	0.006	0.041	0.013	0.005						<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.05	0.06	0.41	0.13	0.05						<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<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						<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<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						<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	<0.003	<0.003	<0.003	<0.003						<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03						<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVA#	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001						<0.00001	mg/l	TM61/PM38
Mercury Dissolved by CVA#	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001						<0.0001	mg/kg	TM61/PM38
Phenol	<0.01	<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						<0.1	mg/kg	TM26/PM0
Fluoride	0.5	0.5	0.4	0.4	0.4						<0.3	mg/l	TM173/PM0
Fluoride	5	5	4	4	4						<3	mg/kg	TM173/PM0
Sulphate as SO4 #	0.40	0.08	8.41	1.73	9.97						<0.05	mg/l	TM38/PM0
Sulphate as SO4 #	4.0	0.8	84.1	17.3	99.7						<0.5	mg/kg	TM38/PM0
Chloride #	0.6	<0.3	<0.3	<0.3	7.2						<0.3	mg/l	TM38/PM0
Chloride #	6	<3	<3	<3	72						<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	<2	<2	2	<2	<2						<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	<20	20	<20	<20						<20	mg/kg	TM60/PM0
pH	8.53	8.60	8.54	8.69	8.71						<0.01	pH units	TM73/PM0
Total Dissolved Solids #	94	85	104	56	86						<35	mg/l	TM20/PM0
Total Dissolved Solids #	940	850	1040	560	860						<350	mg/kg	TM20/PM0

6 of 17

**Matrix : Solid**



**Client Name:** Ground Investigations Ireland  
**Reference:** 17/12/7289  
**Location:** Stillorgan Library  
**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, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Jones Environmental Laboratory consultant, Jones Environmental Laboratory cannot be responsible for inaccurate or unrepresentative sampling.

Signed on behalf of Jones Environmental Laboratory:



Ryan Butterworth  
 Asbestos Team Leader

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Date Of Analysis	Analysis	Result
18/486	1	BH01	1.00	3	17/01/2018	General Description (Bulk Analysis)	Soil/Stones
					17/01/2018	Asbestos Fibres	NAD
					17/01/2018	Asbestos Fibres (2)	NAD
					17/01/2018	Asbestos ACM	NAD
					17/01/2018	Asbestos ACM (2)	NAD
					17/01/2018	Asbestos Type	NAD
					17/01/2018	Asbestos Type (2)	NAD
					17/01/2018	Asbestos Level Screen	NAD
18/486	1	BH02	1.00	6	17/01/2018	General Description (Bulk Analysis)	Soil/Stones
					17/01/2018	Asbestos Fibres	NAD
					17/01/2018	Asbestos Fibres (2)	NAD
					17/01/2018	Asbestos ACM	NAD
					17/01/2018	Asbestos ACM (2)	NAD
					17/01/2018	Asbestos Type	NAD
					17/01/2018	Asbestos Type (2)	NAD
					17/01/2018	Asbestos Level Screen	NAD
18/486	1	BH04	1.00	9	17/01/2018	General Description (Bulk Analysis)	Soil/Stones
					17/01/2018	Asbestos Fibres	NAD
					17/01/2018	Asbestos Fibres (2)	NAD
					17/01/2018	Asbestos ACM	NAD
					17/01/2018	Asbestos ACM (2)	NAD
					17/01/2018	Asbestos Type	NAD
					17/01/2018	Asbestos Type (2)	NAD
					17/01/2018	Asbestos Level Screen	NAD
18/486	1	BH04	3.00	12	17/01/2018	General Description (Bulk Analysis)	Soil/Stones
					17/01/2018	Asbestos Fibres	NAD
					17/01/2018	Asbestos Fibres (2)	NAD
					17/01/2018	Asbestos ACM	NAD
					17/01/2018	Asbestos ACM (2)	NAD
					17/01/2018	Asbestos Type	NAD
					17/01/2018	Asbestos Type (2)	NAD
					17/01/2018	Asbestos Level Screen	NAD
18/486	1	BH05	1.00	15	17/01/2018	General Description (Bulk Analysis)	Soil/Stones
					17/01/2018	Asbestos Fibres	NAD
					17/01/2018	Asbestos Fibres (2)	NAD

**Client Name:** Ground Investigations Ireland  
**Reference:** 17/12/7289  
**Location:** Stillorgan Library  
**Contact:** Conor Finnerty

[illegible]

**Matrix : Solid**

Reference: 7289-12-17

**Location:** Stillorgan Library

**Contact:** Conor Finnerty

[illegible]

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

JE Job No.: 18/486

### 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. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°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.

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

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

### 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.

### REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Please include all sections of this report if it is reproduced

**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 a Jones Environmental 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

JE Job No: 18/486

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/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.				
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 USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5	Modified USEPA 8015B method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) with carbon banding within the range C8-C40 GC-FID.	PM16	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	
TM5/TM36	please refer to TM5 and TM36 for method details	PM12/PM16	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis./Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			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

JE Job No: 18/486

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM21	Modified USEPA 415.1. Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO <sub>2</sub> 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
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 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
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.	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.	PM12	Modified US EPA method 5021. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	PM0	No preparation is required.	Yes		AR	Yes

JE Job No: 18/486

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	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 the Thermo Aquakem Photometric Automatic Analyser. Modified US EPA methods 325.2, 375.4, 365.2, 353.1, 354.1	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
TM60	Modified USEPA 9060. Determination of TOC by calculation from Total Carbon and Inorganic Carbon using a TOC analyser, the carbon in the sample is converted to CO2 and then passed through a non-dispersive infrared gas analyser (NDIR).	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.	PM38	Samples are brominated to reduce all mercury compounds to Mercury (II) which is analysed using method TM061.	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			AR	Yes
NONE	No Method Code	PM17	Modified method 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.				



JE Job No: 18/486

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	PM17	Modified method 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	

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

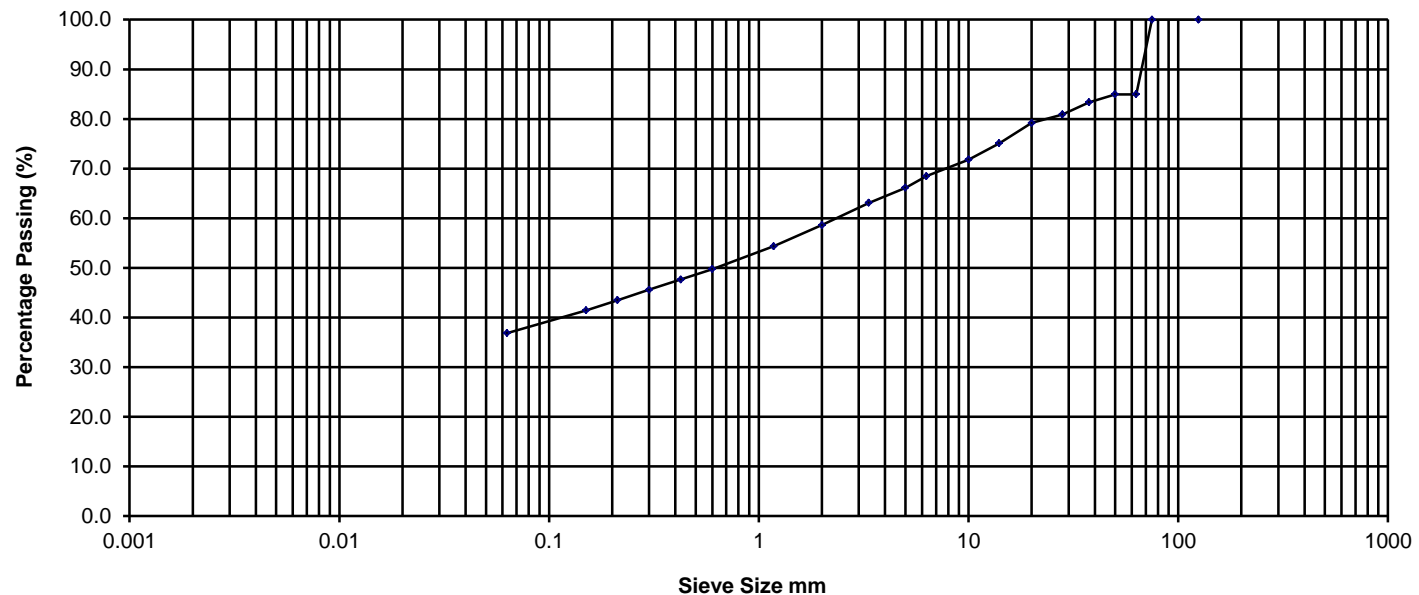
Leachate tests	
10l/kg; 4mm	I.S. EN 12457-2:2002 Specified particle size; water added to L/S ratio; capped; agitated for 24 ± 0.5 hours; eluate settled and filtered over 0.45 µm membrane filter.
Eluate analysis	
As	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Ba	I.S. EN 12506 : EN ISO 11885 (ICP-OES)
Cd	I.S. 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 - Jones Env)
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
<b>Notes:</b> *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, Dibenzo(a,h)anthracene, Fluorene, Fluoranthene, Indeno(1,2,3-c,d)pyrene, Phenanthrene and Pyrene.	

**NMTL Ltd**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	85.0
50.000	85.0
37.500	83.3
28.000	80.9
20.000	79.2
14.000	75.1
10.000	71.8
6.300	68.5
5.000	66.1
3.350	63.1
2.000	58.6
1.180	54.4
0.600	49.7
0.425	47.7
0.300	45.6
0.212	43.5
0.150	41.4
0.063	36.8

## Determination of Particle Size Distribution

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



Percentage Particle Size										Cobbles	Boulder
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
silt				Sand			Gravel				
36.8				21.8			26.3			15.0	0.0

Sample Description Brown slightly sandy very gravelly silty CLAY, with some cobbles.

Project No. NMTL 2426

BH/TP No. BH01

Sample No. B

Project Stillorgan Library

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	30/01/2018	Depth	3.00m
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**NM*****TL***

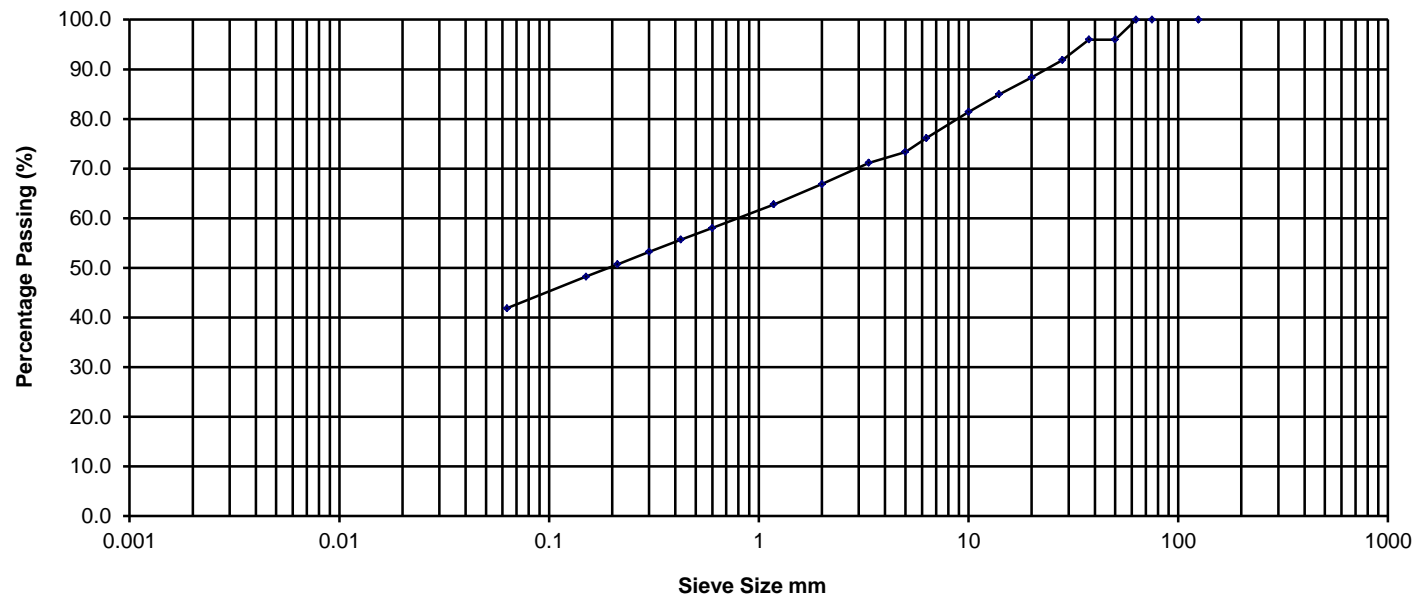
**Ltd**

**NMTL Ltd**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	96.0
37.500	96.0
28.000	91.9
20.000	88.3
14.000	85.0
10.000	81.4
6.300	76.2
5.000	73.4
3.350	71.2
2.000	66.9
1.180	62.8
0.600	58.0
0.425	55.7
0.300	53.2
0.212	50.7
0.150	48.2
0.063	41.9

## Determination of Particle Size Distribution

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



Percentage Particle Size										Cobbles	Boulder
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
silt				Sand			Gravel				
41.9				25.0			33.1			0.0	0.0

Sample Description Brown slightly sandy very gravelly silty CLAY.

Project No. NMTL 2426

BH/TP No. BH02

Sample No. B

Project Stillorgan Library

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	30/01/2018	Depth	2.00m
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<b><i>NM</i></b>	
	<b><i>TL</i></b>

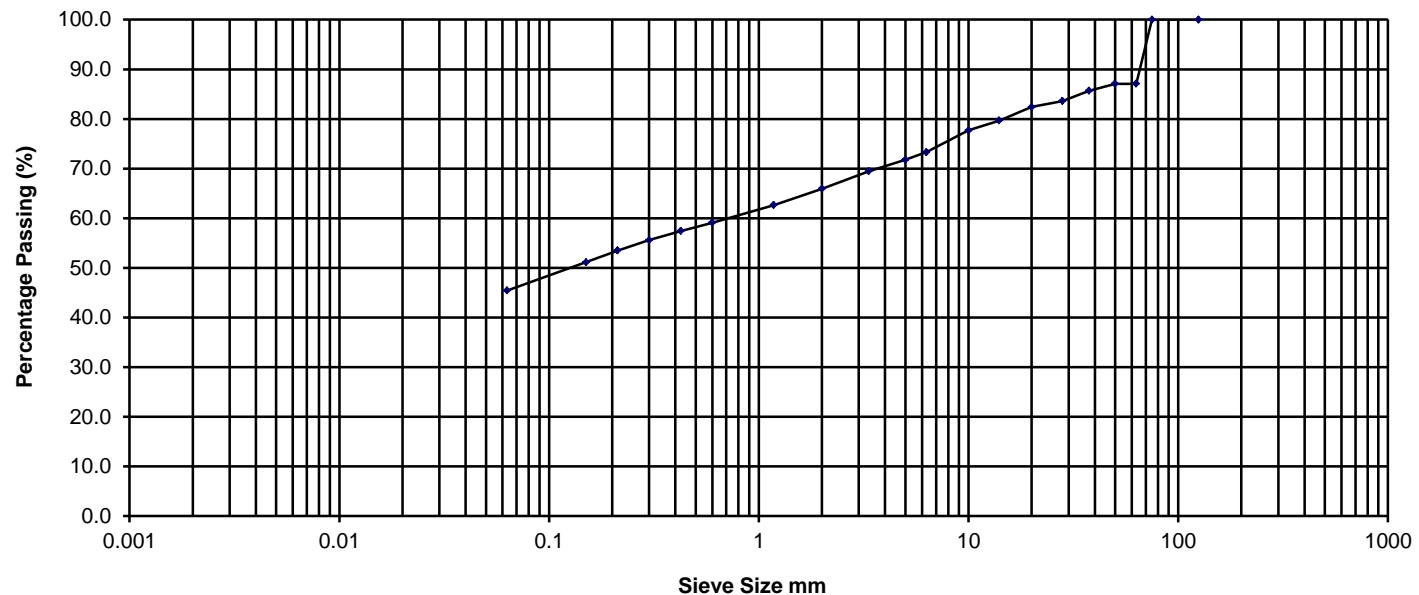
**Ltd**

**NMTL Ltd**

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	87.1
50.000	87.1
37.500	85.7
28.000	83.6
20.000	82.4
14.000	79.7
10.000	77.7
6.300	73.3
5.000	71.8
3.350	69.5
2.000	65.9
1.180	62.6
0.600	59.1
0.425	57.4
0.300	55.6
0.212	53.5
0.150	51.2
0.063	45.4

## Determination of Particle Size Distribution

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



Percentage Particle Size										Cobbles	Boulder
Clay	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		
silt				Sand			Gravel				
45.4				20.5			21.2			12.9	0.0

Sample Description Dark brown slightly sandy very gravelly silty CLAY, with some cobbles.

Project No. NMTL 2426

BH/TP No. BH03

Sample No. B

Project Stillorgan Library

Operator	Tzr	Checked	Nc	Approved	Bc	Date sample tested	30/01/2018	Depth	1.00m
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<b><i>NM</i></b>	
	<b><i>TL</i></b>

**Ltd**

**National Materials Testing Laboratory Ltd.**

**SUMMARY OF TEST RESULTS**

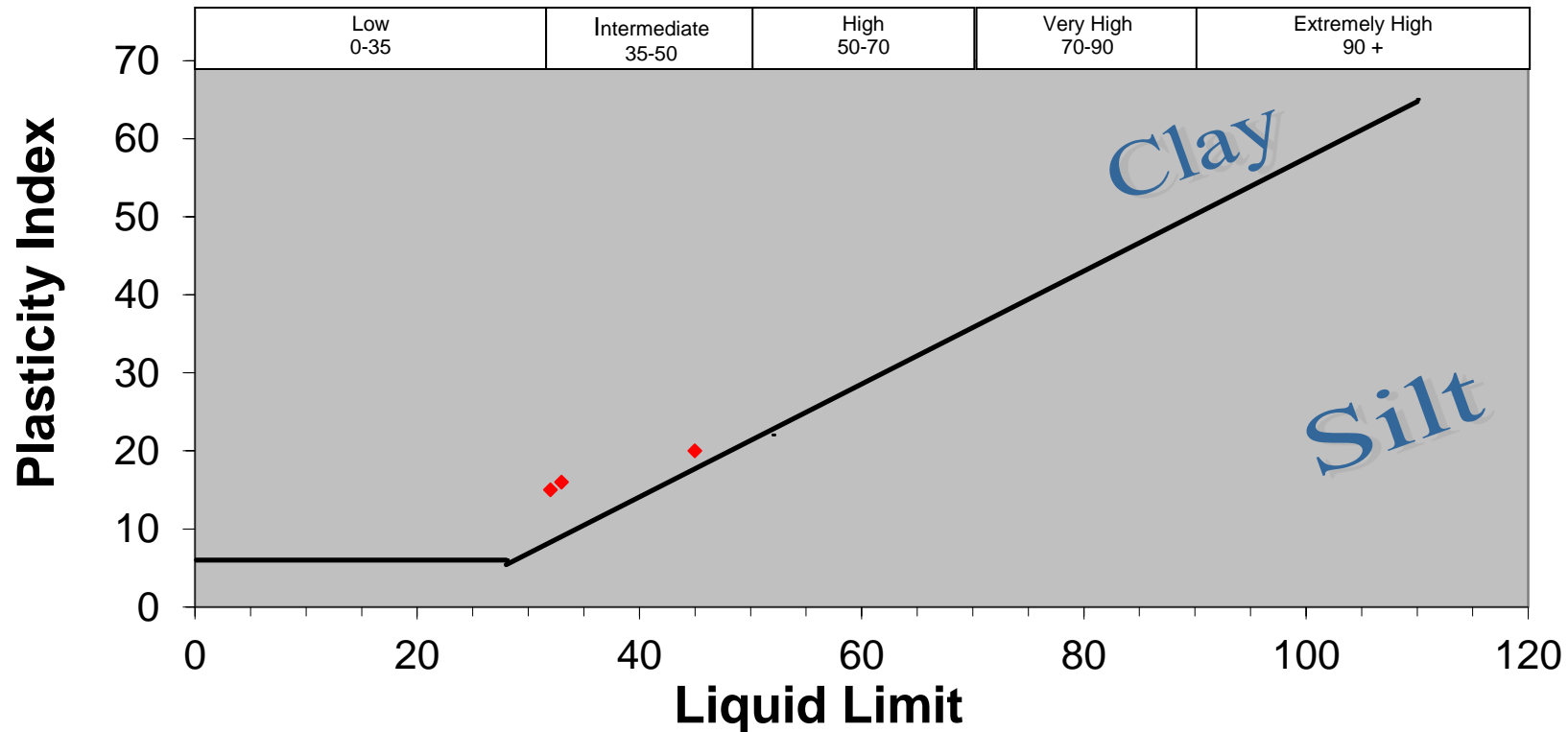
**National Materials Testing Laboratory Ltd.**

**SUMMARY OF TEST RESULTS**

				Particle			Index Properties		Bulk	Cell	Undrained Triaxial Tests		Lab	
BH/TP	Depth	sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
BH01	3.00	B	16.2		47.7	32	17	15						
BH02	2.00	B	15.8		55.7	33	17	16						
BH03	1.00	B	27.3		54.7	45	25	20						
NMTL		Notes : 1. All BS tests carried out using preferred (definitive) method unless otherwise stated.									Job ref No.	NMTL 2426		Table
											Location	Stillorgan Library		

**NMTL LTD**  
**Unit 18c, Tullow Industrial Estate**  
**Tullow**  
**County Carlow**  
Tel: 00353 59 9180822  
Mob: 00353 872575508  
[billachana@eircom.net](mailto:billachana@eircom.net)

**Contract:** Stillorgan Library  
**Client:** Ground Investigations Ireland Ltd  
**Engineer:** N/A  
**Date:** 01/02/2018  
**Tested By:** Tzr **Checked:** Bc  
**Job ref No.** NMTL 2426





**Trinity College Dublin**  
Coláiste na Tríonóide, Baile Átha Cliath  
The University of Dublin

Geotechnical Laboratory,  
Civil, Structural & Environmental Engineering  
& Environmental Engineering  
Trinity College,  
Dublin.2.

Ground Investigations Ireland Ltd,  
Catherinestown House,  
Hazelhatch Road,  
Newcastle,  
Co. Dublin

**Point Load Index Tests**  
**(single diametral determination)**

+353 1 8961009  
[edunne@tcd.ie](mailto:edunne@tcd.ie)

**Project:** Stillorgan Library

**Delivery date:** 25.01.2018

**Test Date:** 25.01.2018

<b>Borehole No.</b>	<b>Depth (m)</b>	<b>Is(50) (Mpa)</b>
BH - 01	7.30 - 7.40	1.26
BH - 01	11.24 - 11.29	0.29
BH - 02	6.43 - 6.57	2.52
BH - 02	9.03 - 9.16	2.15
BH - 03	6.90 - 6.97	0.15
BH - 03	9.66 - 9.72	0.06
BH - 04	3.90 - 4.00	0.92
BH - 04	7.05 - 7.15	0.69
BH - 05	5.79 - 5.93	0.77
BH - 05	9.93 - 10.10	0.62

Prof. Brendan O'Kelly

Specimens prepared and tested in accordance with suggested method from  
International Society for Rock Mechanics (ISRM), 1985



## **APPENDIX 4 – Groundwater Monitoring**



**GROUND  
INVESTIGATIONS  
IRELAND**

Ground Investigations Ireland Ltd.,  
Catherinestown House,  
Hazelhatch Road,  
Newcastle, Co Dublin.  
Tel: 01 601 5175 / 5176 | Fax: 01 601 5173  
Email: info@gii.ie | Web: gii.ie

## GROUNDWATER MONITORING

### Stillorgan Library

BOREHOLE	DATE	TIME	GROUNDWATER (mBGL )	Comments
BH02	25/01/2018	15.00	1.40	
BH05	25/01/2018	15.05	3.80	