

8.0 LAND AND SOILS

8.1 INTRODUCTION

This chapter of the EIAR assesses the impact on the geological environment of the proposed development. The objectives are to provide a review of baseline geological conditions across the footprint of the site, to assess the potential impact of the proposed development on the underlying soils and geology and to provide appropriate mitigation measures for any identified potential impacts, if deemed necessary.

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This chapter includes an assessment of any impact to date on the geological environment at and within the general environs of the site as a result of historical site activities. Potential impacts from planned future works are assessed. A Phase 1 Environmental Site Assessment Report was prepared by BlueRock Environmental Limited in February 2018 identifying all potential sources of contamination or environmental liability associated with the site. Relevant information from this report has been utilised in the compilation of this chapter. The Report is included as Appendix 8.1 of this chapter. A Ground Investigations Report is included as Appendix 8.2.

8.2 STUDY METHODOLOGY

The assessment was undertaken by undertaking the following:

- A desktop study of soils, subsoils and bedrock
- A review of existing site investigation data
- Interpretation of all data and reporting

A number of site investigations were undertaken across the site as detailed in Section 8.3.

The following sources of information were also used in the compilation of this assessment:

- Former Magee Barracks Site - Phase 1 Environmental Site Assessment, BlueRock Environmental Ltd, February 2018
- Ordnance Survey of Ireland (OSI) Discovery Series, Sheet 55
- Ordnance survey of Ireland (OSI) online historical maps and aerial photographs
- Geology of Kildare-Wicklow, Geological Survey of Ireland (GSI) (1:100,000), Sheet 16
- GSI on-line groundwater database
- GSI Curragh West groundwater body (GWB)
- Soil Map of Ireland (Second Edition, 1980), National Soil Survey of Ireland, An Foras Talúntais
- National Parks and Wildlife Service on-line database (www.npws.ie)
- OPW hydro-data (<http://www.opw.ie/hydro-data>)
- Met Éireann (met.ie) monthly climatological data
- Kildare County Council online planning files and County Development Plan
- White Young Green (2002). Curragh Aquifer - Current Conceptual Understanding and Numerical Modelling
- Landslides in Ireland. GSI. Irish Landslides Working Group (2006)
- Directory of Active Quarries, Pits and Mines in Ireland (3rd Edition) GSI. 2002

This chapter was undertaken in accordance with the following:

- Guidelines on the Information to be Contained in Environmental Impact Statements (EPA, 2002)
- Geology in Environmental Impact Statements (IGI, 2002)
- Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA Document)
- Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI, 2013)
- Institute of Geologists Ireland (2002): Geology in Environmental Impact Statements
- Draft EPA revised Guidelines on Information to be Contained in Environmental Impact Statements; and Advice Notes for Preparing EIS, 2015.

8.3 THE EXISTING RECEIVING ENVIRONMENT (BASELINE SITUATION)

8.3.1 Site Location and Context

The site of the proposed development is located approximately 500 metres to the east of Kildare town core, north of Hospital Street.

The former Magee Barracks site currently consists of a number of vacant military buildings, all of which are in serious disrepair, areas of hard surfacing formerly used as training grounds / assembly areas and underutilised green-field lands.

Surrounding land uses include residential housing developments to the north, east and west with a number of retail / commercial land uses to the south of the site, along Hospital Street. The commercial uses include 2 no. car showrooms, a supermarket, a petrol station, a resource centre, a pharmacy and a primary care centre.

The proposed development comprises the first phase of the overall development of the applicant's c. 20.78 ha landholding at this location. The planning application is accompanied by an overall site masterplan drawing which identifies, along with the residential element of the proposed development, a supermarket, a cancer treatment clinic (proton therapy) and a Phase 2 residential development of circa 250 units.

8.3.2 Bedrock

The bedrock geology beneath Kildare town consists of carboniferous limestone deposits. Land subsidence occurring during the Carboniferous period in the Upper Palaeozoic led to extensive ingress of seawater into low lying areas which led to an accumulation of marine sediment deposits comprising intertidal laminated mud and sand. The type of sediment being accumulated was governed by the depth of the sea in a given location, and therefore progressive subsidence resulted in shallow water sediments to be deposited below the deep water marine sediments.

According to GSI sheet 11, the main rock unit underlying the study area is the Rickardstown Formation ((RK) – see Figure 8.1). Rickardstown Limestone is cherty and often dolomitised. The GSI have identified two distinct horizons within this formation. The lower horizon is varied and includes thin interbedded units of nodular crinoidal, cherty micrite and fossiliferous shale. The upper part consists primarily of quite uniform, moderately dark grey, fine grained dolomite with abundant chert.

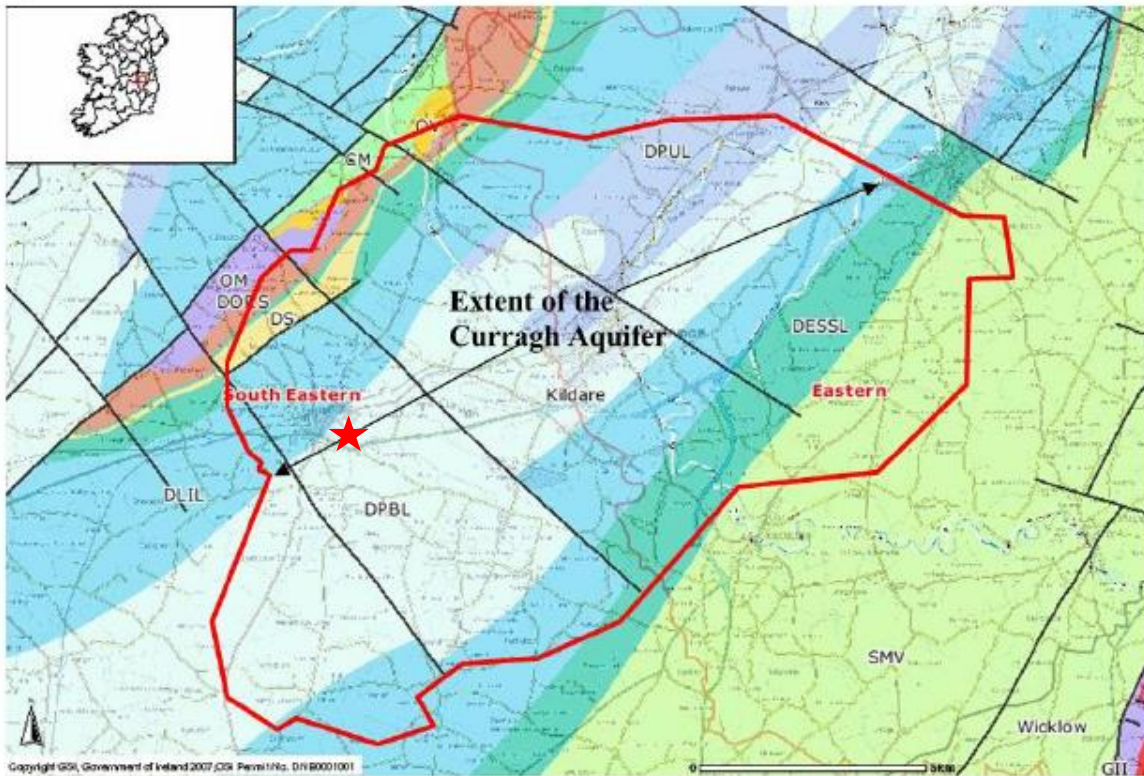
Other formations in proximity to the site include the Boston Hill formation which includes major units of very distinctive, laminated limestone, which distinguish this formation from the Ballysteen formation.

The area surrounding Kildare town is cut with faults running predominantly in northwest-southeast direction. The site lies between two of these faults, one located approximately 1.55 km to the south-west and the other approximately 2.5 km to the north-east.

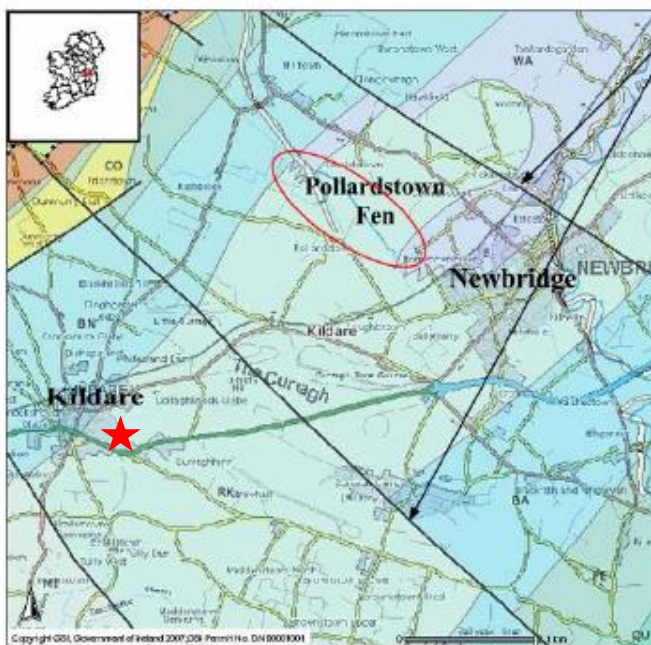
No bedrock outcrops or karst features have been mapped across or in the vicinity of the site by the GSI.

Fig. 8.1: Bedrock geology map of the area surrounding (a) the Curragh Aquifer and (b) Pollardstown Fen. The former Magee Barracks site is marked with a red star.

a)



b)



Faults

Legend:

- DPUL* – Dinantian Pure Unbedded Limestone
- DPBL* – Dinantian Pure Bedded Limestones
- DLIL* – Dinantian Lower Impure Limestones
- SMV* – Silurian metasediments and volcanics
- DESSL* – Dinantian Early Sandstones, Shales & Limestones
- DS* – Dinantian Sandstone
- DORS* – Devonian Old Red Sandstones
- OM* – Ordovician Metasediments
- CM* – Cambrian Metasediments
- OV* – Ordovician Volcanics
- WA* – Waulsortian Limestones (Carb. Limestones)
- BA* – Ballysteen Formation (Carb. Limestones)
- RK* – Rickardstown Formation (Carb. Limestones)
- BN* – Boston Hill Formation (Carb. Limestones)
- FE* – Feighcullen Formation (Carb. Limestones)
- CO* – Croughaun Formation (Carb. Limestone Shales)



8.3.3 Subsoil (Quaternary) Geology

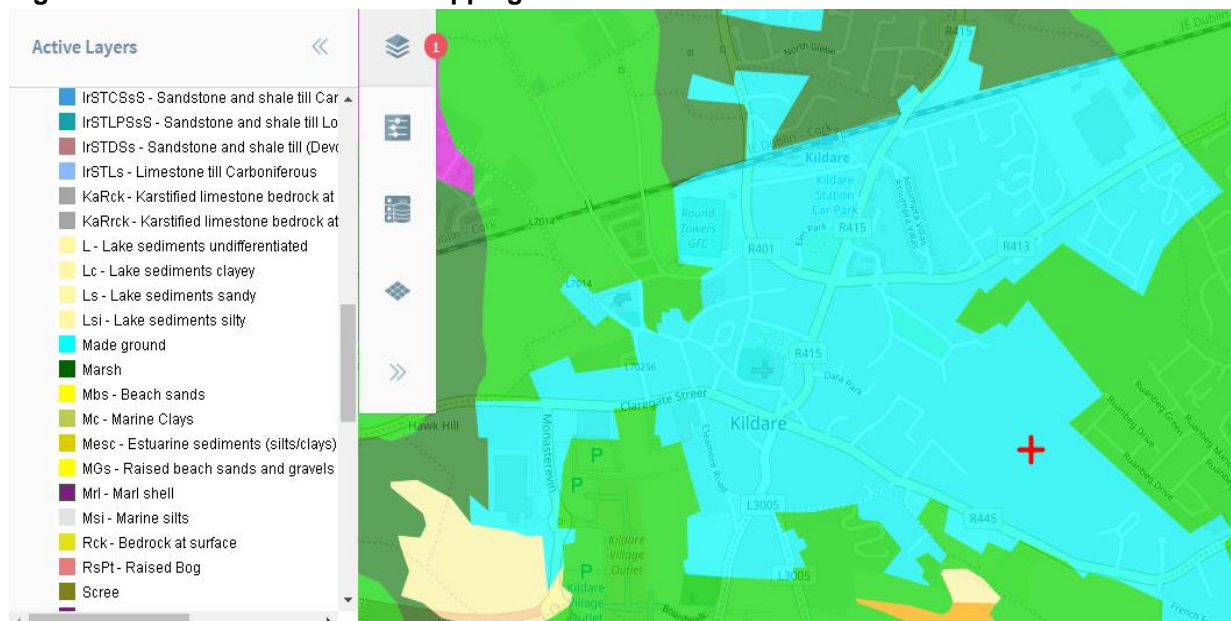
The quaternary period is the most recent stage of the geological time period. It marks the period of the Ice Age and the postglacial period which extends to the present day. Most surface deposits were deposited in the Quaternary period and provide the parent materials for the soils in the area.

Most sediments of the Quaternary period were deposited during the Ice Age itself either directly from the huge ice sheets or by meltwater from the sheets as they melted. Ice sheets would have slowly eroded the underlying bedrock producing sediment. This sediment may include particles of all sizes ranging from clay to boulder and which when spread over the surface by glacial ice, takes the form of till (boulder clay). Alternatively, sediment may be carried and sorted by meltwater and deposited as sand and gravel, with silt and clay deposited separately in lake systems or carried away to the sea. Glacial deposits therefore contain fragments of the type of bedrock over which the ice originally passed.

8.3.4 Soils

The EPA soils map indicates the predominant soil type in the development area to be made ground. An extract from the EPA soils map relevant to Kildare Town is detailed in Figure 8.2 below.

Fig. 8.2: Extract from EPA soils mapping



8.3.5 Contamination

According to the EPA website, there are no recorded waste disposal or contaminated sites located in proximity to the proposed site. There is one EPA IED licenced facility (i.e. Kildare Chilling Company, Licence NO. P0170) located approximate 860 metres east of the site.

According to the EPA database there are no reported contaminated soil or groundwater issues present at this site.

8.3.8 Radon

Radon is a radioactive gas which is naturally produced in the ground from the uranium present in small quantities in all rocks and soils. The RPS has produced a radon map of Ireland based on the results of the National Radon Survey where radon measurements were carried out in a number of houses in each 10 km grid square of the OS national grid.

The results were used to predict the percentage of homes in each 10km grid square with radon concentrations in excess of the national reference level of 200 Bq/m³ (Becquerels per cubic metre). The radon map has five categories: less than 1%, 1-5%, 5-10%, 10-20% and greater than 20%. These categories refer to the number of homes in the 10km grid square that are likely to have radon concentrations above the reference level.

This map was accessed online on the 9th February 2018 and the 10km grid of Kildare town indicated that only 1-5% of the homes surveyed in this area had radon concentrations above the Reference Level.

The EPA has issued specific guidelines with respect to underground residential and commercial developments. In relation to the proposed development, following construction the risk of radon impact is considered to be imperceptible.

8.3.9 Site Investigations

Site investigations were undertaken across the site in 2016 and 2017:

- Ground Investigations Limited – August 2016 – 10 no. trial pits and 10. no. infiltration tests within each trial pit.
- Site Investigations Limited – May 2017 – 15 no. cable percussive boreholes and 22 no. trial pits.
- Infiltration testing – February 2018 – 9 no. infiltration tests. (Discussed in Chapter 9 of the EIAR)

Ground Investigations Ltd. (August 2016)

Ground Investigations Ltd undertook a ground investigation across the entire footprint of the former Magee Barracks site in August 2016. The works comprised the following:

- 10 no. trial pits; and
- 10 no. soakaways within the same trial pits.

A summary of ground conditions encountered is outlined below:

- Topsoil was encountered in all but three of the trial pits and was present to a maximum depth of 0.2 mbgl. Tarmac surfacing was present in three pits typically to a depth of 0.1 mbgl.
- Made ground deposits were encountered beneath the topsoil at depths of between 0.2 and 0.7 mbgl and were described as brown slightly sandy gravel with frequent cobbles and contained occasional fragments of concrete, red brick, glass and plastic.
- Cohesive till deposits were encountered underlying the made ground at depths of between 0.2 and 0.7 mbgl and were described as brown slightly sandy slightly gravelly clay with occasional cobbles. The deposits increased in strength with depth and were firm to stiff or stiff below 0.7 mbgl.
- Granular till deposits were encountered mainly in 2 no. locations at shallow depths between 0.2 and 0.3 mbgl and interbedded with the cohesive deposits in two locations at a depth of 1.1 m and

extending to a depth of 1.3 mbgl. They were typically described as brownish grey clayey gravelly fine to coarse sand or gravel with occasional cobbles and varying minor constituents.

- Groundwater was not encountered in any of the trial pits.
- Infiltration testing undertaken within each trial pit was recorded. Infiltration rates of 6.78×10^{-5} , 2.63×10^{-4} , 7.0×10^{-6} , 2.07×10^{-5} and 1.17×10^{-5} m/s respectively were calculated for the soakaway locations SA01, SA03, SA04, SA06 and SA07. SA03 could not be filled completely as water flowed too quickly out of it. At the locations of SA02, SA05, SA08, SA09 and SA010 the water level dropped too slowly to allow calculation of 'f' – the soil infiltration rate and therefore these tests failed and were therefore unsuitable for soakaway design and construction.

All trial pit and infiltration test locations are presented in Figure 8.4 and the report is included within Appendix A to the Phase 1 Environmental Site Assessment Report (Appendix 8.1).

Fig. 8.4: 2016 site investigation locations



Site Investigations Ltd. (May 2017)

Site Investigations Ltd (SIL) was appointed to complete ground investigations as follows:

- 15 No. cable percussive boreholes; and
- 22 No. trial pits.

The locations of investigations across the site are outlined in Figure 8.5 and the report is included within Appendix A to the Phase 1 Environmental Site Assessment Report (Appendix 8.1).

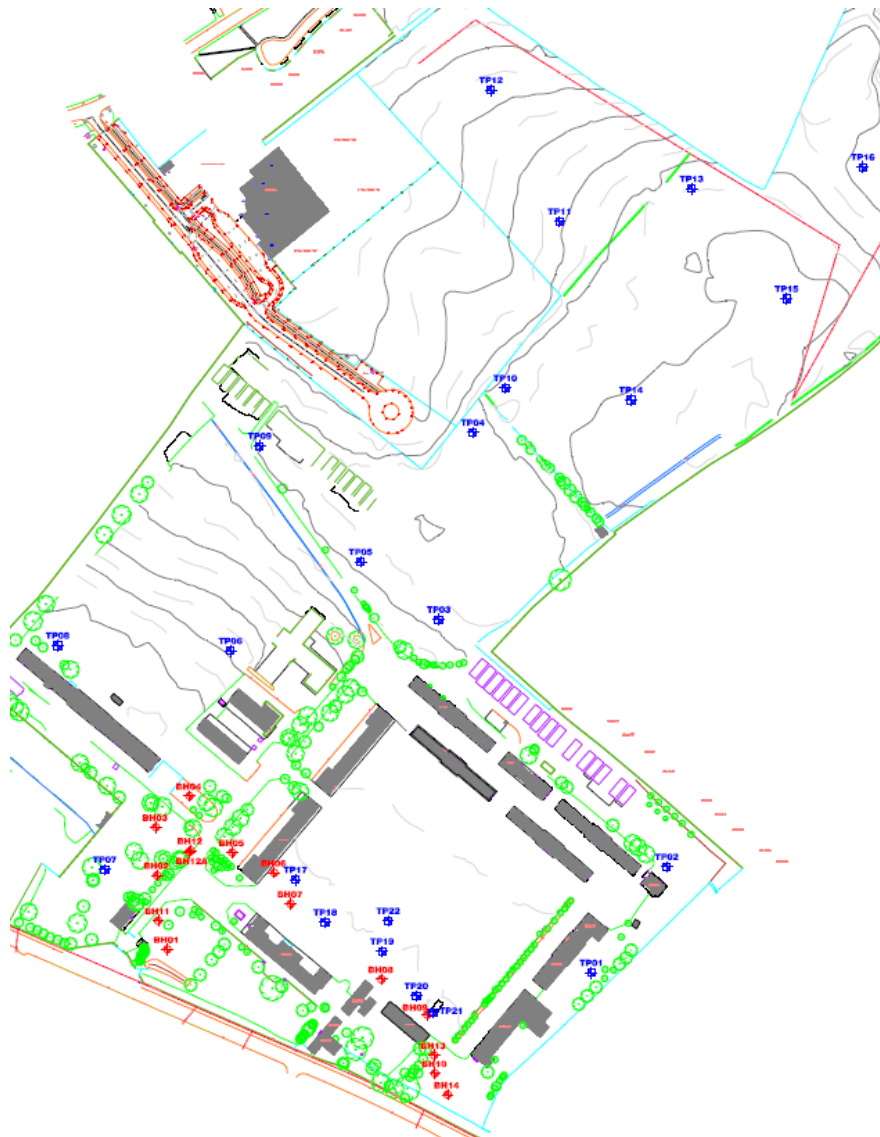
A generalised summary of the ground profile encountered across the site is provided below:

- Made ground was described generally as brown slightly sandy gravelly clay with frequent cobbles containing occasional fragments of concrete, red brick, glass and plastic. With the exception of tarmac areas or areas with a thin layer of stone fill, made ground was detected across a wide area of the site (i.e. within 21 of 37 no. investigation locations) at depths greater than 0.25 metres. The depths of made ground were recorded up to 2.3 mbgl with an average depth of 1.0 metre being recorded. The material appears to be broadly representative of reworked soils with residual, historical and low levels of construction and demolition (C&D) waste material present within this horizon.

Greater depths of made ground, up to 8.3 mbgl, were recorded in the southeast of the former barracks site outside the proposed development site boundary (i.e. boreholes BH13 and BH14). The material at these locations comprised similar type made ground recorded elsewhere with increased quantities of brick, timber, glass and metal at much greater depths. The material description at this location suggests the material is former C&D material from the historical usage of Magee Barracks.

- Cohesive till deposits were identified comprising of brown slightly sandy slightly gravelly clay with occasional cobbles with a strength increasing from firm to stiff or stiff with depth up to 9.7 metres in places. These deposits had some occasional or frequent cobble and boulder content where noted on the exploratory logs.
- Granular till deposits – sand and gravel deposits were encountered across the site although not as a continuous body. The average thickness was 0.7 metres and the greatest thickness was recorded up to 4.3 metres within trial pits TP19 and TP20 in the southern region of the site. Deeper gravel deposits were encountered in the south-eastern region of the site only and within borehole BH10. The gravel deposits encountered at this location were encountered between 9 and 15 mbgl and may be representative of a deeper sand and gravel horizon as part of the Curragh gravel aquifer. The gravel deposits encountered at shallower depths are considered unlikely to be part of this same gravel body given the presence of the low permeability clays underlying this shallow material.
- Groundwater was not encountered in any of the boreholes or trial pits across the site, although it is acknowledged that no monitoring wells were installed within any of the boreholes to facilitate groundwater monitoring over time.

Fig. 8.5: 2017 site investigation locations



8.3.10 Potential Sources of Waste / Contamination

Potential sources of buried waste or contamination were identified and assessed. The potential sources were identified based on the historical information provided in Chapter 4 of this EIAR (Archaeology and Cultural Heritage), site conditions observed on the current site and on information provided in the Phase 1 Environmental Site Assessment Report (Appendix 8.1). This report reviews historical maps and historical activities that reportedly occurred across the site and identified a number of areas requiring further investigation/consideration.

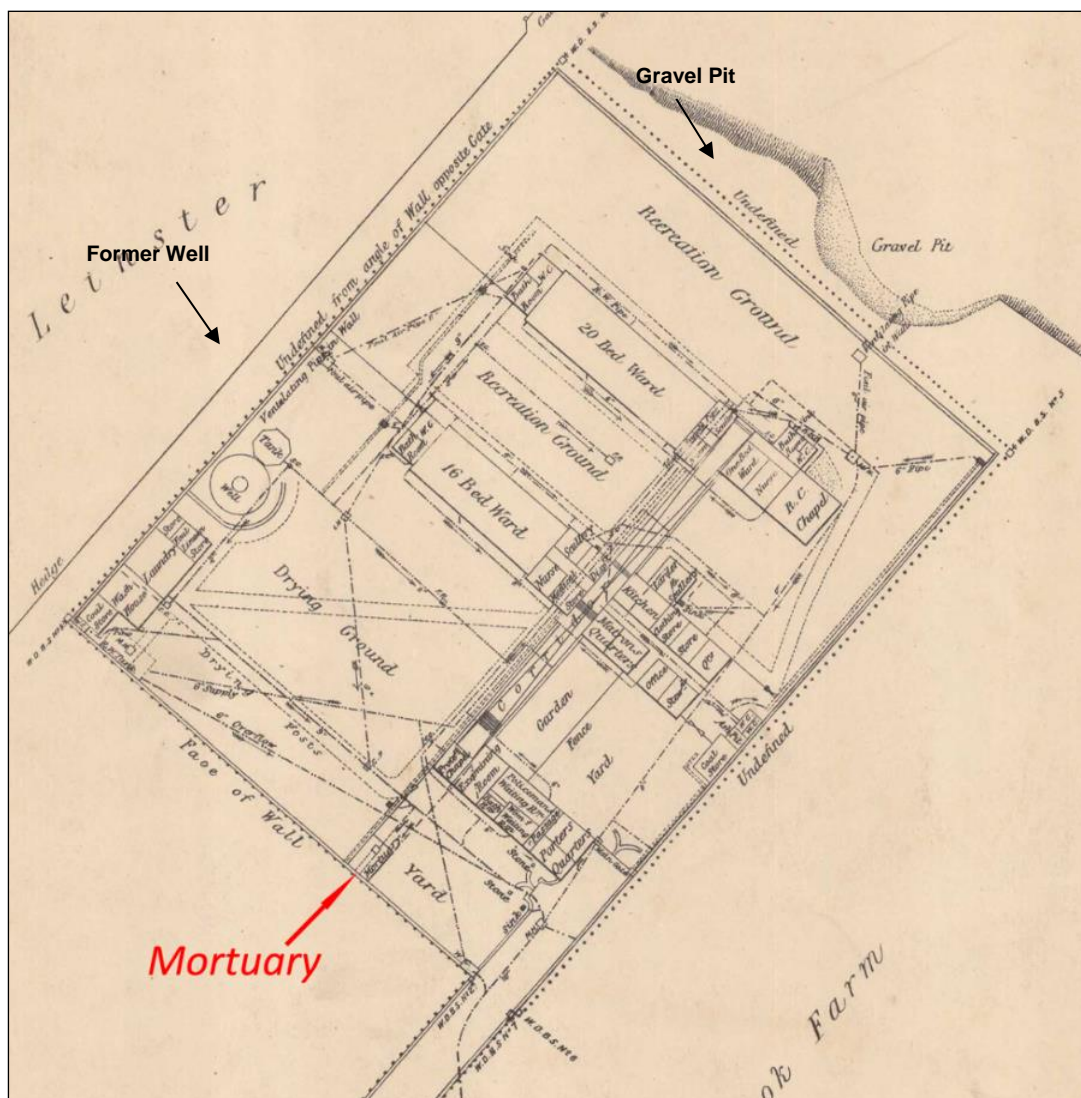
Potential sources of buried waste or contamination include the following:

- Borehole logs undertaken in the southeast of the former barracks site (within the site of the proposed cancer treatment clinic) recorded made ground material with notable amounts of brick, concrete, glass and plastic to depths up to 8.3 mbgl. The depth of this material would suggest a notable infilling exercise historically occurred in this area. Appropriate assessment of this material will be required prior to development to ensure no risk to human health or the environment currently exists or will exist into the future. The remainder of the site comprises both greenfield areas and areas previously

developed using reworked made ground material with construction and demolition (C&D) material entrained throughout this horizon.

- The north-eastern corner of the former barracks site is formed by a high gravel ridge, with a mature hedgerow running along the top of it. The ridge slope has been at least partly augmented by construction waste material, with a large mound extending east from it just outside the former barracks site boundary. This area will require further assessment as part of future redevelopment activities.
- A gravel pit is shown on historic maps to the north of the former hospital on site (see Figure 8.6 below – sourced from the Phase 1 ESA report in Appendix 8.1). The material used to backfill this pit is unclear and additional testing in this area should be undertaken to confirm the type of material present.

Fig. 8.6: Locations of former gravel pit and water well associated with the to the former Lock Hospital



- A water well, reportedly 62 feet in depth, was located on the grounds of the former hospital (see Figure 8.6). If not appropriately sealed or backfilled, this well may provide a preferential vertical

pathway of possible contaminants within the shallow subsoils to the underlying sand and gravel aquifer and should be appropriately identified and assessed during any redevelopment activities.

- It is unclear whether asbestos was used in the construction of any element of the former barracks. No evidence of asbestos has been reported to-date during the previous site investigations undertaken. Any future redevelopment works should take cognisance of the possibility of asbestos being present within the fill material across the site and appropriate mitigation measures should be implemented to minimise any potential risk to human health.
- Although not identified on historical maps or within Chapter 4 of this EIAR, it is likely that fuels and chemicals were stored within particular areas of the site attributed to the historical operation of the former hospital and more recently of the former barracks. Depending on how these materials were stored, transported, used and discarded, the potential for localised contaminant hotspots within the subsurface remains a possibility. It is noted that no detections of any contaminant hotspots associated with these material have been visually recorded to date.
- Chapter 4 of this EIAR notes that the OS-map 25-inch map 1907-09 shows:

‘..two areas of open ground between the hut rows and the rear of the barracks, presumably grounds for parade or recreation. Beyond these areas are large rectilinear open plots (partly within the Phase 1 proposed development site) which may represent the vegetable plots known to have been present within the barracks (Cf. Magee Barracks Local Area Plan) or some form of temporary enclosure or structure. Adjacent buildings housed the transport sheds, gun sheds, stables, stores etc., with the fields beyond used to graze the horses (i.e. within the northern half of the overall Masterplan Area)’.

These adjacent buildings and the area of ground in proximity to these buildings may potentially be associated with burial areas of waste material including the potential for discarded ammunitions. It is noted however that no detections of buried waste material (apart from the C&D derived made ground present across much of the site) or ammunitions have been visually detected to date.

- Water supply to the hospital was historically sourced from the local well on site. The source of water to the former barracks is unclear but was potentially sourced from the same well. The pipe network servicing this well to the hospital and the barracks may potentially be constructed from lead which may pose a risk (albeit likely to be a low risk) to the surrounding environment in the case of historical leaks from the pipe network with potentially elevated levels of lead present.

8.4 CHARACTERISTICS OF THE PROPOSED DEVELOPMENT

The development will consist of the demolition of 16 no. existing buildings (including the Officers’ Mess building and Water Tower structure) with a GFA of 16,115 sq.m, and the construction of a development comprising of 264 no. residential units, a neighbourhood centre comprising of 3 no. single storey retail units with a GFA of 115 sqm, 105 sqm and 100 sq.m respectively, a café (including gallery / exhibition area at mezzanine level) with a GFA of 300 sq.m, a two-storey childcare facility with a GFA of 680 sq.m and associated play area, all internal roads, car parking, pedestrian and cycle paths, public open space, and all associated site and infrastructural works on an application site of c. 11.14 ha.

The development will consist of the demolition of 17 no. existing buildings (including a range of former Barracks buildings, the Officers’ Mess building and Water Tower structure) with a GFA of 16,320 sq.m, and the construction of a development comprising of 375 no. residential units, a neighbourhood centre comprising of 3 no. single-storey retail units with a GFA of 130 sq.m, 105 sq.m and 100 sq.m respectively,

a café (including gallery / exhibition area at mezzanine level) with a GFA of 300 sq.m, a two-storey childcare facility with a GFA of 680 sq.m and associated play area, all internal roads, car parking, pedestrian and cycle paths, public open space, and all associated site and infrastructural works on an application site of c. 11.35 ha.

The 375 no. residential units proposed consist of the following:

- 76 no. 3 bed semi-detached units;
- 42 no. 3 bed terrace units;
- 60 no. 4 bed semi-detached units;
- 7 no. 4 bed detached units;
- 16 no. 1 bed apartment units within the duplex blocks;
- 34 no. 2 bed apartment units within the duplex blocks;
- 18 no. 3 bed apartment units within the duplex blocks;
- 30 no. 1 bed apartment units within the apartment blocks; and
- 92 no. 2 bed apartment units within the apartment blocks.

The houses are 2 to 3 storeys in height, the duplex blocks are 2 to 3 storeys in height and the apartment blocks are 4 to 5 storeys in height over basement car park. The associated site and infrastructural works include foul and surface / storm water drainage, attenuation tanks, 639 no. car parking spaces comprising, 560 no. spaces for the residential units, 51 no. visitor spaces and 28 no. spaces to serve the proposed creche, retail, and café units, public open space measuring c. 1.80 hectares, bin and bike stores, 3 no. electricity substations, landscaping, boundary walls, railings and fences.

A new signalised road junction is proposed onto Hospital Street providing access to the proposed development and also to the adjacent lands where a supermarket and cancer treatment clinic are proposed. Road works are also proposed to Hospital Street (R445), including pedestrian crossings, provision of cycle lanes, upgrades to footpaths, signage, road markings and traffic signalling.

The proposed development comprises the first phase of the overall development of the applicant's c. 20.78 ha landholding at this location. The application is accompanied by an overall site masterplan drawing indicating a future Phase 2 residential development of c. 250 units, a supermarket for which planning has been granted and a cancer treatment clinic (proton therapy). An application for planning permission for the treatment clinic was lodged with Kildare County Council (planning reference number 18/149). Permission was subsequently granted but is currently subject to an An Board Pleanála appeal..

8.5 POTENTIAL IMPACT OF THE PROPOSED DEVELOPMENT

The significance of potential impacts on geological and hydrogeological sensitive receptors was estimated by implementing the National Roads Authority (NRA) *Design Manual for Roads and Bridges* (DMRB) and IGI Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (2013) style of assessment using geological type attributes and measures to determine the magnitude of the impact on the attribute.

Table 8.1 illustrates the criteria for determining the importance of geologically sensitive attributes (receptors) at the site, Table 8.2 demonstrates the criteria for estimating the magnitude of the impact on an attribute and Table 8.3 presents the resulting estimation of the significance of potential impacts.

Table 8.1 Estimation of Importance of Sensitive Attributes

Importance	Criterion	Typical Examples
Very High	<p>Attribute has a high quality,significance or value on a regional or national scale</p> <p>Degree or extent of soil contamination is significant on anational or regional scale</p>	<p>Geological feature rare on a regional or national scale (NHA)</p> <p>Large existing quarry or pit</p> <p>Proven economically extractable mineral resource</p>
High	<p>Attribute has a high quality, significance or value on a local scale</p> <p>Degree or extent of soilcontamination is significant on alocal scale</p>	<p>Contaminated soil on site with previous heavy industrial usage</p> <p>Large recent landfill site for mixed wastes</p> <p>Geological feature of high value on a local scale (e.g. countygeological site)</p> <p>Well drained and/or high fertility soils</p> <p>Moderately sized existing quarry or pit</p> <p>Marginally economic extractable mineral resource</p>
Medium	<p>Attribute has a medium quality, significance or value on a localscale</p> <p>Degree or extent of soil contamination is moderate on a local scale</p>	<p>Contaminated soil on site with previous light industrial usage</p> <p>Small recent landfill site for mixed wastes</p> <p>Moderately drained and/or moderate fertility soils</p> <p>Small existing quarry or pit</p> <p>Sub-economic extractable mineral resource</p>
Low	<p>Attribute has a low quality, significance or value on a local scale</p> <p>Degree or extent of soil contamination is minor on a local scale</p>	<p>Large historical and/or recent site for construction anddemolition wastes</p> <p>Small historical and/or recent landfill site for construction and demolition wastes</p> <p>Poorly drained and/or low fertility soils</p> <p>Uneconomically extractable mineral resource</p>

Table 8.2 Estimation of the Magnitude of a Potential Impact on an Attribute

Magnitude	Criterion	Typical Example
Major Adverse	Results in loss of attribute and/or quality and integrity of attribute. Severe	<p>Loss of high proportion of future quarry or pit reserves</p> <p>Irreversible loss of high proportion of local high fertility soils</p> <p>Removal of entirety of geological heritage feature</p> <p>Requirement to excavate / remediate entire waste site</p> <p>Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment.</p>
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute. Major	<p>Loss of moderate proportion of future quarry or pit reserves</p> <p>Removal of part of geological heritage feature</p> <p>Irreversible loss of moderate proportion of local high fertility soils</p> <p>Requirement to excavate / remediate significant proportion of waste site</p> <p>Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment</p>
Minor Adverse	Results in some measurable change in attributes quality or vulnerability. Minor	<p>Loss of small proportion of future quarry or pit reserves</p> <p>Removal of small part of geological heritage feature</p> <p>Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils</p> <p>Requirement to excavate / remediate small proportion of waste site</p> <p>Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment</p>
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity. Not significant	No measurable changes in attributes
Minor	Results in some beneficial effect	Minor enhancement of geological heritage feature

Magnitude	Criterion	Typical Example
Beneficial	on attribute or a reduced risk of negative effect occurring.	
Moderate Beneficial	Results in moderate improvement of attribute quality	Moderate enhancement of geological heritage feature
Major Beneficial	Results in major improvement of attribute quality	Major enhancement of geological heritage feature

A qualitative approach was used in this evaluation, generally following the significance classification in Table 8.3 and through professional judgement. The significance of a predicted impact is based on a combination of the sensitivity or importance of the attribute and the predicted magnitude of any effect.

Table 8.3 Estimation of the Significance of Potential Impact

Importance of Attribute	Magnitude of Potential Impact			
	Negligible	Minor Adverse	Moderate Adverse	Major Adverse
Extremely High	Imperceptible	Significant	Profound	Profound
Very high	Imperceptible	Significant/ Moderate	Profound/ Significant	Very Large
High	Imperceptible	Moderate/ Slight	Significant/ Moderate	Profound/ Significant
Medium	Imperceptible	Slight	Moderate	Significant
Low	Imperceptible	Imperceptible	Slight	Slight / Moderate

Terms relating to the duration of impacts are as described in the EPA’s Guidelines on the Information to be Contained in Environmental Impact Statements (March 2002) as:

- Temporary Impact - lasting one year or less;
- Short term Impact - lasting one to seven years;
- Medium term Impact - lasting seven to fifteen years;
- Long term Impact - lasting fifteen to sixty years; and
- Permanent Impact - lasting over sixty years.

The prediction of potential impacts from the proposed development is summarised in tables Tables 8.4 and 8.5. The impacts are separated into construction stage impacts and operational stage impacts.

Table 8.4 Potential Construction Phase Impacts

No.	Construction Activity	Attribute	Character of Potential Impact	Importance of Attribute (see Table 8.1)	Magnitude of Potential Impact(see Table 8.2)	Significance of Potential Impact(see Table 8.3)
1	Excavation works	Bedrock	It is anticipated that the development site works and excavation proposals will not be deep enough to intersect or impact the underlying bedrock geology. Therefore the impact on bedrock is considered to be imperceptible.	Medium	Negligible	Imperceptible
2	Excavation works	Site Subsoils	Extensive stripping and wide-scale excavation of soils and sub-soils to prepare and construct the development is proposed. The main volume of excavation will be resultant from the proposed underground surface water soakaway systems. Reusable excavated soils will be retained on-site for backfilling or drainage purposes to reduce the total volume of imported material. It is anticipated that the impact on soils arising from the construction phase will be short-term and slight.	Medium	Minor Adverse	Slight
3	Excavation works leading to soil erosion	Site Subsoils	Earthworks and the removal of topsoil would expose subsoil layers to the effects of weathering and may result in the erosion of soil, particularly in times of adverse weather conditions.	Medium	Minor Adverse	Slight
4	Construction works	Geomorphology	It is considered that the proposed construction works would have minor effects on the geomorphology of the area, as the development would not materially change the local slopes and topography.	Medium	Negligible	Imperceptible
5	Fuel storage/usage on site	Subsoils Future Site Users	Accidental spillage of contaminants during construction works may cause short to long term, moderate to significant impacts to subsoils and to future site users if not stored and used in an environmentally safe manner. (Potential impacts to groundwater are addressed separately within Chapter 9 of this EIAR)	Medium	Moderate Adverse	Moderate

No.	Construction Activity	Attribute	Character of Potential Impact	Importance of Attribute (see Table 8.1)	Magnitude of Potential Impact(see Table 8.2)	Significance of Potential Impact(see Table 8.3)
6	Construction Traffic	Subsoils Future Site Users	There may be a risk of soil and groundwater pollution from site traffic through the accidental release of oils, fuels and other contaminants from vehicles. (Risks to groundwater are discussed in more detail in Chapter 9 of this EIAR)	Medium	Moderate Adverse	Moderate
7	Contaminated land/ buried waste (undetected)	Subsoils	Localised buried made ground material (possibly historical C&D waste) comprising brown sandy gravelly silty clay with significant quantities of brick, timber, glass and metal to depths up to 8.3 mbgl was encountered in the southeast of the former barracks site (outside the proposed development site boundary). No testing of this material has been undertaken to date, although visual observations did not record any leaching effects, odours, contaminant staining or visual evidence of active contamination in this location. The disturbance and release of pollutants during excavation works in this area is considered a possibility that may pose a long term risk to the surrounding subsoils, groundwater or to future/adjacent site users without a more detailed investigation in this area of the site.(Risks to groundwater are discussed in more detail in Chapter 9 of this EIAR)	Medium	Moderate Adverse	Moderate
8		Future Site Users		<p>A number of potential sources of buried waste / contamination were identified that warrant further investigation prior to the commencement of development works. These include a former gravel pit, a former well, earthen embankments containing construction and demolition waste material and former fuel and artillery storage areas. In addition, asbestos within the existing made ground material across much of the site must be</p>	Medium	Moderate Adverse

No.	Construction Activity	Attribute	Character of Potential Impact	Importance of Attribute (see Table 8.1)	Magnitude of Potential Impact(see Table 8.2)	Significance of Potential Impact(see Table 8.3)
			<p>considered a possibility without more detailed site investigation information.</p> <p>Based on site investigations undertaken to date, the made ground material recorded at shallow depths across much of the site is considered unlikely to pose a significant risk to human health or to the environment; however without chemical testing of this material the risk cannot be fully discounted.</p>			
9	Contaminated Infill	Subsoils Future Site Users	The importation of unsuitable or contaminated fill material for the purpose of reinstatement works or access roads may pose a risk to the surrounding subsoils and/or to future site users.	Medium	Moderate Adverse	Moderate
10	Waste arisings	Subsoils	Waste material generated from construction activities may require disposal off-site if not suitable for reuse on site. Temporary storage on site may be required and impacts to exposed subsoils and groundwater from possible contaminated direct runoff during rainfall events may occur.	Medium	Moderate Adverse	Moderate
11	Vandalism	Subsoils FutureSite Users	Pollution due to vandalism of stores or plant poses a risk to subsoils and to future site users. (The risks posed to the underlying groundwater body are considered in Chapter 9 of this EIAR)	Medium	Moderate Adverse	Moderate
12	Buried unexploded ordnances	Site Workers Off-site residents	The risk of encountering buried unexploded ordnances is considered low based on non-detection todate during previous site investigations. However, as a conservative measure a high risk is assigned without a more detail survey of the site undertaken.	Very high	Major Adverse	Profound

Table 8.5 Potential Operational Impacts

No.	Construction Activity	Attribute	Character of Potential Impact	Importance of Attribute(see Table 8.9)	Magnitude of Potential Impact(see Table 8.10)	Significance of Potential Impact(see Table 8.11)
1	Hydrocarbon laden surface water runoff from roads, carparks and general hardstanding	Subsoils	Road surface runoff and poorly designed drainage system being channelled to subsoils before infiltrating to groundwater can result in contamination of the surrounding subsoils.	Medium	Moderate Adverse	Moderate
2	Contaminated land / waste	Subsoils Future Site Users	<p>Localised buried made ground material (possibly historical C&D waste) comprising brown sandy gravelly silty clay with significant quantities of brick, timber, glass and metal to depths up to 8.3 mbgl was encountered in the southeast of the former barracks site (outside the proposed development site boundary). No testing of this material has been undertaken to date, although visual observations did not record any leaching effects, odours, contaminant staining or visual evidence of active contamination in this location. The disturbance and release of pollutants during excavation works in this area is considered a possibility that may pose a long term risk to the surrounding subsoils, groundwater or to future/adjacent site users without a more detailed investigation in this area of the site.</p> <p>Based on site investigations undertaken to date, the made ground material recorded at shallow depths across much of the site is considered unlikely to pose a significant risk to human health or to the environment; however without chemical testing of this material the risk cannot be fully discounted.</p>	Very High	Minor Adverse	Significant / Moderate

			The importation of unsuitable or contaminated fill material for the purpose of reinstatement works or access road may also pose a risk to the surrounding subsoils.			
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8.6 POTENTIAL CUMULATIVE IMPACTS

EU Guidelines¹ define cumulative impacts as:

‘..impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project. For example:

- *Incremental noise from a number of separated developments;*
- *Combined effect of individual impacts, e.g. noise, dust and visual, from one development on a particular receptor; and*
- *Several developments with insignificant impacts individually but which together have a cumulative effect.’*

The EPA Guidelines on the Information to be Contained in Environmental Impact Statements mirrors this approach and defines cumulative impacts as *‘The addition of many small impacts to create one larger, more significant, impact’*.

Therefore, the assessment of cumulative impacts considers the total impact associated with the proposed development when combined with other past, present, and reasonably foreseeable future developments.

An examination of the potential for other projects to contribute cumulatively to the impacts from the proposed development was undertaken during the preparation of this EIAR.

The proposed development comprises the first phase of the overall development of the applicant’s c. 20.78 ha landholding at this location. The application is accompanied by an overall site masterplan drawing indicating a future Phase 2 residential development of c. 250 units, a supermarket for which planning has been granted and a cancer treatment clinic (proton therapy).

An application for planning permission for the treatment clinic was lodged with Kildare County Council (planning reference number 18/149). Permission was subsequently granted but is currently subject to an An Bord Pleanála appeal. Planning permission has also been granted by Kildare County Council for the Lidl supermarket and is currently on-site.

Given the scale of the wider masterplan proposals and the capacity of the surrounding environment to accommodate development, the cumulative impact of the construction of the required buildings, infrastructure and hardstanding on the underlying geology is predicted to be long term and slight. Potential impacts on subsoils and human health may occur should unexpected buried waste or contaminated material be encountered during the development works; however, provided appropriate mitigation measures (refer to Section 8.8 of this chapter) are in place, the overall impact on soils and local geology is likely to be imperceptible.

8.7 ‘DO NOTHING’ IMPACT

If the proposed development did not proceed, it is envisaged that the land use would remain unchanged as a derelict military barracks. Although no evidence of contamination has been identified in the course of site investigations carried out to date, given its historic uses, the site in its current state may represent a local soil and groundwater contamination risk.

8.8 AVOIDANCE, REMEDIAL & MITIGATION MEASURES

With regard to the above assessment the following mitigation measures are recommended.

8.8.1 Pre-Construction

LS PRE-CONST 1: Where feasible, the extent of excavation works and depths for dwellings and roads shall be limited through design to minimise disturbance of the original soil

¹Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, May 2009, EC DG XI Environment, Nuclear Safety & Civil Protection Ref: NE80328/D1/3

and subsoil formations and to retain soil structure. This will also help to reduce the volumes of backfill and material to be removed off-site.

LS PRE-CONST 2: No development works shall take place before a geophysical survey of areas of the site where buried ordnances may have been deposited has been undertaken. Any potential detections will followed by an environmental site investigation, risk assessment and the implementation of a remediation program. All such works shall be undertaken in consultation with Kildare County Council and validation of any remedial works required shall be provided to the Council prior to the commencement of development works.

LS PRE-CONST 3: A detailed asbestos survey shall be undertaken within existing above ground structures and any asbestos identified shall be appropriately removed for off-site disposal by a licensed asbestos removal contractor and validation of the removal certified prior to the commencement of site demolition works.

LS PRE-CONST 4: A number of potential sources of buried waste / contamination were identified that warrant further investigation prior to the commencement of development works. These include a former gravel pit, a former well, earthen embankments containing construction and demolition waste material and former fuel and artillery storage areas. In addition, asbestos within the existing made ground material across much of the site must be considered a possibility without more detailed site investigation information. These areas shall be investigated prior to the commencement of development works and suitable mitigation measures (including special environmental and human health contingency plans and procedures, following best-practice guidance) for the unexpected discovery of contaminated land or illegally deposited waste materials shall be developed and implemented as part of a detailed risk assessment under the direction of a contaminated land consultant / hydrogeologist.

LS PRE-CONST 5: No development works shall take place before a site investigation programme has been carried out to assess identified potential sources of land contamination. Investigations shall include further trail pitting, borehole drilling and soil and water sampling.

LS PRE-CONST 6: No development works shall take place before a soil sampling exercise has been undertaken in relation to areas where soils are to be excavated for off-site disposal. The soils shall be appropriately tested and classified in accordance with best practice and waste management legislation.

LS PRE-CONST 7: Detailed plans to deal with the possibility of encountering contaminated land / materials during construction shall be developed and included within an overall Construction Environmental Management Plan (CEMP) to be approved in advance of the commencement of development works by Kildare County Council. In the event that contamination is encountered, the approved plans shall be adhered to at all times by relevant contractors and subcontractors.

LS PRE-CONST 8: Monitoring prior to, during and post construction works of groundwater quality shall be undertaken to ensure minimum disturbance of water quality in the general vicinity of the site. During the construction phase, the monitoring programme shall include daily checks, weekly inspections and monthly audits to ensure compliance with the Construction and Demolition Waste Management

Plan (CDWMP) and the CEMP. This shall be undertaken in consultation with Kildare County Council.

8.8.2 Construction Phase

LS CONST 1: Suitable runoff and sediment control measures shall be designed and implemented prior to and during construction activities. These control measures depend upon weather conditions, site characteristics and construction activities and will ensure protection to the underlying subsoils and groundwater aquifer. Discharges or runoff to any surface water body are not anticipated as there are no surface water features present at or in close proximity to the site.

LS CONST 2: Adequate security measures shall be installed on the construction site. Early assessment of sensitivities and risks will assist in the design of the site layout and security measures required. Security measures shall include secure fencing, secure site access, securing plant and equipment, secure storage of materials, sufficient warning signage and security lighting.

LS CONST 3: Wheel wash facilities shall be provided close to the site entrance to reduce the deposition of mud, soils and other substances on the surrounding road network.

LS CONST 4: Waste fuels and materials shall be stored in designated areas that are isolated from surface water drains or open waters (e.g. excavations). Skips shall be closed or covered to prevent materials being blown or washed away and to reduce the likelihood of contaminated water leakage. Hazardous wastes such as waste oil, chemicals and preservatives, shall be stored in sealed containers and kept separate from other waste materials while awaiting collection by a registered waste carrier. Fuelling, lubrication and storage areas and site offices shall not be located within 25m of drainage ditches, surface waters or open excavations. Fuel interceptor tanks shall be installed on the site to treat any runoff.

LS CONST 5: All waste containers (including all ancillary equipment such as vent pipes and refuelling hoses) shall be stored within a secondary containment system (e.g. a bund for static tanks or a drip tray for mobile stores and drums). The bunds shall be capable of storing 110% of the tank capacity. Where more than one tank is stored, the bund shall be capable of holding 110% of the largest tank or 25% of the aggregate capacity (whichever is greater). Drip trays used for drum storage shall be capable of holding at least 25% of the drum capacity. Where more than one drum is stored the drip tray shall be capable of holding 25% of the aggregate capacity of the drums stored. Spill kits shall be kept in these areas in the event of spillages.

LS CONST 6: All construction vehicles, plant and machinery shall be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected. Precautions shall be taken to avoid spillages, including:

- Supervision of deliveries and refuelling activities;
- Use of secondary containment e.g. bunds around oil storage tanks;
- Use of drip trays around mobile plant; and
- Designating and using specific impermeable refuelling areas isolated from surface water drains.

LS CONST 7: All potentially hazardous materials shall be securely stored on site.

LS CONST 8:	Soils shall be reused on site where possible. Chemical analysis will be carried out to assess whether the backfill material is inert or presents a risk to human and / or environmental receptors. Suitable soil disposal routes and waste soil receiving facilities shall be determined and incorporated into the Construction & Demolition Waste Management Plan (C&DWMP) for the works.
LS CONST 9:	Excavated materials shall be visually assessed for signs of contamination. Should material appear to be contaminated or potentially contaminated, samples shall be analysed by an appropriate testing laboratory. Contaminated material shall be treated in accordance with the Waste Management Regulations. All excess fill and material considered unacceptable for reuse on site in terms of the residual risk posed to human health and to the environment shall be appropriately disposed of in accordance with the Waste Management Regulations.
LS CONST 10:	Surplus subsoil arisings caused by excavations for foundations, roads and drainage shall be minimised and where necessary, stockpiled and taken off-site to a licensed landfill facility. Any topsoil that is removed shall be used for re-grading at a later stage.
LS CONST 11:	Reusable excavated gravels, sands or rock shall be retained on-site for backfilling or drainage purposes to reduce the total volume of imported material.
LS CONST 12:	All imported soils and stones shall be sourced from a licenced / permitted facility with suitable documentation to confirm the material is inert and fit for purpose.
LS CONST 13:	Topsoil shall be stored in an appropriate manner on site for the duration of the construction works and protected for re-use on completion of the main site works.
LS CONST 14:	Top-soiling and landscaping of the works shall be undertaken as soon as finished levels are achieved, in order to reduce weathering and erosion and to retain soil properties. Existing topsoil shall be retained on site to be used for the proposed development.
LS CONST 15:	The construction phase shall be monitored in relation to: <ul style="list-style-type: none">• Prevention of oil and diesel spillages;• Adequate runoff control of potential stockpiles of contaminated subsoil;• Protection of topsoil stockpiled for re-use; and• Cleanliness of the adjoining road network.

8.8.3 Operational Phase

No mitigation measures are considered necessary during the operational phase of development if all mitigation measures listed within Sections 8.8.1 and 8.8.2 of this Chapter are implemented.

8.9 PREDICTED IMPACTS OF THE PROPOSED DEVELOPMENT

The potentially significant impacts detailed within Tables 8.4 and 8.5 are resolved within Table 8.6 and Table 8.7 on the basis of the proposed mitigation measures set out in Section 8.8. Impacts assessed as imperceptible within Tables 8.4 and 8.5 are not considered further.

Table 8.6 Predicted Construction Phase Impacts

No.	Construction Activity	Attribute	Character of Impact	Mitigation	Residual Impact
2	Excavation works	Site Subsoils	Extensive stripping and wide-scale excavation of soils and sub-soils to prepare and construct the development is proposed. The main volume of excavation will be resultant from the proposed underground surface water soakaway systems. Reusable excavated soils will be retained on-site for backfilling or drainage purposes to reduce the total volume of imported material. It is anticipated that the impact on soils arising from the construction phase will be short-term and slight.	No development works shall take place before a soil sampling exercise has been undertaken in relation to areas where soils are to be excavated for off-site disposal. The soils shall be appropriately tested and classified in accordance with best practice and waste management legislation. Surplus subsoil arisings caused by excavations for foundations, roads and drainage shall be minimised and where necessary, stockpiled and taken off-site to a licensed landfill facility. Any topsoil that is removed shall be used for re-grading at a later stage.	Imperceptible
3	Excavation works leading to soil erosion	Site Subsoils	Earthworks and the removal of topsoil would expose subsoil layers to the effects of weathering and may result in the erosion of soil, particularly in times of adverse weather conditions.	Where feasible, the extent of excavation works and depths for dwellings and roads shall be limited through design to minimise disturbance of the original soil and subsoil formations and to retain soil structure. This will also help to reduce the volumes of backfill and material to be removed off-site. Suitable runoff and sediment control measures shall be designed and implemented prior to and during construction activities. These control measures depend upon weather conditions, site characteristics and construction activities and will ensure protection to the underlying subsoils and groundwater aquifer. Discharges or runoff to any surface water body are not anticipated as there are no surface water features present at or in close proximity to the site.	Imperceptible

				<p>Wheel wash facilities shall be provided close to the site entrance to reduce the deposition of mud, soils and other substances on the surrounding road network.</p> <p>Reusable excavated gravels, sands or rock shall be retained on-site for backfilling or drainage purposes to reduce the total volume of imported material.</p> <p>Topsoil shall be stored in an appropriate manner on site for the duration of the construction works and protected for re-use on completion of the main site works</p> <p>Top-soiling and landscaping of the works shall be undertaken as soon as finished levels are achieved, in order to reduce weathering and erosion and to retain soil properties. Existing topsoil shall be retained on site to be used for the proposed development.</p> <p>The construction phase shall be monitored in relation to:</p> <ul style="list-style-type: none"> • Prevention of oil and diesel spillages; • Adequate runoff control of potential stockpiles of contaminated subsoil; • Protection of topsoil stockpiled for re-use; an • Cleanliness of the adjoining road network. 	
5	Fuel storage/usage on site	Subsoils Future Site Users	Accidental spillage of contaminants during construction works may cause short to long term, moderate to significant impacts to subsoils and to future site users if not stored and used in an environmentally safe manner. (Potential impacts to groundwater are addressed separately within Chapter 9	Detailed plans to deal with the possibility of encountering contaminated land / materials during construction shall be developed and included within an overall Construction Environmental Management Plan (CEMP) to be approved in advance of the commencement of development works by Kildare County Council. In the event that contamination is encountered, the approved plans shall be adhered to	Imperceptible

			<p>of this EIAR)</p>	<p>at all times by relevant contractors and subcontractors. Monitoring prior to, during and post construction works of groundwater quality shall be undertaken to ensure minimum disturbance of water quality in the general vicinity of the site. During the construction phase, the monitoring programme shall include daily checks, weekly inspections and monthly audits to ensure compliance with the Construction and Demolition Waste Management Plan (CDWMP) and the CEMP. This shall be undertaken in consultation with Kildare County Council.</p> <p>Waste fuels and materials shall be stored in designated areas that are isolated from surface water drains or open waters (e.g. excavations). Skips shall be closed or covered to prevent materials being blown or washed away and to reduce the likelihood of contaminated water leakage. Hazardous wastes such as waste oil, chemicals and preservatives, shall be stored in sealed containers and kept separate from other waste materials while awaiting collection by a registered waste carrier. Fuelling, lubrication and storage areas and site offices shall not be located within 25m of drainage ditches, surface waters or open excavations. Fuel interceptor tanks shall be installed on the site to treat any runoff.</p> <p>All waste containers (including all ancillary equipment such as vent pipes and refuelling hoses) shall be stored within a secondary containment system (e.g. a bund for static tanks or a drip tray for mobile stores and drums). The bunds shall be capable of storing 110% of the tank capacity. Where more than one tank is stored, the bund shall be capable of holding 110% of the largest tank or 25% of the aggregate capacity (whichever is greater). Drip trays used for drum</p>	
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				storage shall be capable of holding at least 25% of the drum capacity. Where more than one drum is stored the drip tray shall be capable of holding 25% of the aggregate capacity of the drums stored. Spill kits shall be kept in these areas in the event of spillages. All potentially hazardous materials shall be securely stored on site.	
6	Construction traffic	Subsoils Future Site Users	There may be a risk of soil and groundwater pollution from site traffic through the accidental release of oils, fuels and other contaminants from vehicles. (Risks to groundwater are discussed in more detail in Chapter 9 of this EIAR)	All construction vehicles, plant and machinery shall be maintained on a weekly basis and checked daily to ensure any damage or leakages are corrected. Precautions shall be taken to avoid spillages, including: <ul style="list-style-type: none"> • Supervision of deliveries and refuelling activities; • Use of secondary containment e.g. bunds around oil storage tanks; • Use of drip trays around mobile plant; and • Designating and using specific impermeable refuelling areas isolated from surface water drains 	Imperceptible
7	Contaminated land/ buried waste (undetected)	Subsoils	Localised buried made ground material (possibly historical C&D waste) comprising brown sandy gravelly silty clay with significant quantities of brick, timber, glass and metal to depths up to 8.3 mbgl was encountered in the southeast of the former barracks site (outside the proposed development site boundary). No testing of this material has been undertaken to date, although visual observations did not record any leaching effects, odours, contaminant staining or visual evidence of active contamination in this location. The disturbance and release of pollutants during excavation	A detailed asbestos survey shall be undertaken within existing above ground structures and any asbestos identified shall be appropriately removed for off-site disposal by a licensed asbestos removal contractor and validation of the removal certified prior to the commencement of site demolition works. A number of potential sources of buried waste / contamination were identified that warrant further investigation prior to the commencement of development works. These include a former gravel pit, a former well, earthen embankments containing construction and demolition waste material and former fuel and artillery storage areas. In addition, asbestos within the existing made ground material across much of the site must be considered a possibility without	Imperceptible
8		Future Site Users			Imperceptible

			<p>works in this area is considered a possibility that may pose a long term risk to the surrounding subsoils, groundwater or to future/adjacent site users without a more detailed investigation in this area of the site. (Risks to groundwater are discussed in more detail in Chapter 9 of this EIAR)</p> <p>A number of potential sources of buried waste / contamination were identified that warrant further investigation prior to the commencement of development works. These include a former gravel pit, a former well, earthen embankments containing construction and demolition waste material and former fuel and artillery storage areas. In addition, asbestos within the existing made ground material across much of the site must be considered a possibility without more detailed site investigation information.</p> <p>Based on site investigations undertaken to date, the made ground material recorded at shallow depths across much of the site is considered</p>	<p>more detailed site investigation information. These areas shall be investigated prior to the commencement of development works and suitable mitigation measures (including special environmental and human health contingency plans and procedures, following best-practice guidance) for the unexpected discovery of contaminated land or illegally deposited waste materials shall be developed and implemented as part of a detailed risk assessment under the direction of a contaminated land consultant / hydrogeologist.</p> <p>No development works shall take place before a site investigation programme has been carried out to assess identified potential sources of land contamination. Investigations shall include further trail pitting, borehole drilling and soil and water sampling.</p> <p>Detailed plans to deal with the possibility of encountering contaminated land / materials during construction shall be developed and included within an overall Construction Environmental Management Plan (CEMP) to be approved in advance of the commencement of development works by Kildare County Council. In the event that contamination is encountered, the approved plans shall be adhered to at all times by relevant contractors and subcontractors.</p> <p>Excavated materials shall be visually assessed for signs of contamination. Should material appear to be contaminated or potentially contaminated, samples shall be analysed by an appropriate testing laboratory. Contaminated material shall be treated in accordance with the Waste Management Regulations. All excess</p>	
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			unlikely to pose a significant risk to human health or to the environment; however without chemical testing of this material the risk cannot be fully discounted.	fill and material considered unacceptable for reuse on site in terms of the residual risk posed to human health and to the environment shall be appropriately disposed of in accordance with the Waste Management Regulations.	
9	Contaminated infill	Subsoils Future Site Users	The importation of unsuitable or contaminated fill material for the purpose of reinstatement works or access roads may pose a risk to the surrounding subsoils and/or to future site users.	All imported soils and stones shall be sourced from a licenced / permitted facility with suitable documentation to confirm the material is inert and fit for purpose.	Imperceptible
10	Waste arisings	Subsoils	Waste material generated from construction activities may require disposal off-site if not suitable for reuse on site. Temporary storage on site may be required and impacts to exposed subsoils and groundwater from possible contaminated direct runoff during rainfall events may occur.	Soils shall be reused on site where possible. Chemical analysis will be carried out to assess whether the backfill material is inert or presents a risk to human and / or environmental receptors. Suitable soil disposal routes and waste soil receiving facilities shall be determined and incorporated into the Construction & Demolition Waste Management Plan (C&DWMP) for the works. Any contaminated subsoils stockpiled on site shall be appropriately located and protected to minimise the generation of contaminated runoff migrating to the surrounding subsoils.	Imperceptible
11	Vandalism	Subsoils Future Site Users	Pollution due to vandalism of stores or plant poses a risk to subsoils and to future site users. (The risks posed to the underlying groundwater body are considered in Chapter 9 of this EIAR)	Adequate security measures shall be installed on the construction site. Early assessment of sensitivities and risks will assist in the design of the site layout and security measures required. Security measures shall include secure fencing, secure site access, securing plant and equipment, secure storage of materials, sufficient warning signage and security lighting.	Imperceptible

12	Buried unexploded ordnances	Site Workers Off-site residents	The risk of encountering buried unexploded ordnances is considered low based on non-detection to date during previous site investigations. However, as a conservative measure a high risk is assigned without a more detail survey of the site undertaken.	No development works shall take place before a geophysical survey of areas of the site where buried ordnances may have been deposited has been undertaken. Any potential detections will followed by an environmental site investigation, risk assessment and the implementation of a remediation program. All such works shall be undertaken in consultation with Kildare County Council and validation of any remedial works required shall be provided to the Council prior to the commencement of development works.	Imperceptible
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Table 8.7 Predicted Operational Impacts

No.	Construction Activity	Attribute	Character of Impact	Mitigation	Residual Impact
1	Hydrocarbon laden surface water runoff from roads, car parks and general hardstanding	Subsoils	Road surface runoff and poorly designed drainage system being channelled to subsoils before infiltrating to groundwater can result in contamination of the surrounding subsoils.	An appropriately designed drainage system shall be incorporated into the road design, as described in Chapter 9 of this EIAR.	Imperceptible

2	Contaminated land / waste	Subsoils Future Site Users	<p>Localised buried made ground material (possibly historical C&D waste) comprising brown sandy gravelly silty clay with significant quantities of brick, timber, glass and metal to depths up to 8.3 mbgl was encountered in the southeast of the former barracks site (outside the proposed development site boundary). No testing of this material has been undertaken to date, although visual observations did not record any leaching effects, odours, contaminant staining or visual evidence of active contamination in this location. The disturbance and release of pollutants during excavation works in this area is considered a possibility that may pose a long term risk to the surrounding subsoils, groundwater or to future/adjacent site users without a more detailed investigation in this area of the site.</p> <p>The importation of unsuitable or contaminated fill material for the purpose of reinstatement works or access road may also pose a risk to the surrounding subsoils.</p>	<p>A number of potential sources of buried waste / contamination were identified that warrant further investigation prior to the commencement of development works. These include a former gravel pit, a former well, earthen embankments containing construction and demolition waste material and former fuel and artillery storage areas. In addition, asbestos within the existing made ground material across much of the site must be considered a possibility without more detailed site investigation information. These areas shall be investigated prior to the commencement of development works and suitable mitigation measures (including special environmental and human health contingency plans and procedures, following best-practice guidance) for the unexpected discovery of contaminated land or illegally deposited waste materials shall be developed and implemented as part of a detailed risk assessment under the direction of a contaminated land consultant / hydrogeologist.</p> <p>No development works shall take place before a site investigation programme has been carried out to assess identified potential sources of land contamination. Investigations shall include further trail pitting, borehole drilling and soil and water sampling.</p>	Imperceptible
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8.10 MONITORING

Pre-construction site investigations will include the installation of boreholes and monitoring wells at the site, trial pitting, soil and groundwater sampling for chemical analysis and ground gas monitoring. In addition, a groundwater monitoring program comprising groundwater level monitoring and groundwater quality sampling over an extended period of time will be undertaken to confirm baseline hydrogeological conditions across the site and to provide an additional level of protection during development works.

Soil removed during the construction phase is to be monitored to maximise potential for re-use on site. Monitoring of any hazardous material stored on-site will form part of the proposed Construction and Demolition Waste Management Plan and Construction Environmental Management Plan.

A waste soil sampling exercise shall be undertaken in relation to areas where soils are to be excavated for off-site disposal. The soils shall be appropriately tested and classified in accordance with best practice and waste management legislation.

A dust management programme shall be implemented during the construction phase of development. The quantities of topsoil, subsoil and rock removed off site shall also be recorded.

8.11 REINSTATEMENT

In open space areas where finished ground levels are altered and extensive excavation of topsoil and subsoil is required, the areas should be seeded and landscaped in a timely manner to ensure weathering of subsoils is limited.

8.12 INTERACTIONS

The potential for interrelationships arises with the environmental topics of Water and Biodiversity. Soils, geology and hydrogeology have an important interrelationship with the water and ecological environment, as a determinant of water chemistry, river flow regimes, water storage capacity and watercourse location. It also has an impact on water quality through the ability of bedrock and surface deposits to filter potential pollutants. Potential ecological impacts could also occur through the mishandling of soils or through the deposition of excavated soils in ecologically sensitive areas.

An evaluation was undertaken based on the identification of potential sources, pathways and receptors across the site. If all three elements (source, pathway and receptor) are present, there is a linkage and there is a potential impact on the receptor(s). In terms of the site geology, the only potential sources related to the possible contaminant hotspot locations within the subsoils at the site identified in Section 8.3.10 of this chapter. Receptors include the groundwater aquifer and future site and off-site users. There are no SACs or groundwater dependent terrestrial ecosystems (GWDTEs) receptors downgradient or in close proximity to the site. Pathways include inhalation of ground gases or vapour, dermal contact, ingestion and absorption through the skin via direct contact.

During construction the potential impacts to the underlying subsoils from the proposed works could derive from accidental spillages of fuels or the disturbance of previously unidentified buried waste material, which could impact on groundwater quality (if allowed to infiltrate to groundwater) or ecological receptors. The application of the mitigation measures proposed in this chapter, together with those proposed in chapters 6 and 9 of this EIAR will ensure that residual impacts on water and biodiversity, although long-term, will be imperceptible.

8.13 DIFFICULTIES ENCOUNTERED IN COMPILING

No difficulties were encountered during the course of this assessment.

8.14 REFERENCES

NRA Design Manual for Roads and Bridges, 2011

Radon Map of Ireland (<http://www.epa.ie/radiation/radonmap>)

Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions, May 2009, EC DG XI Environment, Nuclear Safety & Civil Protection Ref: NE80328/D1/3

Kuczynska, A. (2008) Eco-hydrology of Pollardstown Fen, County Kildare. Ph.D. Thesis. Trinity College Dublin, Ireland.

APPENDIX 8.1 PHASE 1 ENVIRONMENTAL SITE ASSESSMENT REPORT



Former Magee Barracks Site Phase 1 Environmental Site Assessment (Revised)

Report for:
Columbia Estates Management (IE) Limited

Date:
3rd July 2019

Report No:
BRE17020Rp06A01

BlueRock Environmental Limited
Suite 332, 48 Lower Salthill,
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The conclusions and recommendations contained in this report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by BREL has not been independently verified by BREL, unless otherwise stated in the report. Where assessments of works or costs identified in this report are made, such assessments are based upon the information available at the time and where appropriate are subject to further investigations or information which may become available.

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Where field investigations are carried out, these have been restricted to a level of detail required to meet the stated objectives of the services. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in issuing this report.

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1 INTRODUCTION

1.1 Introduction

BlueRock Environmental Ltd (BREL) presents within this report a Phase 1 Environmental Site Assessment (ESA) of the former Magee Barracks site, in Kildare town, Co. Kildare. The objective of the assessment is to assess any potential environmental liabilities associated with the site in terms of soils, geology, groundwater, surface water and contamination.

1.2 Scope of Work

The following scope of works was undertaken during the completion of this assessment:

- A desk top review of all available geological, hydrogeological, hydrological and contamination pertaining to the site and its general environs and to develop an initial conceptual understanding of the site;
- A site visit to confirm the findings of the desk study and to identify any additional issues associated with the site. A site walkover was undertaken by a BREL Environmental Consultant on the 1st July 2019 to assess current site conditions and to confirm the findings of the desk study;
- A review all historical and current maps, reports and activities undertaken at the site and in the general environs including a review of previous site investigations undertaken across the site; and,
- Collation of all above information into a Phase 1 Environmental Site Assessment including, if necessary, proving recommendations for investigative works to address any environmental issues/liabilities identified.

1.3 Desk Study

The following sources of publicly available information were consulted as part of the desk study:

- Ordnance Survey of Ireland, Discovery Series, Sheet 55;
- Ordnance survey of Ireland (OSI) online historical maps and aerial photographs;
- Geology of Kildare-Wicklow, Geological Survey of Ireland (GSI) (1:100,000), Sheet 16;
- GSI On-line Groundwater database. Aquifer Classification, Aquifer Vulnerability, Teagasc Soil Classification;
- GSI Curragh West Groundwater body (GWB);
- Soil Map of Ireland (Second Edition, 1980), national Soil Survey of Ireland, An Foras Talúntais.
- National Parks and Wildlife Service On-line database www.npws.ie;
- EPA Online Water Quality Mapping; <http://www.epa.ie/rivermap/>;
- OPW Hydro-Data (<http://www.opw.ie/hydro-data>);
- Met Eireann - Met.ie – monthly climatological data;
- Kildare County Council Online Planning Files and County Development Plan;
- Directory of Active Quarries, Pits and Mines in Ireland (3rd Edition) GSI. 2002;

2 BACKGROUND SITE INFORMATION

2.1 Site Location and Setting

The site in question is located within Kildare town on Hospital street (see Figure 2.1). It was formerly known as Magee Barracks, comprising of abandoned army barracks and attached green field areas.

BREL understands that as part of a current Masterplan for the entire site the area at will be developed under 2 separate phases. The Phase 1 portion of the site is bounded by Hospital Street (R445) to the south, Ruanbeg Housing Development to the East, Phase 2 green field site to the northeast, recently completed primary school (PL Ref: 1613), Kildare Gael Scoil, to the northwest and Campion Crescent / Magee Terrace Housing to the west.

The future Phase 2 portion of the site is located north of phase 1 and is bounded by Melitta Park Housing to the north, Melitta Road (R413) to the northwest, primary school to the west and Ruanbeg Housing to the east.

The Phase 1 lands are brownfield in nature, predominantly macadam surfaced parade grounds with reception and barracks building around the perimeter.

The total area of the Phase 1 and Phase 2 lands in the applicant's ownership is circa. 21 hectares – approximately 50% comprises each phase.



Figure 2.1 Current Site Location & Layout

2.2 Site Layout

The Phase 1 site is generally level and occupied by various redundant military installations, with only limited areas of greenfield. The remainder of the Masterplan to the northeast is greenfield, sloping gently to the north and east.

The northern half of the Masterplan comprises two large fields, or parts thereof (Fields 2 & 3 and a narrow strip of Field 1) – see Figure 2.9. For the most part the land slopes gently in a north /

northeasterly direction and the fields are rough pasture with an uneven ground surface. Houses back onto the western, northern and eastern boundaries.

The townland boundary between Kildare and Collaghknock Glebe at the northeastern corner of the Masterplan Area is formed by a high gravel ridge, with mature hedgerow running along the top of it. The ridge slope has been at least partly augmented by dumps of construction material, with a large mound extending east from it just outside the Masterplan Area.

2.3 Site History & Operation

A review of relevant historical information pertaining to the site was undertaken by reviewing historical maps in addition to a detailed historical review undertaken by Courtney Dery Heritage Consultancy Limited in 2017 as part of an EIS application currently being submitted for the redevelopment of the Phase 1 portion of the Masterplan of the site.

This chapter provides significant detail relating to the historical activities and site layouts of the site over time including its immediate surrounds and should be reviewed separately to this Phase 1 ESA report to provide a more detailed understanding of the site's history. Salient information from this report, including historical maps, has been utilised in the compilation of Section 2.3 within this report for clarity.

The following information provides a brief and relevant summary of the site's history with a focus on potential historical activities or features that may present on-going or future environmental liabilities for the site.

2.3.1 The Lock Hospital, 1869-1887

Hospital Street is named for a mid-19th century Lock Hospital (on the site of the later Magee Barracks) which was constructed on land leased from the Duke of Leinster and opened in 1869 (the hospital had a relatively short life-span and was separate to the County Infirmary which was located a short distance away on the opposite side of the road (N7) on the site of the present Curragh Lodge Hotel).

The Lock Hospital was built by direction of the British Secretary of State for the War Department (or War Office) and known officially as the Curragh Lock Hospital because of its close association with the then recently constructed Curragh Military Camp for 10,000 soldiers of the British Army. 'Lock Hospital' was the name given to institutions treating venereal diseases and the hospital operated under the auspices of the Contagious Disease Acts (1864 & 1866) until the Repeal Act in 1886.

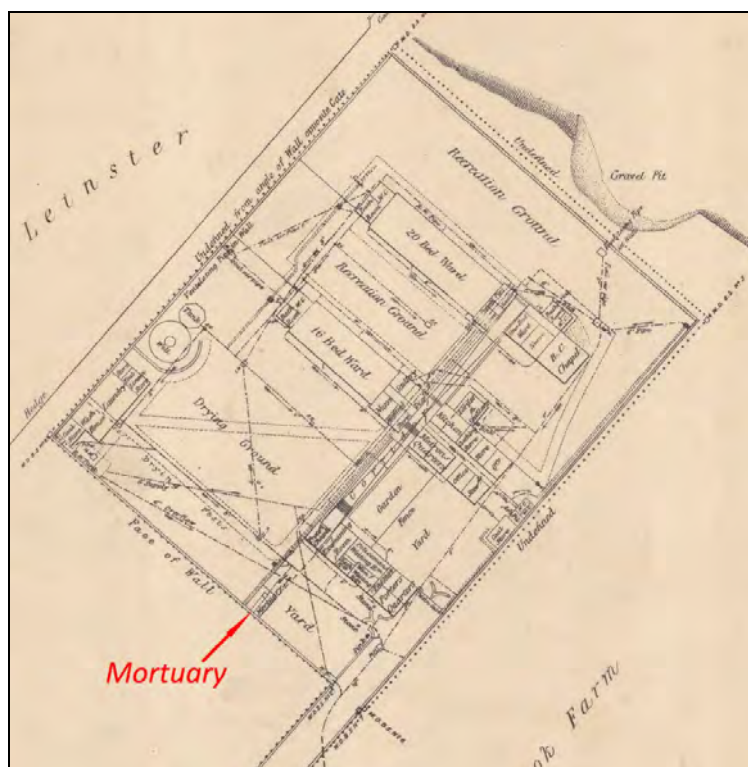


Figure 2.2 Extract of War Office Plan showing Lock Hospital, 1878

The building design consisted of a long corridor linking three blocks widely spaced using a single-storey pavilion principle (see Figure 2.2). A brief section of Crawford (2005)¹ describes the construction and layout of the hospital:

The external boundary walls of the hospital grounds were constructed of dressed stone masonry and capped. The hospital walls were constructed using local Athy stock bricks and hollow (cavity) walls were used for the wards and store building. The foundations were of brick laid on concrete. Slates were used on the roofs and the gables of the various buildings for weathering purposes.....The floors consisted of one inch timber sheeting laid on plates supported by dwarf walls ... The floor of the corridor was finished in asphalt. The hospital complex consisted of a long corridor linking three blocks, known as block A., B. and C. Block A, which was located beside the entrance gates, was the main reception area. This consisted of the porter's quarters, the policeman's waiting room, patient's waiting room and the medical officer's examination room. In addition to these facilities there was a bathroom and at the end next to the connecting corridor was the Protestant chapel. Block B was located fifty feet further along the corridor and on the south side of the corridor of the complex, and consisted of the matron's quarters, office, kitchen scullery and larder, clothing stores and steward's quarters. Immediately north of the corridor there was a nurse's quarter, medical store and dispensary leading on to a sixteen-bed ward. At the extreme end of this ward there was a bathroom and WC. Block C was located approximately fifty feet further along the corridor and consisted of a twenty-bed ward with a bathroom and WC at the extreme north side. South of the corridor there was a one-bed ward, nurses quarters, bath, WC, sink and shower. A Roman Catholic chapel completed the block. The remainder of the hospital complex was made up of two coal houses, wash room, a foul linen room, laundry which contained a washing machine, extensive drying grounds, incidental WCs and a mortuary. The water supply system consisted of a well sunk sixty-two feet to the ground water level, the shaft of which was

¹ Crawford, H. 2005. 'The Kildare Lock Hospital'. *Journal of the County Kildare Archaeological Society and Surrounding Districts*. Vol. 19 (3) 1-25.

supported by a brick lined wall. The water was pumped to an octagonal shaped water tower approximately fifty feet high with storage for 5,000 gallons ... The sewage and ground storm water was relayed to a sewage tank located some distance away from the hospital complex. This called for a network of underground sewers and ancillary inspection manholes. The remainder of the site was taken up with recreation areas and drying facilities.'

There is a mortuary depicted on the 1878 plan (see Figure 2.2) but it is not known whether the hospital had its own burial ground, official or otherwise. The hospital was closed in April 1887 following the passing of the Contagious Disease Repeal Act in 1886. Soon after the closure, the War Department acquired additional land around the site and incorporated the former hospital buildings into a new artillery barracks.

2.3.2 Kildare (Magee) Military Barracks (1900-1998)

The 1901 Census records the barracks consisting of four camp hutments with 65 carpenters and joiners, Irish and English involved in the construction of the barracks that would serve troops during both the Boer War and World War I. A public house was reportedly located on site. The Lock hospital building was retained and converted into a recreation and administration centre.

The barracks was first occupied in 1901. Following the war of Independence and signing of the treaty, the British made plans to vacate the barracks in April 1922. The families of all soldiers left the barracks on 15th April 1922 when it was handed over to the National Army (*Ibid.*).

The site became the location for training of new Civic Police until 1925 when the Artillery Corps which was formed in 1923 moved from Dublin to Kildare.

In 1998, the reorganisation of the Irish Army led to closure of the Kildare Barracks after 97 years of usage. Since its closure in 1998, the barracks has been used as a centre for Asylum Seekers, assisting Kosovan refugees displaced during the war in the Balkans.

2.3.3 Historical Maps

- *Noble and Keenan's Map of County Kildare, 1752*

There is more detail provided on Noble and Keenan's *Map of County Kildare* almost a century later (see Figure 2.3). The road from Kildare to Dublin (part of which is now Hospital Street / R445) can be seen branching eastwards and crossing the Curragh. The present Melitta Road (R413) is also depicted (with 'Whitesland' annotated to the north of it; i.e. Whitesland East townland), allowing an approximation of the proposed development site location; no features are depicted within this area.

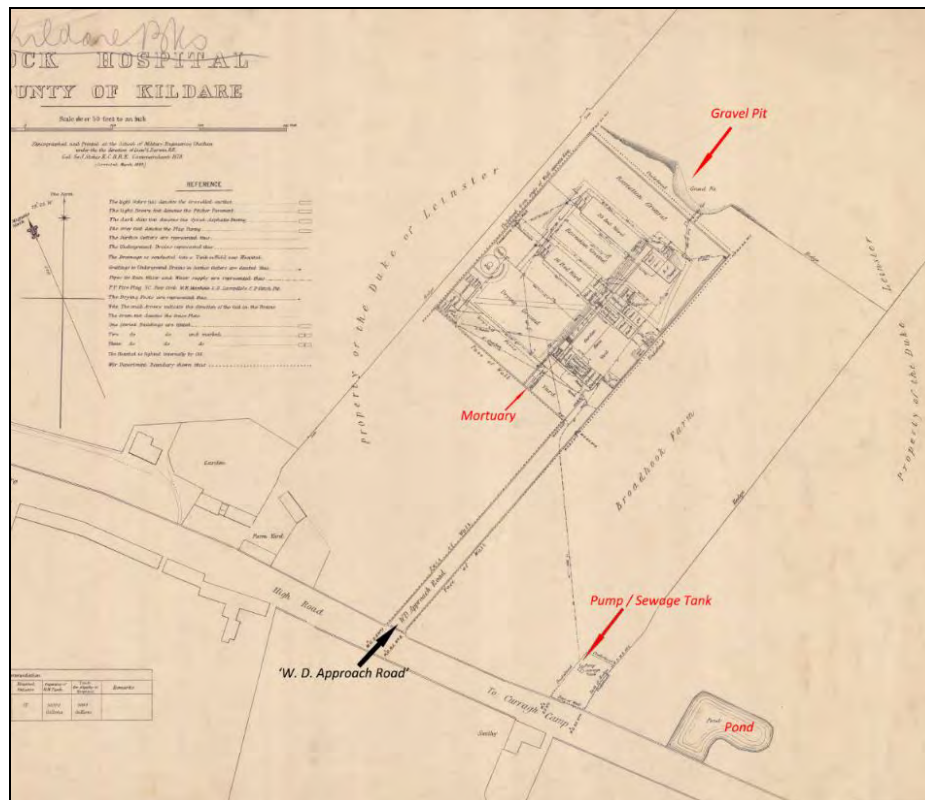
- *OS Town Plan of Kildare, scale 1:500, 1870-72 (Sheet 6 & 7)*

The 1870-72 town plan shows the recently constructed Lock Hospital, on the newly-named Hospital Street. The laneway depicted on the first edition OS map is still in place (see Figure 2.5), running along the northwestern boundary of the hospital, but a new entrance avenue has been created off Hospital Street further to the southeast. A gravel pit is marked and annotated at the rear of the hospital. The hospital occupied a relatively small and contained site (for the most part within the proposed development site) and the surrounding field and property boundaries remained unchanged.



(Source: Courtney Dery Heritage Consultancy, 2017)

Figure 2.5 Extract of Ordnance Survey Town Plan of Kildare, 1870-72



(Source: Courtney Dery Heritage Consultancy, 2017)

Figure 2.6 War Office Plan of Lock Hospital 1878 (corrected 1882)

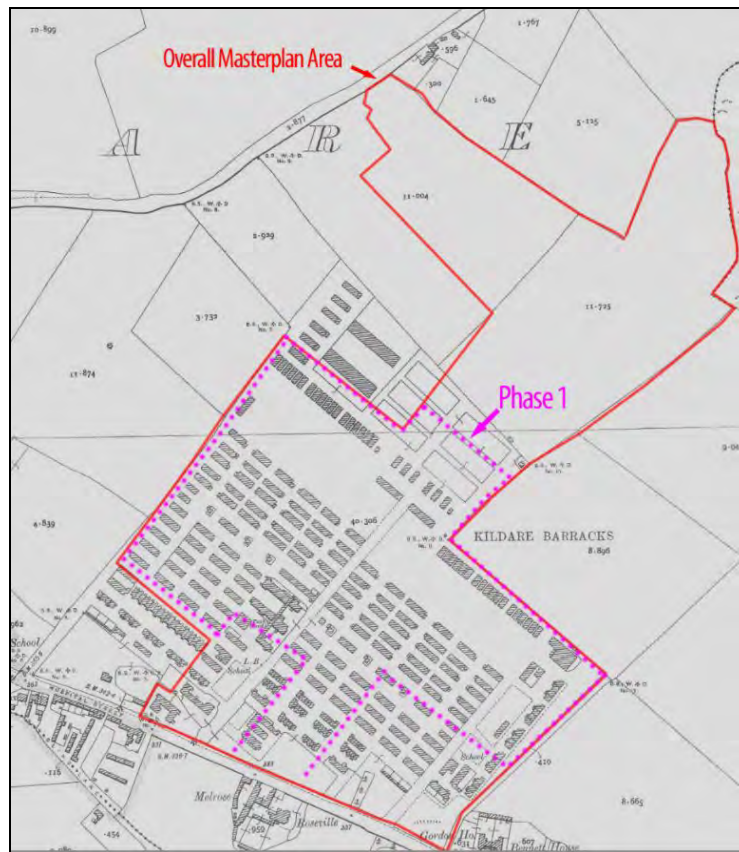
- **War Office Plan of Lock Hospital, 1878 (corrected 1882)**

The War Office plan of 1878 (Figure 2.6) provides a more detailed picture of the Lock Hospital and its layout. Broadhook farm-house, yard and a garden are located at Hospital Street, with the laneway extending northeastwards. The rear boundary to the hospital is a hedge to the southeast and large gravel pit to the northwest. The underground sewerage system connects to a pump and sewage tank in the southeast corner of the farm, at the roadside. The large L-shaped pond is depicted in the adjoining field to the east, also on the north side of the road, within the proposed development site.

- **Revised edition OS map, 25-inch, 1907-09**

The 1907-09 25-inch OS map details the constructed artillery barracks and is named 'Kildare Barracks' on the map (see Figure 2.7). The original hospital buildings have been incorporated into the design, as has the main avenue, with the latter now extending towards the rear of the barracks. Rows of wooden huts are neatly aligned on both sides of the avenue. There are some more substantial buildings depicted (two of which are annotated as schools), largely confined to the southern end of the barracks (both outside of the proposed Phase 1 development site).

There are two areas of open ground between the hut rows and the rear of the barracks, presumably grounds for parade or recreation. Beyond these areas are large rectilinear open plots (partly within the Phase 1 proposed development site) which may represent the vegetable plots known to have been present within the barracks or some form of temporary enclosure or structure. Adjacent buildings housed the transport sheds, gun sheds, stables, stores etc., with the fields beyond used to graze the horses (i.e. within the northern half of the overall Masterplan Area).

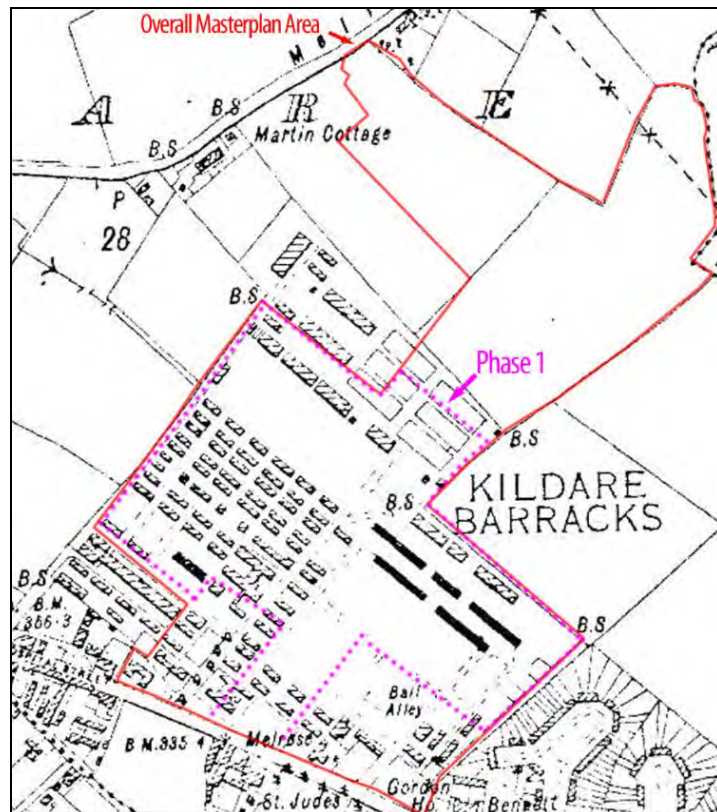


(Source: Courtney Dery Heritage Consultancy, 2017)

Figure 2.7 Extract of first edition Ordnance Survey 25-inch map, 1907-09

- **Revised edition Ordnance Survey (OS) six-inch map, 1939 (Sheet 22-12 & 22-16)**

By 1939, the new permanent barracks was under construction (the new permanent structures are marked in black on Figure 2.8). The most obvious change is the clearance of the hut rows on the southeast side of the avenue to create the parade ground and five long narrow blocks newly built along its northeast side, within the proposed Phase 1 development site. Some of the structures depicted along the southeast side of the new parade ground have been demolished, but not yet replaced. On the northwest side of the parade ground there have been few alterations to the original encampment, with the rows of huts still in place and only one new building depicted, on the southwest side of the 19th century hospital building, within the proposed Phase 1 development site.



(Source: Courtney Dery Heritage Consultancy, 2017)

Figure 2.8 Extract of revised edition Ordnance Survey (OS) six-inch map, 1939

2.4 Current Site Conditions

A site walkover was undertaken by a BREL Environmental Consultant on the 1st July 2019 to assess current site conditions and to confirm the findings of the desk study. It was noted that construction activities have commenced on the southern regions of the site where separate planning applications for a Proton Clinic and a supermarket have been granted approval.

Salient points of note relating to the current condition of the site are as follows:

- The northeastern corner of the Masterplan is formed by a high gravel ridge, with mature hedgerow running along the top of it. The ridge slope has been at least partly augmented by construction material, with a large mound extending east from it just outside the Masterplan Area.
- The main barracks area was bisected by an avenue, orientated southwest to northeast, running through the site for c. 315m from the entrance at Hospital Street. To the west of the main avenue is the former 'recreation area' which includes buildings that housed the former NCO's Mess and the shell store (now surrounded by a security fence), as well as a water tower. Residential properties back onto the northwestern and southwestern boundaries of this area. The area is entirely covered in tarmac / concrete surface

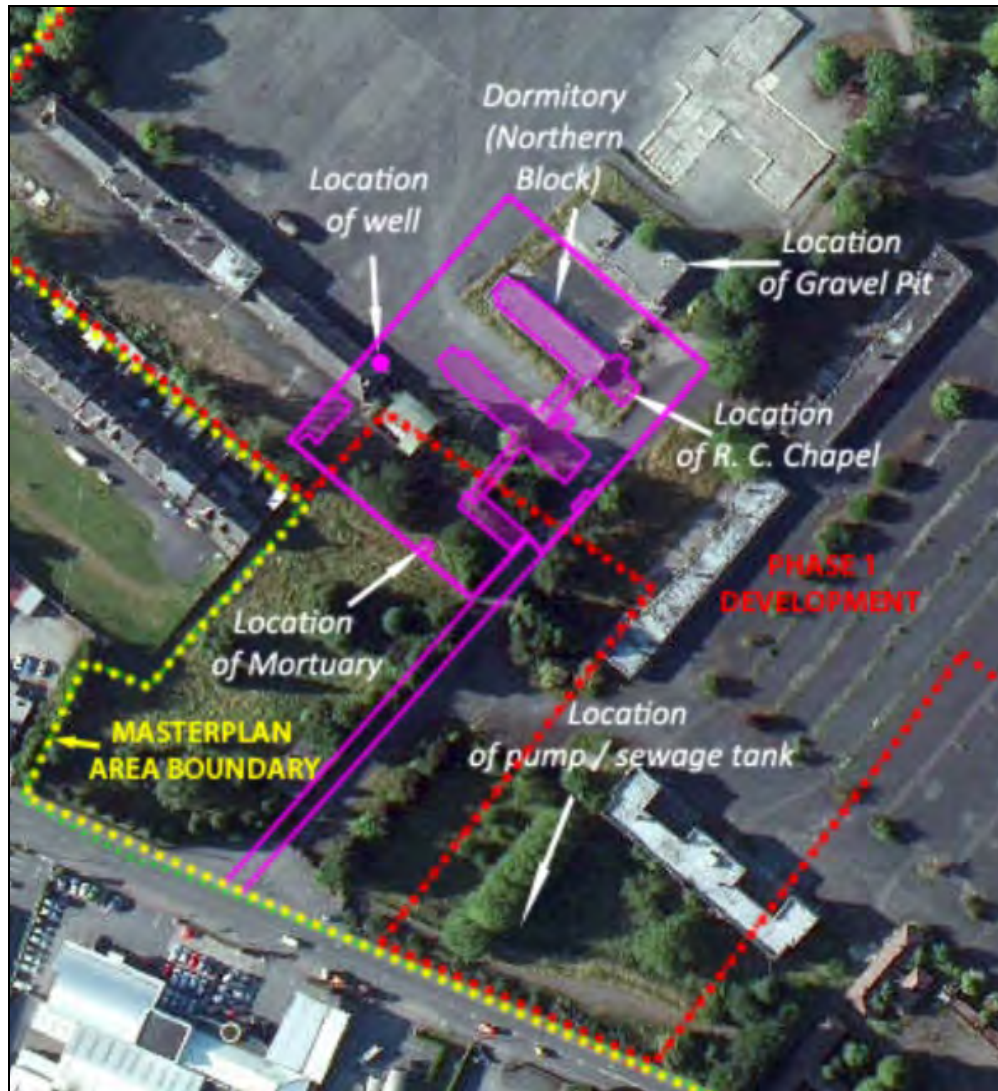


(Source: Courtney Dery Heritage Consultancy, 2017)

Figure 2.9 Aerial photograph showing proposed development site

- The main barracks was located to the east of the main avenue and includes the former Parade Ground, an expansive area with tarmac surface and the outer boundaries lined with mature trees (see Figures 2.9 and 2.10). Long, narrow building ranges (mostly two-storey) occupy the sides of the parade ground, housing accommodation blocks, the Officers Mess, administration, and training schools. There is also a number of smaller related structures to the rear of the main buildings on the northeast side (e.g. gun sheds and an 'electronics' building of recent origin). Most of the buildings are in poor condition. Houses back onto the eastern and northeastern boundaries of this part of the site.
- There is visible evidence of an extensive sewerage, water supply, and / or drainage network that underlies the barracks. Several manholes were noted within the former parade ground, along its southwestern side, and an unusually large number was evident in the former recreation area to the west of the avenue. It is likely that at least some of these date to the 1860s when the Lock Hospital was constructed (the hospital building occupied a plot along the southeastern side of the former recreation area and the use of red-brick in the hospital construction is also recorded). It is reported that the water supply system consisted of a well sunk sixty-two feet to the ground water level, the shaft of which was supported by a brick lined wall. The water was pumped to an octagonal shaped water tower approximately fifty feet high with storage for 5,000 gallons. The sewage and ground storm water was relayed to a sewage tank located some distance away from the hospital complex. This called for a network of underground sewers and ancillary inspection manholes.

- The foundations of the hospital walls were reportedly brick laid on concrete; partly buried and overgrown foundations showing use of these materials were observed in the location of the R. C. Chapel in the northern block of the former hospital, at the edge of the avenue.



(Source: Courtney Dery Heritage Consultancy, 2017)

Figure 2.10 Overlay of Lock Hospital plan (1872) onto modern aerial imagery

3 ENVIRONMENTAL BACKGROUND CONDITIONS

3.1 Geology

3.1.1 Soils & Subsoils

The EPA soils map indicates the predominant soil type in the development area to be Made Ground. The surrounding subsoils and subsoils underlying the made ground are mapped as glacial granular sand and gravel deposits overlying and cohesive gravely clay tills.

3.1.2 Bedrock

The bedrock geology beneath Kildare town consists of Carboniferous limestone deposits.

According to GSI sheet 16, the main rock units underlying the study area is the Rickardstown Formation (RK) – see Figure 3.1. The Rickardstown Limestone is cherty and often dolomitised. The GSI have identified two distinct horizons within this formation. The lower horizon is varied and includes thin interbedded units of nodular crinoidal, cherty micrite and fossiliferous shale. The upper part consists primarily of quite uniform, moderately dark grey, fine grained dolomite with abundant chert.

Other formations in proximity to the site include the Boston Hill Formation which includes major units of very distinctive, laminated limestone, which distinguish this formation from the Ballysteen Formation.

The area surrounding Kildare town is cut with faults running predominantly in northwest-southeast direction. The site lies between two of these faults, one located approximately 1.55 km southwest and the other approximately 2.5 km northeast of the Fen. Pollardstown Fen is located a similar distance northeast of the northeastern fault line mentioned above.

No bedrock outcrops or karst features have been mapped across or in the vicinity of the site by the GSI.

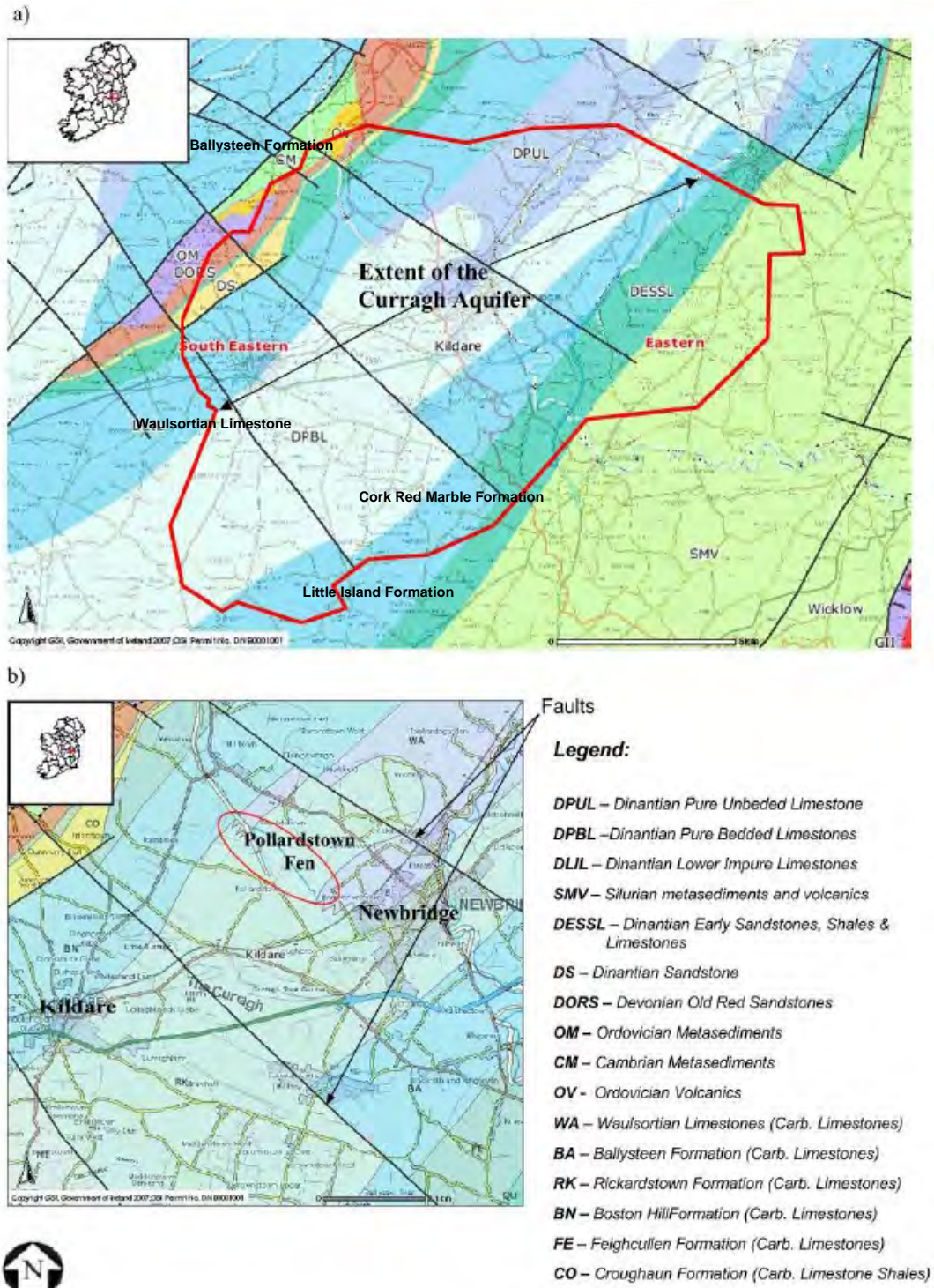


Figure 3.1 Bedrock Mapping

3.2 Designated Protected Areas & Geological Heritage Importance

The nearest site designated for nature conservation is the Curragh proposed Natural Heritage Area (pNHA), (site code 000392) approximately 0.5km to the northwest of Magee Barracks at its closest point. The Grand Canal pNHA (002104) is 5km to the north at its closest point.

The nearest Special Areas of Conservation (SAC) are Pollardstown Fen SAC (000396) located 3.6km to the north east, the River Barrow and River Nore SAC (002162) located 7km to the south and Mouds Bog SAC (002331) located 7km to the north east. Ballynafagh Lake SAC (001387) and Ballynafagh Bog SAC (000391) are located 15km to the north east.

According to the GSI, there is one site of geological interest in proximity to the site. This is the Curragh which is a unique deposit of fluvio-gravels which can reach thickness of 70 metres. This closest point of this feature is 1.1 km due east of the eastern boundary of the proposed site.

3.3 Regional Aquifer Classification

The site is underlain by the Regionally Important (Rg) Curragh Gravel Aquifer West Groundwater Body (GWB). This aquifer lies in a shallow trough, oriented NE-SW, at the surface of the limestone bedrock. The topography of the bedrock surface primarily controls the depth of this aquifer with the areas of greatest thickness to the northeast along the drainage divide where it can be up to 70 metres in thickness with reduced thickness away from this area of higher elevation.

The GWB is a feeder for the Grand Canal and an important source of baseflow for the major river catchments in Kildare, namely the Liffey, the Barrow and the Boyne. This is supported by the estimated flow from the aquifer to the Milltown Feeder at Pollardstown Fen, which is approximately 25,000 m³/day.

The Curragh GWB has a large catchment area. Its hydrogeology is significant as it is an important source of baseflow for rivers and streams, it influences the ecology of a number of interesting habitats and it is the source of water for Pollardstown Fen. In terms of groundwater body classifications for the WFD, a separate groundwater body has been delineated within the Curragh GWB for Pollardstown Fen (see Figure 3.2).

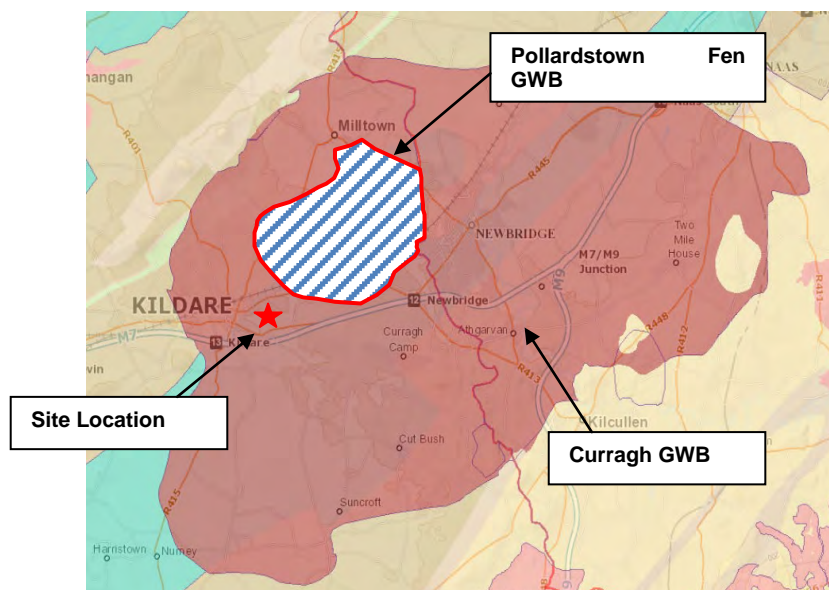


Figure 3.2 Curragh and Pollardstown Fen GWBs

The limestone bedrock aquifer underlying the gravel aquifer comprises a Regionally Important Aquifer – Karstified (diffuse) Rkd.

The Rkd classification of the bedrock aquifer represents those aquifers where flow is more diffuse with higher storage potential. These aquifers frequently have caves and large springs associated with them but the springs have more regular flow associated with them.

3.4 Regional Aquifer Vulnerability

The GSI classify aquifer vulnerability as the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. The vulnerability of groundwater depends on the ability of contaminants to migrate to the underlying aquifer which is dependant predominantly on the permeability and thickness of the subsoils overlying the groundwater body and the types of recharge source (i.e. diffuse or point source).

According to the GSI the classification for the site is **High (H)** likely based on depths to bedrock and/or water table.

3.5 Groundwater WFD Status

Work completed for the Water Framework Directive has recently assigned 'Status' to surface waters and groundwater (www.wfdireland.ie - watermaps). The Water Framework Directive status of the Curragh ground water body, which is linked to Pollardstown Fen SAC, is rated as poor.

The GSI database indicates that the poor status is largely due to abstraction and drainage pressures rather than water quality issues. The South Eastern Regional Basin District (SERBD) Groundwater-Action-Plan-March-2010 also states that Pollardstown Fen and The Curragh GWB are in poor status due to drainage pressures (SERBD).

However, as the Curragh GWB is a gravel aquifer, it is highly vulnerable. Therefore, discharges to the ground may give rise to impacts to the ground water body and the habitats and species that rely on ground water.

The Water Framework Directive (WFD) groundwater body interim assessment summary (www.watermaps.ie) for the South Eastern RBD (2005) shows that the Curragh GWB is 'probably not at significant risk'; however the Pollardstown Fen GWB is 'probably at significant risk'.

In terms of groundwater body classification for the WFD, a separate groundwater body has been delineated within the Curragh GWB for Pollardstown Fen, as shown in Figure 3.2. In terms of groundwater dependant terrestrial ecosystems, two in the SERBD (Pollardstown Fen and the Curragh GWB) are classified as 'Poor Status' due to drainage pressures.

3.6 GSI Well Database

The GSI online map identifies the following list of all wells within 1 km of the site is included in Table 3.1 below.

Easting	Northing	Well Type	Depth	Depth to Rock	Well Use	Yield (m ³ /d)
273460	210860	Dug Well	2.7	Unknown	Unknown	27.28
274330	212890	Unknown	13.4	Unknown	Unknown	Unknown
274750	213090	Borehole	30.5	Unknown	Unknown	Unknown
274760	212650	Dug well	5.8	Unknown	Unknown	Unknown
274810	212400	Borehole	16.2	Unknown	Unknown	Unknown
274680	212240	Dug well	4	Unknown	Unknown	Unknown
274600	212100	Borehole	15	Unknown	Unknown	Unknown
274340	211830	Borehole	13.5	Unknown	Unknown	Unknown
274290	211820	Borehole	13.5	Unknown	Unknown	2,964
274230	211810	Borehole	10	Unknown	Unknown	Unknown
273780	211400	Borehole	11.6	Unknown	Unknown	Unknown
273960	212990	Borehole	56.6	48.8	Unknown	2,182
274230	213080	Dug well	14.8	Unknown	Unknown	Unknown

Table 3.1 Groundwater wells within 1 km

3.7 EPA/GSI Source Protection Zones

As reported by the EPA and GSI, groundwater sources, particularly public, group scheme and industrial supplies, are of critical importance in many regions. Consequently, the objective of source protection zones is to provide protection by placing tighter controls on activities within all or part of the zone of contribution (ZOC) of the source.

There are no source protection areas within 3km of the site. Two public water supply (PWS) schemes are mapped by the GSI as follows (see **Figure 3.3**):

- Curragh Camp PWS – Area of 0.13 km² – (Code IE_SE_G_133) – located within the Curragh Gavel West GWB.
- Monasterevin/Rathangan PWS – Area of 2.92 km² – Code (IE_SE_G_153) – located within the Bagenalstown Upper GWB.

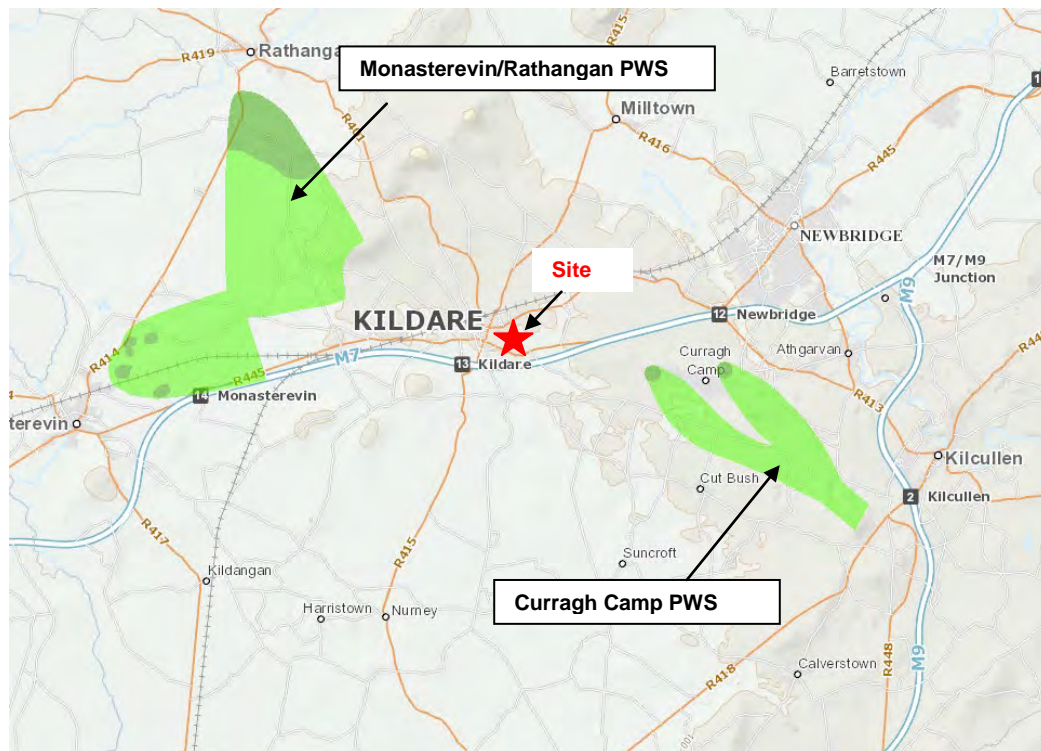


Figure 3.3 Identified Source Protection Zones

3.8 Recharge Rainfall

This GWB is recharged from rainwater percolating through the topsoil and unsaturated sand and gravel deposits. Surface runoff from such gravel aquifers is considered to be low, not more than 20% of effective rainfall. Less permeable layers in the deposit, even if thin, can create perched water tables and prevent recharge of the true water table. Where the water table lies below the local river network it is likely that some stream water may pass into the aquifer. This will be most likely in the higher elevations where a river flows onto the aquifer from where it has previously been flowing over impermeable subsoil or bedrock. The Effective Rainfall (ER) for the site is 491 mm according to the GSI.

3.9 Hydrology

The majority of the site is located in the South Eastern River Basin District (SERBD) in the Barrow catchments (Code: IE14_01) (www.epa.ie).

There are no mapped drains, streams or rivers across or in the vicinity of the site. The Cloncumber Stream that flows into the Slate River in a northeasterly direction is located approximately 5km northeast of the site to the northeast of Pollardstown Fen. The Tully stream, located 2.5 km to the south of the site, flows in a southwesterly direction and ultimately into the River Barrow.

A review of flood mapping for the site suggests that the site is located within a Flood Zone C (low risk) for all sources of flood. A more details flood risk assessment is warranted to confirm this.

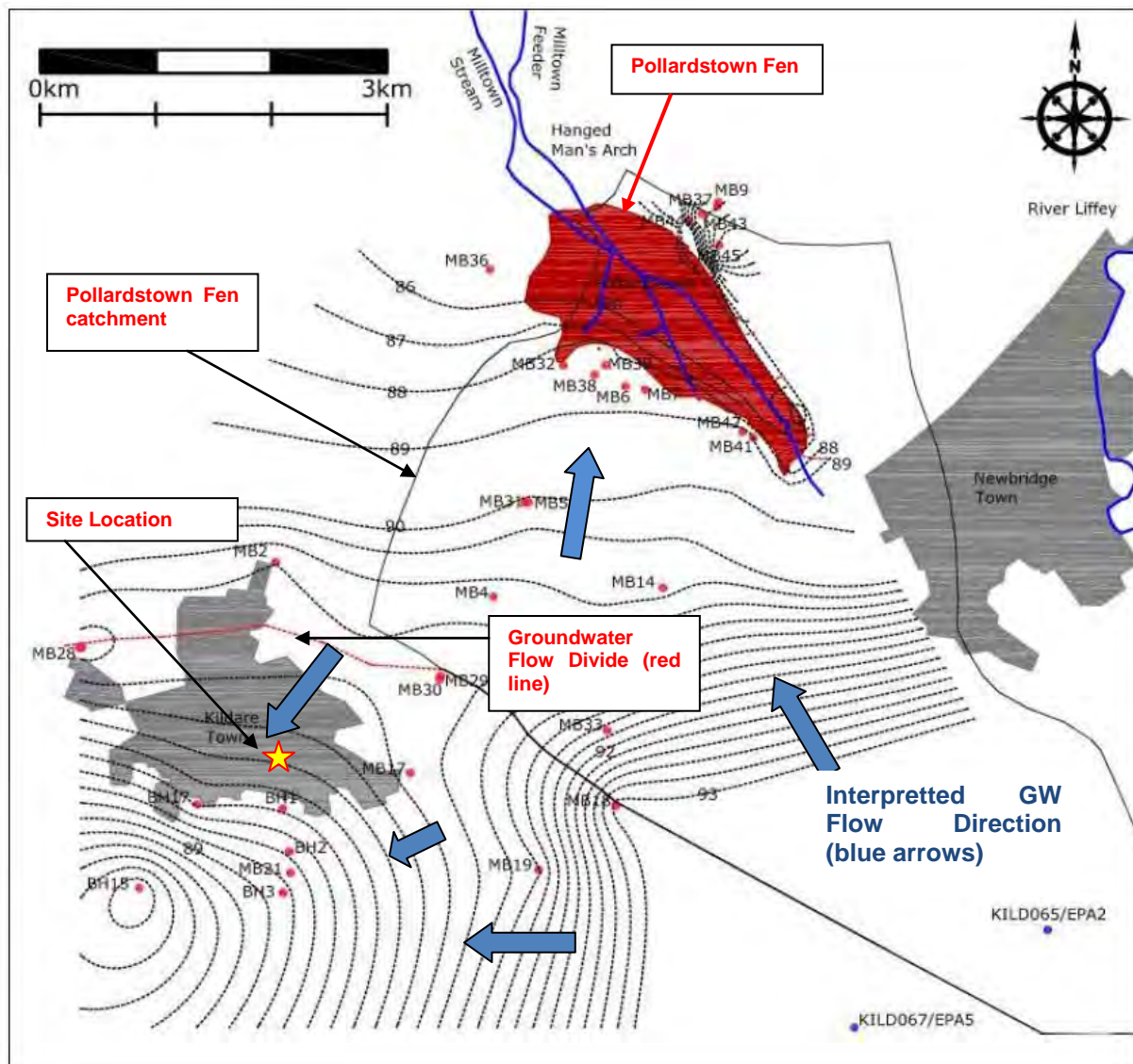
3.10 Groundwater levels, Flow Directions and Gradients

Regional groundwater flow directions estimated by Langford (2011)² in conjunction with Trinity College are outlined in Figure 3.4 based on accurate recording of regional groundwater levels.

Groundwater monitoring was undertaken by Langford, 2011 at a local scale for intensive monitoring of water levels at the Fen margin and at a regional scale for intensive monitoring of the groundwater flow regime across the Curragh Aquifer. The groundwater monitoring network (27 no. monitoring boreholes in total) had been set up previously by WYG and Kildare County Council as part of the monitoring programme established during the construction of the Kildare town by-pass. Monthly groundwater levels were recorded manually from June 2010 to July 2011. Historical groundwater head data from 1997 to 2008 was also assessed by Langford, 2011, which was provided by TCD and WYG Ltd.

The assessment confirms that regional groundwater flow direction to the south of Pollardstown Fen is broadly flowing in a northeasterly direction towards the Fen. However a groundwater divide was confirmed and mapped to the northeast of Kildare town. South of this divide, groundwater was interpreted to flow in a southwesterly direction across Kildare town. The proposed site is located southwest of this divide and therefore groundwater is interpreted to flow locally in a southwesterly direction across the site and not towards Pollardstown Fen.

² Langford, R (2011) Updating/Extending the Water Balance for the Pollardstown Fen



(Source: Langford 2011)

Figure 3.4 Interpreted Groundwater Contours and Fen Catchment

Depths to groundwater are unclear across the site as no monitoring wells have been installed to date. However, as discussed in Section 4, groundwater was not encountered within any of the boreholes drilled to date across the site and is anticipated to be present at least 7 metres below ground level.

3.11 Regional Groundwater Quality

Although there is no available information relating to the groundwater body underlying the proposed site, regional groundwater quality is anticipated to be hard to very hard water (i.e. 250 - >350 mg/l) Average electrical conductivity in this area is 665 $\mu\text{S}/\text{cm}$, which is considered high.

3.12 Off-site Sources of Contamination

According to the EPA website, there are no recorded waste disposal or contaminated sites located in proximity to the proposed site. There is one EPA IED licenced facility (i.e. Kildare Chilling Company, Licence NO. P0170), located approximate 860 metres east of the site.

According to the EPA database there is no reported contaminated soil or groundwater issues present at this site.

3.13 Radon

Radon is a radioactive gas which is naturally produced in the ground from the uranium present in small quantities in all rocks and soils. The EPA has produced a Radon Map of Ireland based on the results of the National radon Survey where radon measurements were carried out in a number of houses in each 10 km grid square of the National Grid.

This map was accessed online at <http://www.epa.ie/radiation/radonmap/> on the 9th February 2018 and the 10km grid of Kildare town indicated that only 1-5% of the homes surveyed in this area had radon concentrations above the Reference Level.

The EPA has issued specific guidelines with respect to underground residential and commercial developments. In relation to the proposed development, following construction the risk of radon impact is considered to be imperceptible.

4 PREVIOUS SITE INVESTIGATIONS

Two intrusive site investigations were undertaken across the site in 2016 and 2017. These include the following:

- Ground Investigations Limited - August 2016 – 10 no. trial pits and 10. no. infiltration tests
- Site Investigations Limited – May 2017 – 15 no. cable percussive boreholes and 22 no. trial pits

Details of the site investigation results are provided Appendix A. All trial pits, boreholes and infiltration test locations are presented in Figures 4.1 and 4.2 respectively.

A generalised summary of the ground profile encountered across the site is outlined below:

- **Made Ground** was described generally as brown slightly sandy gravelly clay with frequent cobbles containing occasional fragments of concrete, red brick, glass and plastic. The depths of made ground were recorded up to 2.3 mbgl with an average depth of 1.0 metre being recorded. The material appears to be broadly representative of reworked soils with residual, historical and low levels of C&D waste material present within this horizon.

Greater depths of made ground, up to 8.3 mbgl, were recorded in the southeastern region of the overall Masterplan footprint and immediately outside the southeastern site boundary of this Phase 1 element of the plan (i.e. within boreholes BH13 and BH14). The material at these locations comprised similar type of made ground recorded elsewhere with increased quantities of brick, timber, glass and metal at much greater depths. The material description at this location suggests the material is former C&D material from the historical usage of Magee Barracks.

- **Cohesive Till Deposits** comprising brown slightly sandy slightly gravelly clay with occasional cobbles with a strength increasing from firm to stiff or stiff with depth was recorded up to 9.7 metres in places. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.
- **Granular Till Deposits** comprising sand and gravel deposits were encountered across the site although not as a continuous body. The average thickness was 0.7 metres and the greatest thickness was recorded up to 4.3 metres within TP19 and TP20 in the southern region of the site. Deeper gravel deposits were encountered in the southeastern region of the site only and within the deepest borehole BH10. The gravel deposits encountered at this location were encountered between 9 and 15 mbgl and may be representative of the regional sand and gravel body that forms part of the Curragh gravel aquifer body. The gravel deposits encountered at shallower depths are considered unlikely to be part of this same gravel body given the presence of the low permeability clays underlying this shallow material and the detections of the material across the site.
- **Groundwater** strikes or seepages were not encountered in any of the boreholes or trial pits across the site, although it is acknowledged that no monitoring wells were installed within any of the boreholes to facilitate groundwater monitoring over time.

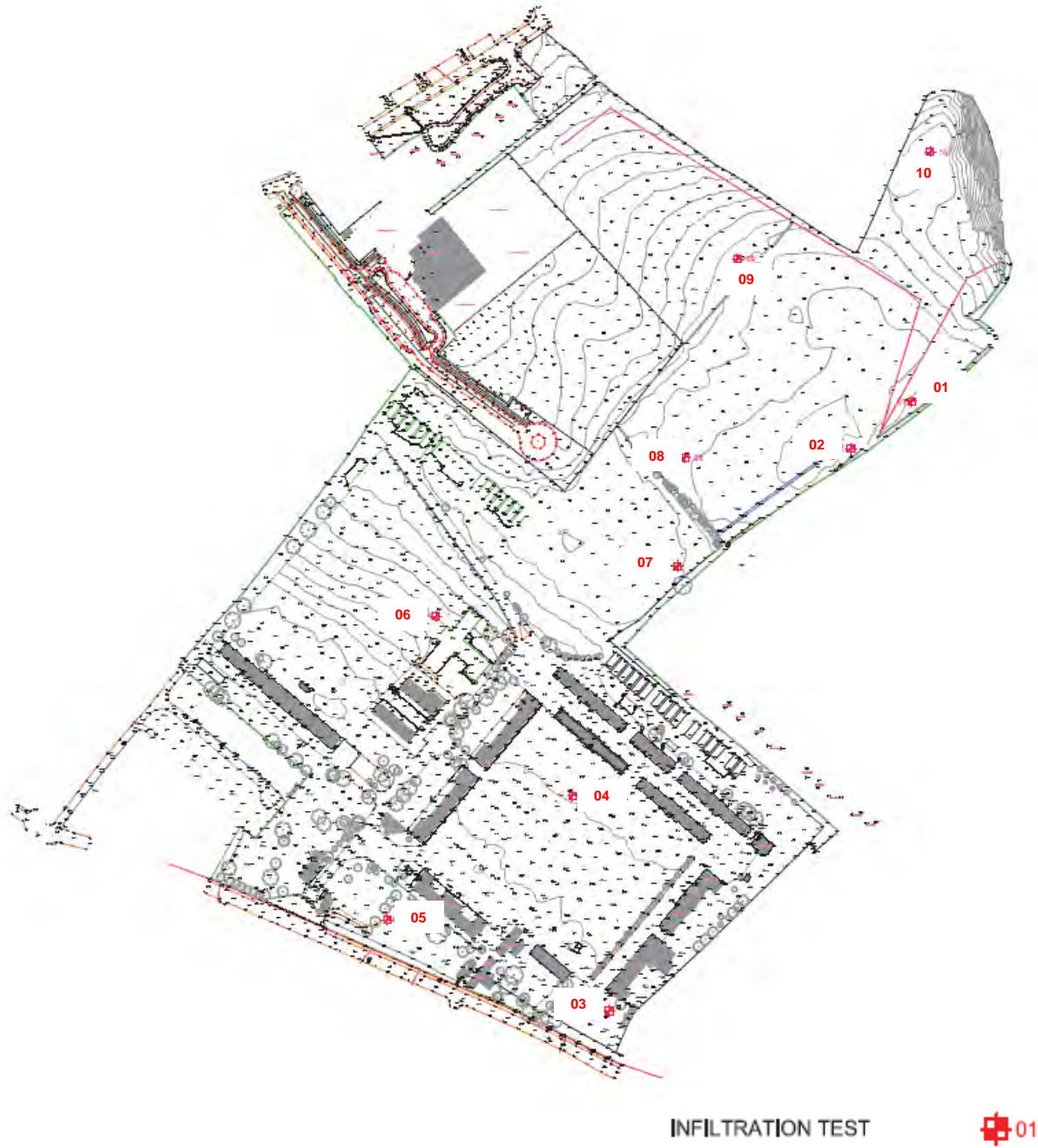


Figure 4.1 2016 Site Investigation Locations in proximity to the Phase 1 site



Figure 4.2 2017 Site Investigation Locations

5 POTENTIAL ENVIRONMENTAL LIABILITIES

Based on the information collated to-date in relation to the former Magee Barracks site, the following potential liabilities may be associated with the site.

1. Buried waste/contaminated material.

Two (2 no.) site investigations were undertaken across the site between 2016 and 2017. No significant contaminated source of contamination or buried waste was encountered across the site. The shallow made ground material present across much of the site comprises brown slightly sandy gravel with frequent cobbles and contained occasional fragments of concrete, red brick, glass and plastic over an average depth of 1.0 mbgl. This material is likely to be representative of general C&D waste material from historical activities at the site, although is unconfirmed at this stage.

Although no chemical testing was undertaken from this made ground material, no olfactory or visual evidence of contamination was identified during the previous site investigations. The material will require further assessment and consideration as part of any future redevelopment works including environmental sampling, testing and monitoring to facilitate the development of an appropriate risk assessment and to identify possible waste disposal or reuse options.

It is noted that the site investigations undertaken in the southeastern region of the overall Masterplan, i.e. across the footprint of the proposed Proton Cancer Care Clinic site, recorded made ground material with notable amounts of brick, concrete, glass and plastic to depths up to 8.3 mbgl. The depth of this material would suggest a notable infilling exercise historically occurred in this area. Although not present within the footprint of the Phase 1 and Phase 2 development footprints, appropriate further investigation in the southeastern region of the Phase 1 development will be required prior to redevelopment to confirm any cross-boundary issue and to ensure no risk to human health or to the environment occurs in the short or long-term.

The northeastern corner of the Masterplan Area is formed by a high gravel ridge, with mature hedgerow running along the top of it. The ridge slope has been at least partly augmented by construction waste material, with a large mound extending east from it just outside the Masterplan Area. This material will require further assessment as part of the Phase 2 redevelopment activities.

2. Historical Fuel Storage Areas

Although not identified on historical maps, it is likely that fuels used for heating and/or artillery use were stored within dedicated areas of the site. Depending on the type of fuels used and how these materials were stored, transported, used and discarded, the potential for localised contaminant hotspots within the subsurface remains a possibility.

Similarly, it is unclear if any chemicals were historically stored at the site. It is noted that no detections of any contaminant hotspots associated with this material has been visually recorded to-date.

3. Former Gravel Pit

A gravel pit is mapped on the historical maps to the north of the former historical hospital on site (see Figure 2.6). The material used to backfill this pit is unknown and additional testing in this area should be undertaken to confirm the type of material present and assess the risk posed to the future site development and to the wider environment.

4. Former Well

An historical well, 62 feet in depth, was located on the grounds of the former hospital (see Figure 3.12). If not appropriately sealed or backfilled, this well may provide a preferential vertical pathway of contaminants to the underlying sand and gravel aquifer and should be appropriately identified, assessed and sealed (if necessary) during any redevelopment activities.

5. Asbestos

It is unclear if asbestos was used in the construction of any element of the former Magee Barracks. No evidence of asbestos has been noted to-date in any site investigation report. Any future redevelopment works should take cognisance of the possibility of asbestos being present within the fill material across the site and appropriate mitigation measure implemented to minimise any potential risk to human health.

It is unclear if asbestos is present within existing buildings at the site. A detailed asbestos survey is recommended and any present should be appropriately removed for off-site disposal by a licensed asbestos removal specialist contractor and validation of the removal certified prior to the commencement of site demolition works.

6. Other

It is reported that to the north of the former hut rows and the rear of the barracks facility were are large rectilinear open plots with adjacent buildings that previously housed transport sheds, gun sheds, stables, stores etc., with the fields beyond used to graze the horses. These adjacent buildings and the area of ground in proximity to these buildings may potentially be associated with burial areas of waste material including possible discarded ammunitions. It is noted however that no detections of buried waste material (apart from the C&D derived made ground present across much of the site) has been visually detected to-date.

7. Lead Pipes

Water supply to the hospital was historically sourced from the local well on site. The source of water to the former barracks is unclear but was potentially sourced from the same well. The pipe network servicing this well to the hospital and the barracks may potentially be constructed from lead which may pose a risk (albeit likely to be a low risk) to the surrounding environment in the case of historical leaks from the pipe network with potentially elevated levels of lead present.

6 PRELIMINARY RISK ASSESSMENT

6.1 Outline Conceptual Site Model (CSM)

The methods used within this preliminary risk assessment follow a risk-based approach, with the potential environmental risk assessed qualitatively using the 'contaminant-pathway-receptor pollutant linkage' concept in accordance with best practice.

Potential Contaminants	On-Site Contaminants	<ul style="list-style-type: none"> The current site use is not considered to act as a significant source of contamination based on existing, but limited, site investigation data. It does appear that much of the site is underlain by a layer of reworked C&D waste soils with glass, plastic, timber, brick and concrete. A number of areas require additional consideration to confirm that no underground sources of buried waste or contamination are present across the site as detailed in Section 5 of this report.
	Off-Site Contaminant	<ul style="list-style-type: none"> BREL are not aware of any contamination or chemical spills in the vicinity of the site. However, notable depths of C&D waste material in the southeastern region of the masterplan footprint adjacent to the Phase 1 site boundary are present.
Potential Receptors	Controlled Waters	<ul style="list-style-type: none"> Curragh sand and gravel aquifer
	Human Health Risks	<ul style="list-style-type: none"> Future site users Third party neighbours Site workers in the event of below ground works
	Other	<ul style="list-style-type: none"> Future buildings and underground services
Potential Contaminant Pathways & Pollutant Linkages	On-Site Contaminant	<ul style="list-style-type: none"> In the absence of any identified potentially significant contamination sources on the subject site from previous site investigations undertaken, no active pollutant linkages have been identified to-date. This linkage requires reassessment subject to more detailed environmental investigations.
	Off-Site Contaminant	<ul style="list-style-type: none"> The subject site is not located downgradient of any identified off-site contaminant sources, thereby reducing the risk of mobile concentration migrating from off-site contaminants and impacting on the subject site.

Table 6.1 CSM

7 CONCLUSIONS

BlueRock Environmental Ltd (BREL) presents within this report a Revised Phase 1 Environmental Site Assessment (ESA) of the former Magee Barracks site, in Kildare town, Co. Kildare. The objective of the assessment is to assess any potential environmental liabilities associated with the site in terms of soils, geology, groundwater and contamination.

- A detailed desk study review of the site including a review of all relevant documentation in relation to the site was undertaken.
- The pertinent findings of assessment includes the following
 - No evidence of active contamination or buried waste material that would pose a notable risk to human health, the environment or to future site users was identified based on the finding of the site investigation reports. However, it is noted that no chemical testing of the made ground material across the site has been undertaken to-date which limits the levels of confidence in this interpretation.
 - The site is generally underlain by an average of 1 metre depth of made ground comprising brown slightly sandy gravelly clay with frequent cobbles containing occasional fragments of concrete, red brick, glass and plastic. The material appears to be representative of historical reworked soils with some C&D waste material entrained within the material.
 - An area of similar material with a larger C&D content is present in the southeastern region of the Masterplan footprint to depths up to 8.3 mbgl adjacent to the Phase 1 development site. Further assessment of this material is recommended to appropriately assess the risks posed to the Phase 1 development site.
 - The earthen embankments in the northeastern region of the Masterplan site have evidence of waste material present within the embankments. Although unlikely to pose a risk to the environment or to human health (assuming no asbestos material is present), the material required appropriate characterisation and classification to determine options for reuse or waste soil disposal off-site .
 - A number of areas were identified as possible locations of contamination at the site including a former gravel pit, former fuel storage areas, the former well and the former artillery storage area/storage sheds. These areas should be appropriately investigated to confirm no residual impact to the proposed development or to the environment is present.
- It is therefore concluded that the site, in its current condition, is unlikely to pose an unacceptable risk to environmental receptors (e.g. groundwater, subsoils, Pollardstown fen etc.) or to human health receptors (i.e. construction worker or future site users) based on available information. It is however noted that this assessment is based on the information supplied to-date and on publically available on-line desk study information. Additional environmental investigations are recommended to more accurately determine the true level of risk posed to sensitive receptors.

8 RECOMMENDATIONS

1. A Phase 2 Environmental Site investigation is recommended prior to commencement of site redevelopment activities to address any uncertainties in relation to the site from a cost redevelopment perspective and environmental/human health risk.

The recommended scope of Phase 2 investigation is outlined below:

- Localised trial pitting and soil sampling for chemical analysis within selected areas across the site to identify potential sources of subsurface contamination/waste i.e.
 - ✓ The former gravel pit area,
 - ✓ The embankments in the northeastern region of the Phase 2 footprint
 - ✓ The southeastern region of the site in proximity boreholes BH13 and BH14, and,
 - ✓ The vicinity of the former artillery storage sheds.
 - In the case of contamination or buried waste being identified it is recommended that the following be undertaken, if appropriate:
 - ✓ Drilling of boreholes to facilitate the installation of monitoring wells within the sand and gravel aquifer underlying the development.
 - ✓ Determine depths to groundwater and groundwater level variability over time
 - ✓ Soil and groundwater sampling and chemical testing; and,
 - ✓ Ground gas monitoring. .
 - ✓ A detailed interpretation and risk assessment of the investigation results to more definitively confirm the level of risk posed to human health and to the environment in addition to determining likely waste disposal and possible remediation costs.
 - The outcome of the above activities should be incorporated into the Construction & Demolition Waste Management Plan (C&DWMP) and Environmental Management Plan for the development works.
2. All construction activities should be undertaken in accordance with best practice to prevent contamination of the underlying groundwater aquifer from fuel spills, vandalism, impacts of fresh cement and any piling activities.

Appendix A

Historical Site Investigation Reports

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH01

Client: Columbia Estates Management (IE) Ltd

Co-ordinates E: 273415.111

Consultant: Garland

N: 212157.436

Site Address: Kildare, Co. Kildare

Elevation: 100.21 m.O.D.

Boring Commenced:

Hole Diameter: 200 mm

Boring Completed:

Drilled by: I. Saville

Rig Type: Dando 2000

Logged by: S. Letch

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
TOPSOIL.	0.00	— T —	100.21						
Firm becoming stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content.	0.30	X	99.91	B	0.70	IS43			
	1.20	X		B SPT(C)	1.20	IS44 N=9-(2,2,2,3)			
	2.20	X		B SPT(C)	2.20	IS45 N=14-(3,4,4,3)			
	3.20	X		B SPT(C)	3.20	IS46 N=18-(3,3,4,8)			
	4.20	X		B SPT(C)	4.20	IS47 N=23-(4,4,6,9)			
	5.20	X		B SPT(C)	5.20	IS48 N=32-(7,8,8,9)			
	6.60	X		B	6.70	IS49			
	6.70	X		B SPT(C)	6.70	N=50/5mm-(50/5mm)	6.70		Dry(E)
Obstruction - boulders. Borehole terminated and backfilled.	6.60 6.70	▲	93.61 93.51						

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
Hand dug inspection pit to 1.20mbgl.
Chiselling: 6.60m to 6.70m: 1.5hr.
Borehole terminated and backfilled.

<p>B Bulk Disturbed Sample</p> <p>D Small disturbed sample</p> <p>W Water sample</p> <p>U(9) Undisturbed sample (drive blows)</p>	<p>Key to Symbols</p> <p>SPT(S) Standard Penetration Test(Split Spoon))</p> <p>SPT(C) Standard Penetration Test(Cone)</p> <p>▼^{0.50} Waterstrike depth</p> <p>▽^{1.0000} Water level depth 20mins after strike</p> <p>17.20(E) Depth to water (E)nd of shift</p> <p>12.20(S) Depth to water (S)tart of shift</p>
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Site Investigations Ltd

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH02

Client: Columbia Estates Management (IE) Ltd

Co-ordinates E: 273408.630

Consultant: Garland

N: 212204.181

Site Address: Kildare, Co. Kildare

Elevation: 101.94 m.O.D.

Boring Commenced:

Hole Diameter: 200 mm

Boring Completed:

Drilled by: I. Saville

Rig Type: Dando 2000

Logged by: S. Letch

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
TOPSOIL.	0.0 0.00	— T —	101.94						
Firm becoming stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content.	0.30	X	101.64	B	0.50	IS38			
	1.0	X		B SPT(C)	1.20	IS39 N=12-(4,3,2,3)			
	2.0	X		B SPT(C)	2.20	IS40 N=17-(4,4,4,5)			
	3.0	X		B SPT(C)	3.20	IS41 N=17-(3,4,4,6)			
	4.0	X		B SPT(C)	4.50	IS42 N=32-(7,8,8,9)			
Obstruction - boulders. Borehole terminated and backfilled.	5.0 5.10 5.20	△	96.84 96.74	SPT(C)	5.20	N=50/10mm- (50/10mm)	5.20		Dry(E)
	6.0								
	7.0								
	8.0								
	9.0								
	10.0								

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
Hand dug inspection pit to 1.20mbgl.

Chiselling: 5.10m to 5.20m: 1.5hr.

Borehole terminated and backfilled.

Key to Symbols

- | | |
|---------------------------------------|---|
| B Bulk Disturbed Sample | SPT(S) Standard Penetration Test(Split Spoon)) |
| D Small disturbed sample | SPT(C) Standard Penetration Test(Cone) |
| W Water sample | ▽ ^{0.50} Waterstrike depth |
| U(9) Undisturbed sample (drive blows) | ▽ ^{1.0000} Water level depth 20mins after strike |
| | 17.20(E) Depth to water (E)nd of shift |
| | 12.20(S) Depth to water (S)tart of shift |

Site Investigations Ltd

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH03

Client: Columbia Estates Management (IE) Ltd

Co-ordinates E: 273407.825

Consultant: Garland

N: 212234.682

Site Address: Kildare, Co. Kildare

Elevation: 102.27 m.O.D.

Boring Commenced:

Hole Diameter: 200 mm

Boring Completed:

Drilled by: I. Saville

Rig Type: Dando 2000

Logged by: S. Letch

Sheet 1 of 2

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
TOPSOIL.	0.0 0.00	— T —	102.27						
Firm becoming stiff becoming very stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content.	0.30	X	101.97	B	0.70	IS28			
	1.0	X		B SPT(C)	1.20 1.20	IS29 N=9-(2,2,2,3)			
	2.0	X		B SPT(C)	2.20 2.20	IS30 N=28-(6,7,7,8)			
	3.0	X		B SPT(C)	3.20 3.20	IS31 N=26-(7,6,5,8)			
	4.0	X		B SPT(C)	4.20 4.20	IS32 N=46- (11,11,11,13)			
	5.0	X		B SPT(C)	5.20 5.20	IS33 N=39- (8,9,12,10)			
	6.0	X		B SPT(C)	6.70 6.70	IS34 N=36- (8,8,9,11)			
	7.0	X		B SPT(C)	8.20 8.20	IS35 N=31- (6,6,7,12)	8.00 8.00		Dry(E) Dry(S)
	10.0	X		B SPT(C)	9.70 9.70	IS36 N=48-			

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
Hand dug inspection pit to 1.20mbgl.

Chiselling: 7.50m to 7.70m: 0.75hr.
11.90m to 12.00m: 1hr

Borehole terminated and backfilled.

Key to Symbols

- B Bulk Disturbed Sample
- D Small disturbed sample
- W Water sample
- U(9) Undisturbed sample (drive blows)
- SPT(S) Standard Penetration Test(Split Spoon))
- SPT(C) Standard Penetration Test(Cone)
- ▽^{0.50} Waterstrike depth
- ▽^{1.0000} Water level depth 20mins after strike
- 17.20(E) Depth to water (E)nd of shift
- 12.20(S) Depth to water (S)tart of shift

Site Investigations Ltd

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH03

Client: Columbia Estates Management (IE) Ltd

Co-ordinates E: 273407.825

Consultant: Garland

N: 212234.682

Site Address: Kildare, Co. Kildare

Elevation: 102.27 m.O.D.

Boring Commenced:

Hole Diameter: 200 mm

Boring Completed:

Drilled by: I. Saville

Rig Type: Dando 2000

Logged by: S. Letch

Sheet 2 of 2

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
Firm becoming stiff becoming very stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content.	10.0 11.0					(13,11,11,13) IS37 N=40- (8,10,10,12)			
Obstruction - boulders. Borehole terminated and backfilled.	11.90 12.0 12.00		90.37 90.27	SPT(C)	12.00	N=50/10mm- (50/10mm)	12.00		Dry(E)
	13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0								

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
Hand dug inspection pit to 1.20mbgl.

Chiselling: 7.50m to 7.70m: 0.75hr.
11.90m to 12.00m: 1hr

Borehole terminated and backfilled.

<p>B Bulk Disturbed Sample</p> <p>D Small disturbed sample</p> <p>W Water sample</p> <p>U(9) Undisturbed sample (drive blows)</p>	<p>Key to Symbols</p> <p>SPT(S) Standard Penetration Test(Split Spoon))</p> <p>SPT(C) Standard Penetration Test(Cone)</p> <p> Waterstrike depth</p> <p> Water level depth 20mins after strike</p> <p>17.20(E) Depth to water (E)nd of shift</p> <p>12.20(S) Depth to water (S)tart of shift</p>
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Site Investigations Ltd

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Cable Percussive Borehole Record

CONTRACT: Magee Barracks		HOLE ID: BH04
Client: Columbia Estates Management (IE) Ltd	Co-ordinates E: 273429.227	
Consultant: Garland	N: 212254.404	
Site Address: Kildare, Co. Kildare	Elevation: 103.25 m.O.D.	
Boring Commenced:	Hole Diameter: 200 mm	
Boring Completed:	Drilled by: I. Saville	
Rig Type: Dando 2000	Logged by: S. Letch	<i>Sheet 1 of 1</i>

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
TOPSOIL.	0.0	0.00	103.25						
Soft becoming very stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content.	0.40		102.85	B	0.70	IS24			
	1.0			B SPT(C)	1.20	IS25 N=6-(1,1,2,2)			
	2.0			B SPT(C)	2.20	IS26 N=39-(11,11,10,7)			
	3.0			B SPT(C)	3.20	IS27 N=50/65mm-(50/65mm)			
Obstruction - boulders. Borehole terminated and backfilled.	3.60 3.70		99.65 99.55	SPT(C)	3.70	N=50/10mm-(50/10mm)	3.70		Dry(E)
	4.0								
	5.0								
	6.0								
	7.0								
	8.0								
	9.0								
	10.0								

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Hand dug inspection pit to 1.20mbgl.
 Chiselling: 1.90m to 2.00m: 0.75hr
 3.60m to 3.70m: 1.5hr.
 Borehole terminated and backfilled.

Key to Symbols

B	Bulk Disturbed Sample	SPT(S)	Standard Penetration Test(Split Spoon))
D	Small disturbed sample	SPT(C)	Standard Penetration Test(Cone)
W	Water sample	▽ ^{1.50}	Waterstrike depth
U(9)	Undisturbed sample (drive blows)	▽ ^{1.0000}	Water level depth 20mins after strike
		17.20(E)	Depth to water (E)nd of shift
		12.20(S)	Depth to water (S)tart of shift

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH05

Client: Columbia Estates Management (IE) Ltd

Co-ordinates E: 273456.285

Consultant: Garland

N: 212218.674

Site Address: Kildare, Co. Kildare

Elevation: 101.52 m.O.D.

Boring Commenced:

Hole Diameter: 200 mm

Boring Completed:

Drilled by: I. Saville

Rig Type: Dando 2000

Logged by: S. Letch

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
MADE GROUND: concrete.	0.0	0.00	101.52						
MADE GROUND: brown sandy gravelly silty clay with much red brick.	0.20	[Cross-hatched]	101.32						
Obstruction - concrete. Made reattempt adjacent to obstruction but still encountered at same depth.	0.50	Hole End	101.02				0.50		Dry(E)
	1.0								
	2.0								
	3.0								
	4.0								
	5.0								
	6.0								
	7.0								
	8.0								
	9.0								
	10.0								

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
Obstruction encountered in hand dug pit. Made reattempt and still encountered obstruction.

B Bulk Disturbed Sample
D Small disturbed sample
W Water sample
U(9) Undisturbed sample (drive blows)

Key to Symbols

SPT(S) Standard Penetration Test(Split Spoon))
SPT(C) Standard Penetration Test(Cone)
▼^{0.50} Waterstrike depth
▽^{1.00000} Water level depth 20mins after strike
17.20(E) Depth to water (E)nd of shift
12.20(S) Depth to water (S)tart of shift

Site Investigations Ltd

BOREHOLE SL 10M_5362.BH.GINT.GPJ_COREHOLE.GDT_09/05/17

Cable Percussive Borehole Record

CONTRACT: Magee Barracks		HOLE ID: BH06
Client: Columbia Estates Management (IE) Ltd	Co-ordinates E: 273482.897	
Consultant: Garland	N: 212205.844	
Site Address: Kildare, Co. Kildare	Elevation: 101.33 m.O.D.	
Boring Commenced:	Hole Diameter: 200 mm	
Boring Completed:	Drilled by: I. Saville	
Rig Type: Dando 2000	Logged by: S. Letch	<i>Sheet 1 of 1</i>

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
MADE GROUND: tarmacadam.	0.0		101.33						
MADE GROUND: grey sandy angular gravel.	0.20		101.13						
Stiff brown sandy gravelly silty CLAY with low cobble content.	0.70		100.63	B	0.70	IS21			
	1.20			B SPT(C)	1.20	IS22 N=30-(8,7,6,9)			
	2.20			B SPT(C)	2.20	IS23 N=50/95mm-(41,9/20mm)			
Obstruction - boulders.	2.50		98.83						
Borehole terminated and backfilled.	2.70	Hole End	98.63	SPT(C)	2.70	N=50/10mm-(50/10mm)	2.70		Dry(E)
	3.0								
	4.0								
	5.0								
	6.0								
	7.0								
	8.0								
	9.0								
	10.0								

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Hand dug inspection pit to 1.20mbgl.
 Chiselling: 2.50m to 2.70m: 1.5hr.
 Borehole terminated and backfilled.

Key to Symbols

B	Bulk Disturbed Sample	SPT(S)	Standard Penetration Test(Split Spoon))
D	Small disturbed sample	SPT(C)	Standard Penetration Test(Cone)
W	Water sample		Waterstrike depth
U(9)	Undisturbed sample (drive blows)		Water level depth 20mins after strike
		17.20(E)	Depth to water (E)nd of shift
		12.20(S)	Depth to water (S)tart of shift

Site Investigations Ltd

Cable Percussive Borehole Record

CONTRACT: Magee Barracks		HOLE ID: BH07
Client: Columbia Estates Management (IE) Ltd	Co-ordinates E: 273493.364	
Consultant: Garland	N: 212186.155	
Site Address: Kildare, Co. Kildare	Elevation: 101.33 m.O.D.	
Boring Commenced:	Hole Diameter: 200 mm	
Boring Completed:	Drilled by: I. Saville	
Rig Type: Dando 2000	Logged by: S. Letch	<i>Sheet 1 of 1</i>

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
MADE GROUND: tarmacadam.	0.0		101.33						
MADE GROUND: brown sandy gravelly silty clay with much red brick.	0.30		101.03						
Very stiff brown sandy gravelly silty CLAY with low cobble content.	0.50		100.83	B	0.70	IS18			
	1.0			B SPT(C)	1.20	IS19 N=34-(9,9,9,7)			
	2.0			B SPT(C)	2.20	IS20 N=50/90mm-(40,10/15mm)			
	2.60		99.73	SPT(C)	2.70	N=50/10mm-(50/10mm)	2.70		Dry(E)
Obstruction - boulders. Borehole terminated and backfilled.	2.70	Hole End	98.63						
	3.0								
	4.0								
	5.0								
	6.0								
	7.0								
	8.0								
	9.0								
	10.0								

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Hand dug inspection pit to 1.20mbgl.
 Chiselling: 2.70m to 2.80m: 1.25hr.
 Borehole terminated and backfilled.

Key to Symbols

B	Bulk Disturbed Sample	SPT(S)	Standard Penetration Test(Split Spoon))
D	Small disturbed sample	SPT(C)	Standard Penetration Test(Cone)
W	Water sample		Waterstrike depth
U(9)	Undisturbed sample (drive blows)		Water level depth 20mins after strike
		17.20(E)	Depth to water (E)nd of shift
		12.20(S)	Depth to water (S)tart of shift

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH08

Client: Columbia Estates Management (IE) Ltd

Co-ordinates E: 273550.877

Consultant: Garland

N: 212138.475

Site Address: Kildare, Co. Kildare

Elevation: 101.29 m.O.D.

Boring Commenced:

Hole Diameter: 200 mm

Boring Completed:

Drilled by: I. Saville

Rig Type: Dando 2000

Logged by: S. Letch

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
MADE GROUND: tarmacadam.	0.0	XXXX	101.29						
Stiff becoming very stiff brown sandy slightly gravelly silty CLAY with low cobble content.	0.15	X	101.14						
	1.0	X		B	0.70	IS14			
	2.0	X		B SPT(C)	1.20 1.20	IS15 N=29-(8,8,7,6)			
	3.0	X		B SPT(C)	2.20 2.20	IS16 N=47- (12,11,11,13)			
	3.60	X		B SPT(C)	3.20 3.20	IS17 N=48- (10,12,13,13)			
Obstruction - boulders. Borehole terminated and backfilled.	3.70	▲	97.69				3.70		
	4.0	▲	97.59	SPT(C)	3.70	N=50/10mm- (50/10mm)			Dry(E)
	5.0								
	6.0								
	7.0								
	8.0								
	9.0								
	10.0								

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
Hand dug inspection pit to 1.20mbgl.

Chiselling: 1.80m to 1.90m: 0.75hr
3.60m to 3.70m: 1hr.

Borehole terminated and backfilled.

<p>B Bulk Disturbed Sample</p> <p>D Small disturbed sample</p> <p>W Water sample</p> <p>U(9) Undisturbed sample (drive blows)</p>	<p>Key to Symbols</p> <p>SPT(S) Standard Penetration Test(Split Spoon))</p> <p>SPT(C) Standard Penetration Test(Cone)</p> <p>▼^{-1.50} Waterstrike depth</p> <p>▽^{-2.0000} Water level depth 20mins after strike</p> <p>17.20(E) Depth to water (E)nd of shift</p> <p>12.20(S) Depth to water (S)tart of shift</p>
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Site Investigations Ltd

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH09

Client: Columbia Estates Management (IE) Ltd

Co-ordinates E: 273579.868

Consultant: Garland

N: 212116.036

Site Address: Kildare, Co. Kildare

Elevation: 101.33 m.O.D.

Boring Commenced:

Hole Diameter: 200 mm

Boring Completed:

Drilled by: I. Saville

Rig Type: Dando 2000

Logged by: S. Letch

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
MADE GROUND: tarmacadam.	0.0	0.00	101.33						
MADE GROUND: brown sandy gravelly silty clay with much cobble and boulder sized blocks of concrete.		0.20	101.13	B	0.70	IS13			
Pushing concrete boulder obstruction.		1.20	100.13	SPT(C)	1.20	N=50/10mm- (50/10mm)			
Obstruction - boulders. Borehole terminated and backfilled.		2.50	98.83	SPT(C) SPT(C)	2.20 2.50	N=50/10mm- (50/10mm) N=50/10mm- (50/10mm)	2.50		Dry(E)

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
Hand dug inspection pit to 1.20mbgl.
Chiselling: 1.20m to 2.50m: 3hrs - pushing boulder sized concrete block.
2.50m to 2.50m: 1hr.
Borehole terminated and backfilled.

B Bulk Disturbed Sample D Small disturbed sample W Water sample U(9) Undisturbed sample (drive blows)	SPT(S) Standard Penetration Test(Split Spoon)) SPT(C) Standard Penetration Test(Cone) ▾ ^{-0.50} Waterstrike depth ▾ ^{-0.0020} Water level depth 20mins after strike 17.20(E) Depth to water (E)nd of shift 12.20(S) Depth to water (S)tart of shift	Key to Symbols
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Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH10

Client: Columbia Estates Management (IE) Ltd

Co-ordinates E: 273584.805

Consultant: Garland

N: 212078.978

Site Address: Kildare, Co. Kildare

Elevation: 102.09 m.O.D.

Boring Commenced:

Hole Diameter: 200 mm


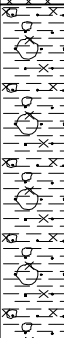
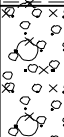
Boring Completed:

Drilled by: I. Saville

Rig Type: Dando 2000

Logged by: S. Letch

Sheet 1 of 2



DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
TOPSOIL.	0.00		102.09						
Possible MADE GROUND: brown sandy slightly gravelly silty clay with low cobble content.	0.20		101.89	B	0.70	IS01			
	1.20		B SPT(C)	1.20	IS02 N=8-(2,2,2,2)				
	2.20		B SPT(C)	2.20	IS03 N=9-(2,2,3,2)				
	3.20		B SPT(C)	3.20	IS04 N=9-(2,3,2,2)				
	4.20		B SPT(C)	4.20	IS05 N=11-(2,3,3,3)				
	5.20		B SPT(C)	5.20	IS06 N=12-(2,3,3,4)				
Stiff dark grey sandy slightly gravelly silty CLAY with low cobble content.	6.50		95.59	B SPT(C)	6.50	IS07 N=15-(3,4,4,4)			
	8.00		B SPT(C)	8.00	IS08 N=23-(4,6,6,7)				
Dense grey brown silty sandy GRAVEL with medium cobble content.	9.00		93.09				9.00		Dry(E)
	9.50		B SPT(C)	9.50	IS09 N=33-(8,8,8,9)			9.00	Dry(S)

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
Hand dug inspection pit to 1.20mbgl.

Chiselling: 2.90m to 3.10m: 0.75hr.
9.00m to 9.30m: 1hr.

Borehole terminated at scheduled depth and backfilled.

<p>B Bulk Disturbed Sample</p> <p>D Small disturbed sample</p> <p>W Water sample</p> <p>U(9) Undisturbed sample (drive blows)</p>	<p>Key to Symbols</p> <p>SPT(S) Standard Penetration Test(Split Spoon))</p> <p>SPT(C) Standard Penetration Test(Cone)</p> <p> Waterstrike depth</p> <p> Water level depth 20mins after strike</p> <p>17.20(E) Depth to water (E)nd of shift</p> <p>12.20(S) Depth to water (S)tart of shift</p>
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Site Investigations Ltd

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH10

Client: Columbia Estates Management (IE) Ltd

Co-ordinates E: 273584.805

Consultant: Garland

N: 212078.978

Site Address: Kildare, Co. Kildare

Elevation: 102.09 m.O.D.

Boring Commenced:

Hole Diameter: 200 mm

Boring Completed:

Drilled by: I. Saville

Rig Type: Dando 2000

Logged by: S. Letch

Sheet 2 of 2

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
Stiff becoming very stiff dark grey slightly sandy slightly gravelly silty CLAY with low cobble content.	10.0		87.09	B SPT(C)	11.00	IS10 N=40- (9,9,11,11)	15.00		Dry(E)
	11.0				12.50				
	12.0				12.50	IS11 N=38- (8,9,9,12)			
	13.0		87.09	B SPT(C)	14.00	IS12 N=36- (7,9,10,10)	15.00		Dry(E)
	14.0				14.00				
	15.0				15.00	Hole End			
Borehole terminated at scheduled depth.	15.0	Hole End	87.09				15.00		Dry(E)
	16.0								
	17.0								
	18.0								
	19.0								
	20.0								

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
Hand dug inspection pit to 1.20mbgl.

Chiselling: 2.90m to 3.10m: 0.75hr.
9.00m to 9.30m: 1hr.

Borehole terminated at scheduled depth and backfilled.

Key to Symbols

- B Bulk Disturbed Sample
- D Small disturbed sample
- W Water sample
- U(9) Undisturbed sample (drive blows)
- SPT(S) Standard Penetration Test(Split Spoon))
- SPT(C) Standard Penetration Test(Cone)
- ▽^{-0.50} Waterstrike depth
- ▽^{-0.0020} Water level depth 20mins after strike
- 17.20(E) Depth to water (E)nd of shift
- 12.20(S) Depth to water (S)tart of shift

Site Investigations Ltd

BOREHOLE SL10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH11

Client: Columbia Estates Management (IE) Ltd
Consultant: Garland
Site Address: Kildare, Co. Kildare
Boring Commenced: 28/04/2017
Boring Completed: 28/04/2017
Rig Type: Dando 150

Co-ordinates E: 273409.321
 N: 212175.534
Elevation: 100.53 m.O.D.
Hole Diameter: 200 mm
Drilled by: T. Tindall
Logged by: S. Letch

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
MADE GROUND: brown sandy gravelly silty clay with some brick and timber.	0.0		100.53						
MADE GROUND: brown sandy silty clay.	0.40	[Cross-hatch pattern]	100.13	B	0.50	TT01			
	1.0			SPT(C)	1.00	N=10-(2,3,2,3)			
	1.50			B	1.50	TT02			
	2.0			SPT(C)	2.00	N=21-(3,4,6,8)			
Stiff becoming very stiff brown sandy slightly gravelly silty CLAY with low cobble content.	2.30	[Stippled pattern]	98.23	B	2.50	TT03			
	3.0			SPT(C)	3.00	N=27-(6,6,8,7)			
	3.50			B	3.50	TT04			
	4.0			SPT(C)	4.00	N=21-(6,5,4,6)			
	4.50			B	4.50	TT05			
	5.0			SPT(C)	5.00	N=38-(8,9,11,10)			
Dense grey brown silty sandy GRAVEL with medium cobble content.	5.40	[Circles and dots pattern]	95.13	B	5.50	TT06			
	6.0			SPT(C)	6.00	N=44-(10,13,10,11)			
	6.50			B	6.50	TT07			
	7.0			SPT(C)	7.00	N=45-(10,11,11,13)			
Obstruction - boulders. Borehole terminated and backfilled.	7.80	[Boulders pattern]	92.73	SPT(C)	7.90	N=50/5mm-(50/5mm)	7.90	28/04/2017	Dry(E)
	7.90								

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Hand dug inspection pit to 1.20mbgl.
 Chiselling: 7.80m to 7.90m: 1.5hr.
 Borehole terminated at scheduled depth and backfilled.

<p>B Bulk Disturbed Sample D Small disturbed sample W Water sample U(9) Undisturbed sample (drive blows)</p>	<p>Key to Symbols SPT(S) Standard Penetration Test(Split Spoon)) SPT(C) Standard Penetration Test(Cone) Waterstrike depth Water level depth 20mins after strike 17.20(E) Depth to water (E)nd of shift 12.20(S) Depth to water (S)tart of shift</p>
<p>Site Investigations Ltd</p>	

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH12

Client: Columbia Estates Management (IE) Ltd

Co-ordinates E: 273430.028

Consultant: Garland

N: 212219.890

Site Address: Kildare, Co. Kildare

Elevation: 101.84 m.O.D.

Boring Commenced: 28/04/2017

Hole Diameter: 200 mm

Boring Completed: 28/04/2017

Drilled by: T. Tindall

Rig Type: Dando 150

Logged by: S. Letch

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
TOPSOIL.	0.0		101.84						
MADE GROUND: brown sandy gravelly silty clay with some brick and timber.	0.10		101.74	B	0.50	TT28			
Obstruction - boulders. Borehole terminated and relocated.	0.80	Hole End	101.04				0.80	04/05/2017	Dry(E)
	1.0								
	2.0								
	3.0								
	4.0								
	5.0								
	6.0								
	7.0								
	8.0								
	9.0								
	10.0								

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
Hand dug inspection pit to 0.80mbgl.

Obstruction encountered at 0.80mbgl - pit backfilled and location moved.

- | | |
|---|--|
| <p>B Bulk Disturbed Sample</p> <p>D Small disturbed sample</p> <p>W Water sample</p> <p>U(9) Undisturbed sample (drive blows)</p> | <p>Key to Symbols</p> <p>SPT(S) Standard Penetration Test(Split Spoon))</p> <p>SPT(C) Standard Penetration Test(Cone)</p> <p> Waterstrike depth</p> <p> Water level depth 20mins after strike</p> <p>17.20(E) Depth to water (E)nd of shift</p> <p>12.20(S) Depth to water (S)tart of shift</p> |
|---|--|

Site Investigations Ltd

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH12A

Client: Columbia Estates Management (IE) Ltd
Consultant: Garland
Site Address: Kildare, Co. Kildare
Boring Commenced: 28/04/2017
Boring Completed: 28/04/2017
Rig Type: Dando 150

Co-ordinates E: 273428.994
 N: 212218.952
Elevation: 101.82 m.O.D.
Hole Diameter: 200 mm
Drilled by: T. Tindall
Logged by: S. Letch

Sheet 1 of 2

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
TOPSOIL. MADE GROUND: brown sandy gravelly silty clay with some brick and timber.	0.0 0.10 1.0 2.0		101.82 101.72	SPT(C)	1.00	N=32-(11,6,6,9)			
Stiff brown sandy slightly gravelly silty CLAY with low cobble content.	2.10 3.0 4.0 5.0 6.0 7.0 8.0		99.72	SPT(C)	2.00	N=21-(9,4,4,4)			
	2.50			B	2.50	TT30			
	3.00			SPT(C)	3.00	N=15-(4,3,4,4)			
	3.50			B	3.50	TT31			
	4.00			SPT(C)	4.00	N=19-(5,4,5,5)			
	4.50			B	4.50	TT32			
	5.00			SPT(C)	5.00	N=18-(4,5,4,5)			
	5.50			B	5.50	TT33			
Dense grey brown silty sandy GRAVEL with medium cobble content.	6.00			SPT(C)	6.00	N=19-(4,5,5,5)			
	6.50			B	6.50	TT34			
	7.00			SPT(C)	7.00	N=20-(4,5,5,6)			
	7.50			B	7.50	TT35			
	8.00			SPT(C)	8.00	N=38-(8,6,11,13)			
	8.50			B	8.50	TT36			
	9.00			SPT(C)	9.00	N=49-(13,14,10,12)			
	9.50			B	9.50	TT37			

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Hand dug inspection pit to 1.20mbgl.

Chiselling: 1.60m to 1.90m: 1hr.
 10.20m to 10.30m: 1.5hr

Borehole terminated at scheduled depth and backfilled.

<p>B Bulk Disturbed Sample D Small disturbed sample W Water sample U(9) Undisturbed sample (drive blows)</p>	<p>Key to Symbols SPT(S) Standard Penetration Test(Split Spoon)) SPT(C) Standard Penetration Test(Cone) Waterstrike depth Water level depth 20mins after strike 17.20(E) Depth to water (E)nd of shift 12.20(S) Depth to water (S)tart of shift</p>
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Site Investigations Ltd

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH13

Client: Columbia Estates Management (IE) Ltd

Co-ordinates E: 273584.183

Consultant: Garland

N: 212090.437

Site Address: Kildare, Co. Kildare

Elevation: 101.95 m.O.D.

Boring Commenced: 28/04/2017

Hole Diameter: 200 mm

Boring Completed: 28/04/2017

Drilled by: T. Tindall

Rig Type: Dando 150

Logged by: S. Letch

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
TOPSOIL.	0.0		101.95						
MADE GROUND: brown sandy gravelly silty clay.	0.10	X	101.85	B	0.50	TT20			
	1.0			SPT(C)	1.00	N=9-(2,2,2,3)			
				B	1.50	TT21			
	2.0			SPT(C)	2.00	N=9-(2,3,2,2)			
MADE GROUND: brown sandy gravelly silty clay with much brick, timber, glass and some metal.	2.10	X	99.85	B	2.50	TT22			
	3.0			SPT(C)	3.00	N=10-(3,2,2,3)			
				B	3.50	TT23			
	4.0			SPT(C)	4.00	N=14-(4,4,3,3)			
				B	4.50	TT24			
	5.0			SPT(C)	5.00	N=17-(4,4,4,5)			
				B	5.50	TT25			
	6.0			SPT(C)	6.00	N=15-(4,3,4,4)			
				B	6.50	TT26			
	7.0			SPT(C)	7.00	N=18-(4,4,5,5)			
				B	7.50	TT27			
Dense grey brown silty sandy GRAVEL with medium cobble content.	7.60	X	94.35	SPT(C)	8.00	N=50/150mm-(12,14,24/0mm)			
Obstruction - boulders.	8.30	X	93.65	SPT(C)	8.40	N=50/5mm-(50/5mm)	8.40	03/05/2017	Dry(E)
Borehole terminated and standpipe installed.	8.40	X	93.55						
	9.0								
	10.0								

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
Hand dug inspection pit to 1.20mbgl.

Chiselling: 8.30m to 8.40m: 1.5hr.

Borehole terminated at scheduled depth and backfilled.

Key to Symbols

- | | |
|---------------------------------------|--|
| B Bulk Disturbed Sample | SPT(S) Standard Penetration Test(Split Spoon)) |
| D Small disturbed sample | SPT(C) Standard Penetration Test(Cone) |
| W Water sample | ▽ ^{-0.50} Waterstrike depth |
| U(9) Undisturbed sample (drive blows) | ▽ ^{-0.0020} Water level depth 20mins after strike |
| | 17.20(E) Depth to water (E)nd of shift |
| | 12.20(S) Depth to water (S)tart of shift |

Site Investigations Ltd

Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH14

Client: Columbia Estates Management (IE) Ltd
Consultant: Garland
Site Address: Kildare, Co. Kildare
Boring Commenced: 02/05/2017
Boring Completed: 03/05/2017
Rig Type: Dando 150

Co-ordinates E: 273592.771
 N: 212065.539
Elevation: 102.17 m.O.D.
Hole Diameter: 200 mm
Drilled by: T. Tindall
Logged by: S. Letch

Sheet 1 of 2

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
TOPSOIL.	0.0		102.17						
MADE GROUND: brown sandy gravelly silty clay.	0.10		102.07	B	0.50	TT09			
	1.0			SPT(C)	1.00	N=11-(3,3,2,3)			
	2.0			B	1.50	TT10			
	2.40		99.77	SPT(C)	2.00	N=10-(3,2,3,2)			
MADE GROUND: brown sandy gravelly silty clay with much brick, timber, glass and some metal.	2.40			B	2.50	TT11			
	3.0			SPT(C)	3.00	N=12-(2,4,3,3)			
	4.0			B	3.50	TT12			
	5.0			SPT(C)	4.00	N=15-(3,4,4,4)			
	6.0			B	4.50	TT13			
	7.0			SPT(C)	5.00	N=15-(4,3,4,4)			
	8.0			B	5.50	TT14			
	8.30		93.87	SPT(C)	6.00	N=17-(4,5,4,4)			
Dense grey brown silty sandy GRAVEL with medium cobble content.	8.30			B	6.50	TT15			
	9.0			SPT(C)	7.00	N=15-(4,3,4,4)			
	9.50			B	7.50	TT16			
	10.0			SPT(C)	8.00	N=41-(7,11,13,10)			
				B	8.50	TT17	9.50	02/05/2017	Dry(E)
				SPT(C)	9.00	N=44-(11,9,11,13)	9.50	03/05/2017	Dry(S)

BOREHOLE SL 10M 5362 BH GINT.GPJ COREHOLE.GDT 09/05/17

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
 Hand dug inspection pit to 1.20mbgl.
 Chiselling: 10.60m to 10.70m: 1.5hr.
 Standpipe installed: Response zone: 1.00mbgl to 10.00mbgl.

<p>B Bulk Disturbed Sample D Small disturbed sample W Water sample U(9) Undisturbed sample (drive blows)</p>	<p>Key to Symbols SPT(S) Standard Penetration Test(Split Spoon)) SPT(C) Standard Penetration Test(Cone) Waterstrike depth Water level depth 20mins after strike 17.20(E) Depth to water (E)nd of shift 12.20(S) Depth to water (S)tart of shift</p>
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Cable Percussive Borehole Record

CONTRACT: Magee Barracks

HOLE ID: BH14

Client: Columbia Estates Management (IE) Ltd

Co-ordinates E: 273592.771

Consultant: Garland

N: 212065.539

Site Address: Kildare, Co. Kildare

Elevation: 102.17 m.O.D.

Boring Commenced: 02/05/2017

Hole Diameter: 200 mm

Boring Completed: 03/05/2017

Drilled by: T. Tindall

Rig Type: Dando 150

Logged by: S. Letch

Sheet 2 of 2

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No. Results	Hole Depth (m)	Date	Water Depth (m)
	10.0	x		SPT(C)	10.00	N=50/225mm-(16,13,14,7/0mm)			
		B		B	10.50	TT19			
Obstruction - boulders. Borehole terminated and standpipe installed.	10.60 10.74	▲	91.57 91.43	SPT(C)	10.70	N=50/5mm-(50/5mm)	10.70	03/05/2017	Dry(E)
	11.0								
	12.0								
	13.0								
	14.0								
	15.0								
	16.0								
	17.0								
	18.0								
	19.0								
	20.0								

Remarks: (Note: Stratum bands <200mm are not indicated pictorially)
Hand dug inspection pit to 1.20mbgl.
Chiselling: 10.60m to 10.70m: 1.5hr.
Standpipe installed: Response zone: 1.00mbgl to 10.00mbgl.

<u>Key to Symbols</u>	
B	Bulk Disturbed Sample
D	Small disturbed sample
W	Water sample
U(9)	Undisturbed sample (drive blows)
SPT(S)	Standard Penetration Test(Split Spoon))
SPT(C)	Standard Penetration Test(Cone)
▼ ^{0.50}	Waterstrike depth
▽ ^{1.00000}	Water level depth 20mins after strike
17.20(E)	Depth to water (E)nd of shift
12.20(S)	Depth to water (S)tart of shift

Site Investigations Ltd

BOREHOLE.SI_10M_5362.BH.GINT.GPJ_COREHOLE.GDT_09/05/17

Appendix 2
Trial Pit Logs and Photographs

TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP01

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273683.921

Consultant: Garland

N: 212142.530

Site Address: Kildare, Co. Kildare

Elevation: 101.99 m.O.D.


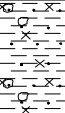
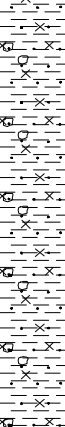
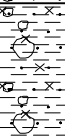
Date Started: 16/02/2017

Logged by: P. McGonagle

Date Completed: 16/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
MADE GROUND: brown slightly sandy slightly gravelly silty clay with some brick and clay pipe at 1.00m.	0.0 0.00		101.99	ENV	0.50	PM01		
Firm brown sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	1.0 1.00		100.99	CBR	1.00	PM02		
	2.0			B	1.50	PM03		
Stiff brown grey slightly sandy slightly gravelly silty CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles and boulders are subangular to subrounded of varied lithologies (up to 350mm diameter).	3.0 3.00		98.99	B	3.00	PM04		
Pit terminated at scheduled depth.	3.50	Hole End	98.49					
	4.0							
	5.0							

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Clay pipe encountered at 1.00mbgl.

Pit terminated at scheduled depth.

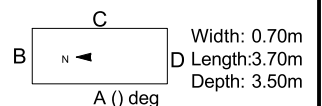
Pit walls stable.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP02

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273731.697

Consultant: Garland

N: 212209.637

Site Address: Kildare, Co. Kildare

Elevation: 100.97 m.O.D.

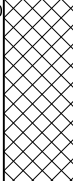
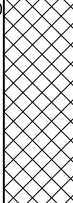

Date Started: 16/02/2017

Logged by: P. McGonagle

Date Completed: 16/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
MADE GROUND: brown slightly sandy slightly gravelly silty clay with some brick.	0.0 0.00		100.97	ENV	0.50	PM05		
MADE GROUND: brown grey slightly sandy slightly gravelly silty clay with low cobble content and clay pipe at 1.50m.	0.70 1.0		100.27	CBR B	1.00 1.00	PM06 PM07		
Light grey slightly silty very sandy subangular to subrounded, fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subrounded to rounded of varied lithologies.	1.50 2.0		99.47	B	2.00	PM08		
Pit terminated due to pit wall collapse.	2.90 3.0 4.0 5.0	Hole End	98.07					

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Clay pipe encountered at 1.50mbgl.

Pit terminated due to pit wall collapse.

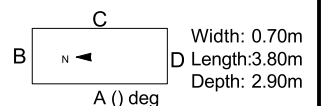
Major pit wall collapse forcing completion of pit.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP03

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273587.111

Consultant: Garland

N: 212365.977

Site Address: Kildare, Co. Kildare

Elevation: 97.74 m.O.D.

Date Started: 15/02/2017

Logged by: M. Kaliski

Date Completed: 15/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
TOPSOIL.	0.00	— T —	97.74					
MADE GROUND: grey brown sandy slightly gravelly silty clay with high cobble content and some plastic fragments and scrap metal. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	0.20	[Cross-hatch pattern]	97.54					
MADE GROUND: grey sandy angular to subangular, fine to coarse gravel with much lean mix concrete.	0.60	[Cross-hatch pattern]	97.14					
MADE GROUND: grey brown sandy slightly gravelly silty clay with high cobble content and some plastic fragments and scrap metal. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	0.70	[Cross-hatch pattern]	97.04					
Firm dark grey sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	0.90	[Dotted pattern]	96.84	CBR	1.00	MK24		
	1.00	[Dotted pattern]						
Firm light grey sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	1.80	[Dotted pattern]	95.94	B	2.00	MK25		
	2.00	[Dotted pattern]						
Light grey silty sandy subangular to subrounded, fine to coarse GRAVEL of varied lithologies with medium cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of varied lithologies.	2.80	[Large circles pattern]	94.94	B	3.00	MK26		
	3.00	[Large circles pattern]						
Pit terminated at scheduled depth.	3.50	Hole End	94.24					
	4.00							
	5.00							

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated at scheduled depth.

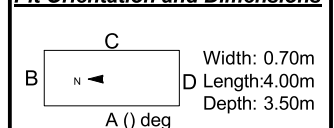
Pit walls stable.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



Site Investigations Ltd

TRIAL PIT SL 5.0M 5362 TP GINT.GPJ COREHOLE.GDT 09/05/17

TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP04

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273608.746

Consultant: Garland

N: 212484.235

Site Address: Kildare, Co. Kildare

Elevation: 97.34 m.O.D.

Date Started: 15/02/2017

Logged by: M. Kaliski

Date Completed: 15/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
TOPSOIL.	0.0	0.00	97.34					
MADE GROUND: grey brown slightly silty sandy subangular to subrounded, fine to coarse gravel of varied lithologies with medium cobble content and some plastic fragments. Sand is fine to coarse. Cobbles are subangular to subrounded of varied lithologies.	0.10		97.24					
Grey silty sandy subangular to rounded, fine to coarse GRAVEL of varied lithologies with high cobble content. Sand is fine to coarse. Cobbles are subangular to subrounded of varied lithologies.	0.50		96.84					
Firm brown sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles are subangular to subrounded of varied lithologies.	1.10		96.24	CBR	1.00	MK20		
Firm light brown sandy slightly gravelly silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles are subangular to subrounded of varied lithologies.	1.70		95.64	B	1.50	MK21		
	2.0			B	2.50	MK22		
	3.0			B	3.50	MK23		
Pit terminated at scheduled depth.	3.50	Hole End	93.84	B	3.50	MK23		
	4.0							
	5.0							

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:
Pit terminated at scheduled depth.

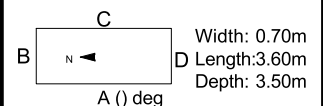
Pit walls stable.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP05

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273537.646

Consultant: Garland

N: 212402.486

Site Address: Kildare, Co. Kildare

Elevation: 97.99 m.O.D.

Date Started: 15/02/2017

Logged by: M. Kaliski

Date Completed: 15/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
TOPSOIL.	0.0	— T —	97.99					
MADE GROUND: grey brown silty sandy subangular to subrounded, fine to coarse gravel of varied lithologies with high cobble content and some red brick fragments. Sand is fine to coarse. Cobbles are subangular to subrounded of varied lithologies.	0.20	[Cross-hatch pattern]	97.79					
MADE GROUND: grey brown sandy gravelly silty clay with some red brick fragments. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	0.80	[Cross-hatch pattern]	97.19	B	1.00	MK17		
Firm brown sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles are subangular to subrounded of varied lithologies.	1.40	[Circles and dashes]	96.59	CBR	1.60	MK18		
Firm becoming stiff light brown slightly sandy gravelly silty CLAY with medium cobble and low boulder content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles and boulders are subangular to subrounded of varied lithologies (up to 400mm diameter).	2.50	[Circles and dashes]	95.49	B	3.00	MK19		
Pit terminated at scheduled depth.	3.50	Hole End	94.49					

TRIAL PIT SL 5.0M 5362 TP GINT.GPJ COREHOLE.GDT 09/05/17

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:
Pit terminated at scheduled depth.

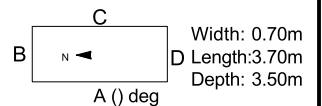
Pit walls stable.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP06

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273455.146

Consultant: Garland

N: 212346.177

Site Address: Kildare, Co. Kildare

Elevation: 101.90 m.O.D.

Date Started: 15/02/2017

Logged by: M. Kaliski

Date Completed: 15/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
MADE GROUND: tarmacadam.	0.0	0.00	101.90					
MADE GROUND: grey silty sandy angular to subangular, fine to coarse gravel with medium cobble content. Sand is fine to coarse. Cobbles are angular to subangular of varied lithologies.	0.10		101.80					
	0.25		101.65					
MADE GROUND: red brown silty sandy subangular to subrounded, fine to coarse gravel of varied lithologies with high cobble content and some plastic bags. Sand is fine to coarse. Cobbles are subangular to subrounded of varied lithologies.	0.60		101.30					
	1.0			CBR	1.00	MK10		
Brown silty very gravelly fine to coarse SAND with medium cobble content. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles are subangular to subrounded of varied lithologies.	1.30		100.60					
	2.0			B	1.50	MK11		
Grey brown slightly silty sandy subangular to subrounded, fine to coarse GRAVEL of varied lithologies with high cobble content. Sand is fine to coarse. Cobbles are subangular of varied lithologies.	3.0							
	2.50			B	2.50	MK12		
Grey brown silty fine to coarse SAND.	3.10		98.80					
Pit terminated at scheduled depth.	3.50	Hole End	98.40					
	4.0							
	5.0							

Note: If deemed necessary, pit face sketches are given on the last sheet. Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated at scheduled depth.

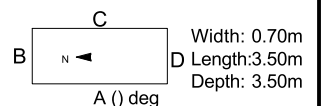
Minor pit wall instability below 1.30mbgl.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP07

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273375.498

Consultant: Garland

N: 212207.892

Site Address: Kildare, Co. Kildare

Elevation: 102.07 m.O.D.

Date Started: 15/02/2017

Logged by: M. Kaliski

Date Completed: 15/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
TOPSOIL.	0.0		102.07					
MADE GROUND: grey silty gravelly fine to coarse sand with low cobble content and some concrete brick fragments. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles are subangular to subrounded of varied lithologies.	0.20		101.87	ENV	0.30	MK01		
Firm brown slightly sandy slightly gravelly silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles are subangular to subrounded of varied lithologies.	0.90		101.17	CBR B	1.00 1.00	MK02 MK03		
Light grey brown slightly silty sandy subangular to subrounded, fine to coarse GRAVEL of varied lithologies with medium cobble and low boulder content. Sand is fine to coarse. Cobbles and boulders are subangular to subrounded of varied lithologies (up to 300mm diameter).	1.50		100.57	B	2.00	MK04		
Stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles are subangular to subrounded of varied lithologies.	2.10		99.97	B	3.00	MK05		
Pit terminated due to boulder obstruction.	3.10	Hole End	98.97					

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated due to boulder obstructions.

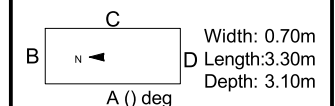
Pit walls stable.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼^{3.50} Waterstrike depth
- ▽^{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP08

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273345.580

Consultant: Garland

N: 212349.531

Site Address: Kildare, Co. Kildare

Elevation: 103.43 m.O.D.

Date Started: 15/02/2017

Logged by: M. Kaliski

Date Completed: 15/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
MADE GROUND: tarmacadam.	0.0		103.43					
MADE GROUND: grey silty sandy angular to subangular, fine to coarse gravel with medium cobble content. Sand is fine to coarse. Cobbles are angular to subangular of varied lithologies.	0.10		103.33					
MADE GROUND: red brown black silty sandy subangular to subrounded, fine to coarse gravel of varied lithologies with medium cobble content and much red brick, glass, steel bars and nails. Sand is fine to coarse. Cobbles are subangular to subrounded of varied lithologies.	0.50		102.93	ENV	0.70	MK06		
	1.0			CBR	1.00	MK07		
Firm brown sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	2.20		101.23					
Grey brown slightly silty very gravelly fine to coarse SAND with medium cobble content. Gravel is subrounded to rounded, fine to coarse of varied lithologies. Cobbles are subrounded of varied lithologies.	2.50		100.93	B	2.50	MK08		
	3.0			B	2.80	MK09		
Pit terminated due to pit wall collapse.	3.10		100.33					
	4.0							
	5.0							

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated at due to pit wall collapse.

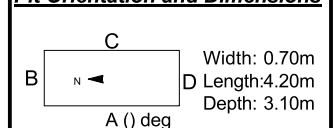
Minor pit wall instability forcing completion of pit.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼ 3.50 Waterstrike depth
- ▽ 1.50(20) Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP09

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273473.720

Consultant: Garland

N: 212475.788

Site Address: Kildare, Co. Kildare

Elevation: 97.99 m.O.D.

Date Started: 15/02/2017

Logged by: M. Kaliski

Date Completed: 15/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
TOPSOIL.	0.0 0.00	— T —	97.99					
MADE GROUND: dark grey silty sandy subangular to subrounded, fine to coarse gravel with low cobble content and some red brick. Sand is fine to coarse. Cobbles are subangular to subrounded of varied lithologies.	0.20	[Cross-hatch]	97.79					
	0.40	[Cross-hatch]	97.59					
MADE GROUND: grey brown sandy gravelly silty clay with some timber fragments. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	0.80	[X-pattern]	97.19					
Firm grey brown sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	1.0	[X-pattern]		B	1.00	MK13		
	1.50	[X-pattern]		CBR	1.50	MK14		
Brown silty very sandy subangular to rounded, fine to coarse GRAVEL of varied lithologies with high cobble and low boulder content. Sand is fine to coarse. Cobbles and boulders are subangular to subrounded of varied lithologies (up to 400mm diameter).	2.20	[Circles]	95.79					
	3.0	[Circles]		B	2.50	MK15		
Pit terminated at scheduled depth.	3.50	Hole End	94.49					
	4.0	[Hole End]		B	3.50	MK16		

Note: If deemed necessary, pit face sketches are given on the last sheet. Strata descriptions refer to all faces unless otherwise specified.

Remarks:
Pit terminated at scheduled depth.

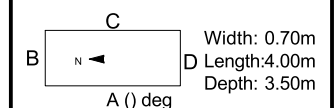
Pit walls stable.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP10

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273629.307

Consultant: Garland

N: 212512.392

Site Address: Kildare, Co. Kildare

Elevation: 96.74 m.O.D.




Date Started: 16/02/2017

Logged by: P. McGonagle

Date Completed: 16/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
MADE GROUND: brown slightly sandy slightly gravelly silty clay with some steel.	0.0 0.00		96.74	ENV	0.50	PM09		
Firm grey slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles are subangular to subrounded of varied lithologies.	1.0 1.00		95.74	CBR B	1.00 1.00	PM10 PM11		
Light grey silty sandy subangular to subrounded, fine to coarse GRAVEL with medium cobble and low boulder content. Sand is fine to coarse. Cobbles and boulders are subrounded to rounded of varied lithologies (up to 300mm diameter).	1.60 2.0 3.0		95.14	B	2.00	PM12		
Pit terminated due to pit wall collapse.	3.20 4.0 5.0	Hole End	93.54					

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated at due to pit wall collapse.

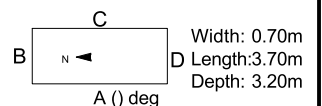
Minor pit wall instability forcing completion of pit.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼^{3.50} Waterstrike depth
- ▽^{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP11

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273663.874

Consultant: Garland

N: 212617.834

Site Address: Kildare, Co. Kildare

Elevation: 98.30 m.O.D.

Date Started: 16/02/2017

Logged by: P. McGonagle

Date Completed: 16/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
TOPSOIL.	0.0	0.00	98.30					
Firm brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	0.20		98.10					
Firm becoming stiff light grey slightly sandy slightly gravelly silty CLAY with medium cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles and boulders are subangular to subrounded of varied lithologies (up to 350mm diameter).	0.60		97.70					
	1.0			CBR B	1.00 1.00	PM23 PM24		
	2.0			B	2.00	PM25		
Grey silty sandy subangular to subrounded, fine to coarse GRAVEL with medium cobble and low boulder content. Sand is fine to coarse. Cobbles and boulders are subrounded to rounded of varied lithologies (up to 300mm diameter).	2.40		95.90					
	3.0			B	3.00	PM26		
Pit terminated at scheduled depth.	3.50	Hole End	94.80					
	4.0							
	5.0							

Note: If deemed necessary, pit face sketches are given on the last sheet. Strata descriptions refer to all faces unless otherwise specified.

Remarks:
Pit terminated at scheduled depth.

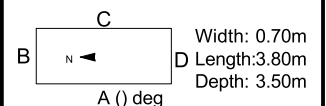
Pit walls stable.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP12

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273620.290

Consultant: Garland

N: 212700.887

Site Address: Kildare, Co. Kildare

Elevation: 100.26 m.O.D.

Date Started: 16/02/2017

Logged by: P. McGonagle

Date Completed: 16/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
TOPSOIL.	0.0	— T —	100.26					
Firm brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	0.20	(Symbol: horizontal dashes with small circles)	100.06					
Firm becoming stiff light grey slightly sandy slightly gravelly silty CLAY with medium cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles and boulders are subangular to subrounded of varied lithologies (up to 350mm diameter).	0.60	(Symbol: horizontal dashes with larger circles)	99.66	CBR B	1.00	PM19		
	1.0	(Symbol: horizontal dashes with larger circles)			1.00	PM20		
	2.0	(Symbol: horizontal dashes with larger circles)		B	2.00	PM21		
Grey silty sandy subangular to subrounded, fine to coarse GRAVEL with medium cobble and low boulder content. Sand is fine to coarse. Cobbles and boulders are subrounded to rounded of varied lithologies (up to 300mm diameter).	2.40	(Symbol: circles of various sizes)	97.86	B	3.00	PM22		
Pit terminated at scheduled depth.	3.50	Hole End	96.76					
	4.0							
	5.0							

Note: If deemed necessary, pit face sketches are given on the last sheet. Strata descriptions refer to all faces unless otherwise specified.

Remarks:
Pit terminated at scheduled depth.

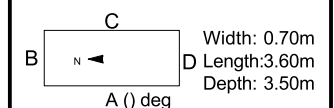
Pit walls stable.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP13

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273747.438

Consultant: Garland

N: 212638.417

Site Address: Kildare, Co. Kildare

Elevation: 96.53 m.O.D.

Date Started: 16/02/2017

Logged by: P. McGonagle

Date Completed: 16/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
TOPSOIL.	0.0	0.00	96.53					
Firm brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	0.20		96.33					
Firm becoming stiff light grey slightly sandy slightly gravelly silty CLAY with medium cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles and boulders are subangular to subrounded of varied lithologies (up to 350mm diameter).	0.60		95.93					
	1.0			CBR B	1.00 1.00	PM16 PM17		
	2.0			B	2.00	PM18		
	3.0							
	3.50	Hole End	93.03					
Pit terminated at scheduled depth.	4.0							
	5.0							

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:
Pit terminated at scheduled depth.

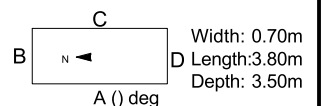
Pit walls stable.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



Site Investigations Ltd

TRIAL PIT SL 5.0M 5362 TP GINT.GPJ COREHOLE.GDT 09/05/17

TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP14

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273709.093

Consultant: Garland

N: 212504.922

Site Address: Kildare, Co. Kildare

Elevation: 96.01 m.O.D.

Date Started: 16/02/2017

Logged by: P. McGonagle

Date Completed: 16/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
MADE GROUND: grey silty sandy angular to subangular, fine to coarse gravel with medium cobble content. Sand is fine to coarse. Cobbles are angular to subangular of varied lithologies.	0.0		96.01					
Firm brown sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles are subangular to subrounded of varied lithologies.	0.20		95.81					
	1.0			CBR B	1.00 1.00	PM13 PM14		
Firm becoming stiff grey sandy slightly gravelly silty CLAY with medium cobble and boulder content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles and boulders are subangular to subrounded of varied lithologies (up to 300mm diameter).	1.20		94.81					
	2.0			B	2.00	PM15		
	3.0							
Pit terminated at scheduled depth.	3.50	Hole End	92.51					
	4.0							
	5.0							

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated at scheduled depth.

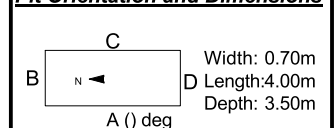
Pit walls stable.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- 3.50 Waterstrike depth
- 1.50(20) Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP15

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273807.656

Consultant: Garland

N: 212568.844

Site Address: Kildare, Co. Kildare

Elevation: 95.83 m.O.D.

Date Started: 16/02/2017

Logged by: P. McGonagle

Date Completed: 16/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
TOPSOIL.	0.0	0.00	95.83					
Firm brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	0.20		95.63					
Firm becoming stiff light grey slightly sandy slightly gravelly silty CLAY with medium cobble and low boulder content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles and boulders are subangular to subrounded of varied lithologies (up to 350mm diameter).	1.10		94.73	CBR B	1.00 1.00	PM31 PM32		
	2.0			B	2.00	PM33		
Pit terminated at scheduled depth.	3.50	Hole End	92.33					

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:
Pit terminated at scheduled depth.

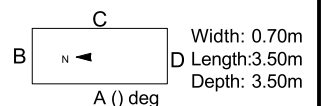
Pit walls stable.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP16

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273856.024

Consultant: Garland

N: 212652.212

Site Address: Kildare, Co. Kildare

Elevation: 98.35 m.O.D.

Date Started: 16/02/2017

Logged by: P. McGonagle

Date Completed: 16/02/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
TOPSOIL.	0.0	0.00	98.35					
Firm brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies.	0.20		98.15					
Firm becoming stiff light grey slightly sandy slightly gravelly silty CLAY with medium cobble and low boulder content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of varied lithologies. Cobbles and boulders are subangular to subrounded of varied lithologies (up to 350mm diameter).	0.40		97.95	ENV	0.50	PM27		
	1.0			CBR B	1.00	PM28		
					1.00	PM29		
	2.0			B	2.00	PM30		
	3.0							
	3.50	Hole End	94.85					
Pit terminated at scheduled depth.								
	4.0							
	5.0							

Note: If deemed necessary, pit face sketches are given on the last sheet. Strata descriptions refer to all faces unless otherwise specified.

Remarks:
Pit terminated at scheduled depth.

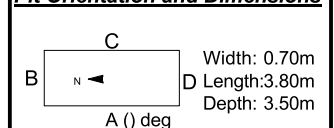
Pit walls stable.

No groundwater encountered.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP17

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273496.293

Consultant: Garland

N: 212201.409

Site Address: Kildare, Co. Kildare

Elevation: 101.48 m.O.D.

Date Started: 02/05/2017

Logged by: M.Kaliski

Date Completed: 02/05/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
MADE GROUND: tarmacadam.	0.0		101.48					
MADE GROUND: dark grey sandy gravel (CI 804).	0.03		101.45					
MADE GROUND: grey sandy slightly gravelly clay with some red brick fragments.	0.08		101.40					
Firm grey brown slightly sandy slightly gravelly silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of various lithologies. Cobbles are subrounded to rounded of various lithologies.	0.25		101.23	B	0.50	MK1		
Grey silty sandy gravelly subangular to rounded COBBLES and BOULDERS of various lithologies (up to 400mm diameter).	1.40		100.08					
Grey brown silty sandy subangular to rounded, fine to coarse GRAVEL of various lithologies with medium cobble and low boulder content. Sand is fine to coarse. Cobbles and boulders are subrounded to rounded of various lithologies (up to 400mm diameter).	1.80		99.68	B	2.00	MK2		
Pit terminated due to obstruction.	3.40	Hole End	98.08	B	3.40	MK3		

TRIAL PIT SL 5.0M 5362 TP GINT.GPJ COREHOLE.GDT 09/05/17

Note: If deemed necessary, pit face sketches are given on the last sheet. Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated at 3.40m due to obstructions.

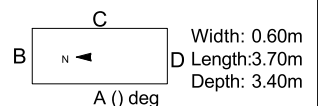
No groundwater encountered.

Pit walls stable.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP18

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273515.128

Consultant: Garland

N: 212174.494

Site Address: Kildare, Co. Kildare

Elevation: 101.51 m.O.D.

Date Started: 02/05/2017

Logged by: M.Kaliski

Date Completed: 02/05/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
MADE GROUND: tarmacadam.	0.0		101.51					
MADE GROUND: dark grey sandy gravel (CI 804).	0.03		101.48					
MADE GROUND: grey brown sandy slightly gravelly clay with medium cobble content and some red brick fragments.	0.08		101.43					
Firm grey brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse of various lithologies. Cobbles are subrounded to rounded of various lithologies.	0.30		101.21	B	0.50	MK4		
Grey brown silty sandy subangular to rounded, fine to coarse GRAVEL of various lithologies with high cobble and boulder content. Sand is fine to coarse. Cobbles and boulders are subangular to rounded of various lithologies (up to 600mm diameter).	1.50		100.01	B	2.00	MK5		
Pit terminated due to obstruction.	3.50	Hole End	98.01	B	3.50	MK6		

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated at 3.5m due to obstructions.

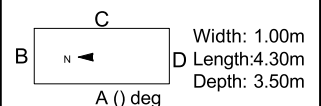
No groundwater encountered.

Pit walls stable.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼_{3.50} Waterstrike depth
- ▽_{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



Site Investigations Ltd

TRIAL PIT SL 5.0M 5362 TP GINT.GPJ COREHOLE.GDT 09/05/17

TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP19

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273551.275

Consultant: Garland

N: 212156.099

Site Address: Kildare, Co. Kildare

Elevation: 101.52 m.O.D.

Date Started: 02/05/2017

Logged by: M.Kaliski

Date Completed: 02/05/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
MADE GROUND: tarmacadam.	0.0		101.52					
MADE GROUND: dark grey sandy gravel (CI 804).	0.03		101.49					
MADE GROUND: grey brown very sandy slightly gravelly clay with frequent red brick fragments	0.08		101.44					
Brown slightly silty fine SAND	0.20		101.32					
	1.0			B	1.00	MK7		
Grey brown silty sandy subangular to rounded, fine to coarse GRAVEL of various lithologies with high cobble content. Sand is fine to coarse. Cobbles are subangular to rounded of various lithologies.	1.90		99.62	B	2.00	MK8		
	2.0							
	3.0							
	4.0							
Pit terminated due at scheduled depth.	4.50	Hole End	97.02	B	4.50	MK9		
	5.0							

Note: If deemed necessary, pit face sketches are given on the last sheet. Strata descriptions refer to all faces unless otherwise specified.

Remarks:
Pit terminated at scheduled depth.

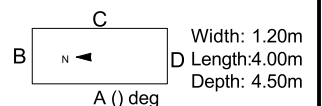
No groundwater encountered.

Pit walls stable.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- ▼^{3.50} Waterstrike depth
- ▽^{1.50(20)} Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP20

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273572.936

Consultant: Garland

N: 212127.899

Site Address: Kildare, Co. Kildare

Elevation: 101.46 m.O.D.

Date Started: 02/05/2017

Logged by: M.Kaliski

Date Completed: 02/05/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
MADE GROUND: tarmacadam.	0.0		101.46					
MADE GROUND: dark grey sandy gravel (CI 804).	0.03		101.43					
Brown slightly silty fine SAND	0.08		101.38					
Grey brown silty sandy subangular to rounded, fine to coarse GRAVEL of various lithologies with high cobble content. Sand is fine to coarse. Cobbles are subangular to rounded of various lithologies.	0.20		101.26	B	0.50	MK10		
Grey brown silty gravelly fine to coarse SAND with low cobble content. Gravel is subangular to rounded, fine to coarse of various lithologies. Cobbles are subangular to rounded of various lithologies.	1.80		99.66	B	2.00	MK11		
Grey brown silty very gravelly fine to coarse SAND with low cobble content. Gravel is subangular to rounded, fine to coarse of various lithologies. Cobbles are subangular to rounded of various lithologies.	3.90		97.56	B	4.00	MK12		
Pit terminated due at scheduled depth.	4.50	Hole End	96.96					

TRIAL PIT SL 5.0M 5362 TP GINT.GPJ COREHOLE.GDT 09/05/17

Note: If deemed necessary, pit face sketches are given on the last sheet. Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated at 4.50m at scheduled depth.

No groundwater encountered.

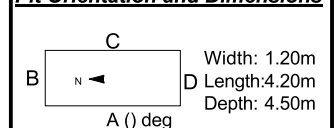
Pit walls stable.

At 1.00m in south side of trench - 100mm ceramic pipe on 30mm concrete foundation.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- Waterstrike depth
- Water level depth 20mins after strike

Pit Orientation and Dimensions



Site Investigations Ltd

TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP21

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273583.620

Consultant: Garland

N: 212117.467

Site Address: Kildare, Co. Kildare

Elevation: 101.36 m.O.D.

Date Started: 02/05/2017

Logged by: M.Kaliski

Date Completed: 02/05/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
MADE GROUND: tarmacadam.	0.0		101.36					
MADE GROUND: dark grey sandy gravel (CI 804).	0.03		101.33					
Brown silty slightly gravelly fine to coarse SAND with fine gravel laminas. Gravel is subangular to subrounded, fine to coarse of various lithologies.	0.08		101.28					
	1.0			B	1.00	MK13		
Grey brown silty sandy subangular to rounded, fine to coarse GRAVEL of various lithologies with low cobble content. Sand is fine to coarse. Cobbles are subangular to rounded of various lithologies.	1.40		99.96					
	2.0			B	2.00	MK14		
Pit terminated due at pit wall instability.	2.70	Hole End	98.66					
	3.0							
	4.0							
	5.0							

Note: If deemed necessary, pit face sketches are given on the last sheet. Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated at 2.70m due to pit wall collapse.

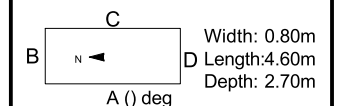
No groundwater encountered.

Pit wall collapse below 1.40m - risk of undermining.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- 3.50 Waterstrike depth
- 1.50(20) Water level depth 20mins after strike

Pit Orientation and Dimensions



TRIAL PIT RECORD

Contract: Magee Barracks

Hole ID:

TP22

Client: Columbia Estates Management (IE) Ltd

Co-ordinates: E: 273555.143

Consultant: Garland

N: 212175.440

Site Address: Kildare, Co. Kildare

Elevation: 101.65 m.O.D.

Date Started: 02/05/2017

Logged by: M.Kaliski

Date Completed: 02/05/2017

Excavator: JCB 3CX

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Water Depth (m)	Date
				Type	Depth (m)	Ref No.		
MADE GROUND: tarmacadam.	0.0		101.65					
MADE GROUND: dark grey sandy gravel (CI 804).	0.03		101.62					
MADE GROUND: grey sandy slightly clayey gravel with high cobble content and red brick fragments	0.08		101.57					
	0.15		101.50					
Firm brown slightly sandy gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to rounded, fine to coarse of various lithologies. Cobbles are subrounded to rounded of various lithologies.	1.0			B	0.50	MK15		
Firm brown slightly sandy gravelly silty CLAY with medium cobble and low boulder content. Sand is fine to coarse. Gravel is subangular to rounded, fine to coarse of various lithologies. Cobbles and boulders are subrounded to rounded of various lithologies (up to 300mm diameter).	2.0		100.45					
	2.10		99.55					
Grey brown silty sandy subangular to rounded, fine to coarse GRAVEL of various lithologies with medium cobble content. Sand is fine to coarse. Cobbles are subangular to rounded of various lithologies.	3.0			B	2.50	MK16		
	4.0			B	3.50	MK17		
Pit terminated due at scheduled depth.	4.50	Hole End	97.15					

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated at scheduled depth.

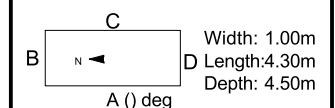
No groundwater encountered.

Pit walls stable.

Key to Symbols

- B Bulk disturbed sample
- D Small disturbed sample
- U Undisturbed sample
- V(60) In-situ hand shear vane test(kPa)
- P Hand Penetrometer Test(N value)
- 3.50 Waterstrike depth
- 1.50(20) Water level depth 20mins after strike

Pit Orientation and Dimensions



TP01 Pit



TP01 Sidewall



TP01 Spoil



TP02 Pit



TP02 Sidewall



TP02 Spoil



TP03 Pit



TP03 Sidewall



TP03 Spoil



TP04 Pit



TP04 Sidewall



TP04 Spoil



TP05 Pit



TP05 Sidewall



TP05 Spoil



TP06 Pit



TP06 Sidewall



TP06 Spoil



TP07 Pit



TP07 Sidewall



TP07 Spoil



TP08 Pit



TP08 Sidewall



TP08 Spoil



TP09 Pit



TP09 Sidewall



TP09 Spoil



TP10 Pit



TP10 Sidewall



TP10 Spoil



TP11 Pit



TP11 Sidewall



TP11 Spoil



TP12 Pit



TP12 Sidewall



TP12 Spoil



TP13 Pit



TP13 Sidewall



TP13 Spoil



TP14 Pit



TP14 Sidewall



TP14 Spoil



TP15 Pit



TP15 Sidewall



TP15 Spoil



TP16 Pit



TP16 Sidewall



TP16 Spoil



TP17 Pit



TP17 Sidewall



TP17 Spoil



TP18 Pit



TP18 Sidewall



TP18 Spoil



TP19 Pit



TP19 Sidewall



TP19 Spoil



TP20 Pit



TP20 Sidewall



TP20 Spoil



TP21 Pit



TP21 Sidewall



TP21 Spoil



TP22 Pit



TP22 Sidewall



TP22 Spoil



Appendix 3
Laboratory Test Results

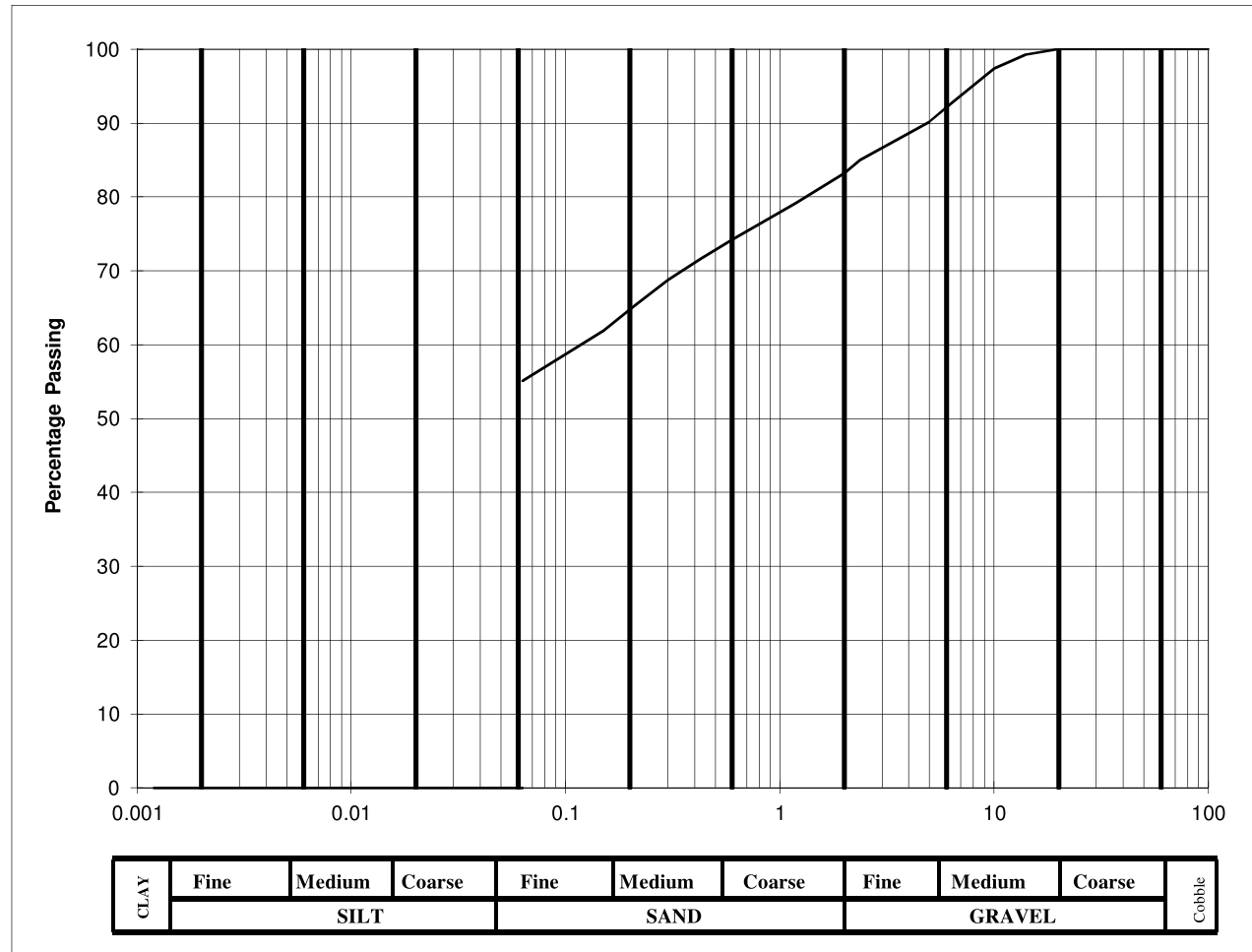
Classification Tests

Client	Columbia Estates Management (IE) Ltd.
Site	Magee Barracks, Kildare Town
S.I. File No	5362 / 17
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email:info@siteinvestigations.ie
Report Date	13th April 2017

Hole ID	Depth	Sample No	Lab Ref No.	Sample Type	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Max. Dry Density Mg/m ³	Min. Dry Density Mg/m ³	Particle Density Mg/m ³	% passing 425um	Comments	Remarks C=Clay; M=Silt Plasticity: L=Low; I=Intermediate; H=High; V=Very High; E=Extremely High
BH01	5.20	IS48	17/1257	B	11.7	32	21				71.6		CL
BH02	4.20	IS42	17/1259	B	22.3	33	21				81.0		CL
BH03	5.20	IS33	17/1261	B	4.9	33	22				69.8		CL
BH04	1.20	IS25	17/1262	B	10.9	32	22				61.4		CL
BH06	1.20	IS22	17/1263	B	14.4	30	21				36.2		CL
BH07	1.20	IS19	17/1265	B	15.2	32	21				42.1		CL
BH08	3.20	IS17	17/1267	B	15.4	30	20				64.5		CL
BH10	1.20	IS02	17/1268	B	17.9	34	21				69.5		CL
BH10	4.20	IS05	17/1269	B	16.5	32	21				61.7		CL
BH10	8.00	IS08	17/1270	B	45.4	47	24				69.1		CI
TP01	1.50	PM03	17/1184	B	28.4	33	22				60.6		CL
TP03	2.00	MK25	17/1188	B	20.1	37	23				82.9		CI
TP07	1.00	MK03	17/1193	B	14.3	37	23				67.1		CI
TP09	1.00	MK13	17/1196	B	18.3	39	24				73.1		CI
TP11	1.00	MK24	17/1201	B	17.1	38	22				70.0		CI
TP14	1.00	PM14	17/1205	B	19.9	32	21				80.7		CL
TP16	1.00	PM29	17/1208	B	11.9	34	21				67.4		CL

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	100		
14	99.3		
10	97.4		
6.3	92.6		
5.0	90.2		
2.36	85		
2.00	83.2		
1.18	79.1		
0.600	74.2		
0.425	71.6		
0.300	68.8		
0.212	65.4		
0.150	61.9		
0.063	55		

Cobbles, %	0
Gravel, %	17
Sand, %	28
Clay / Silt, %	55



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

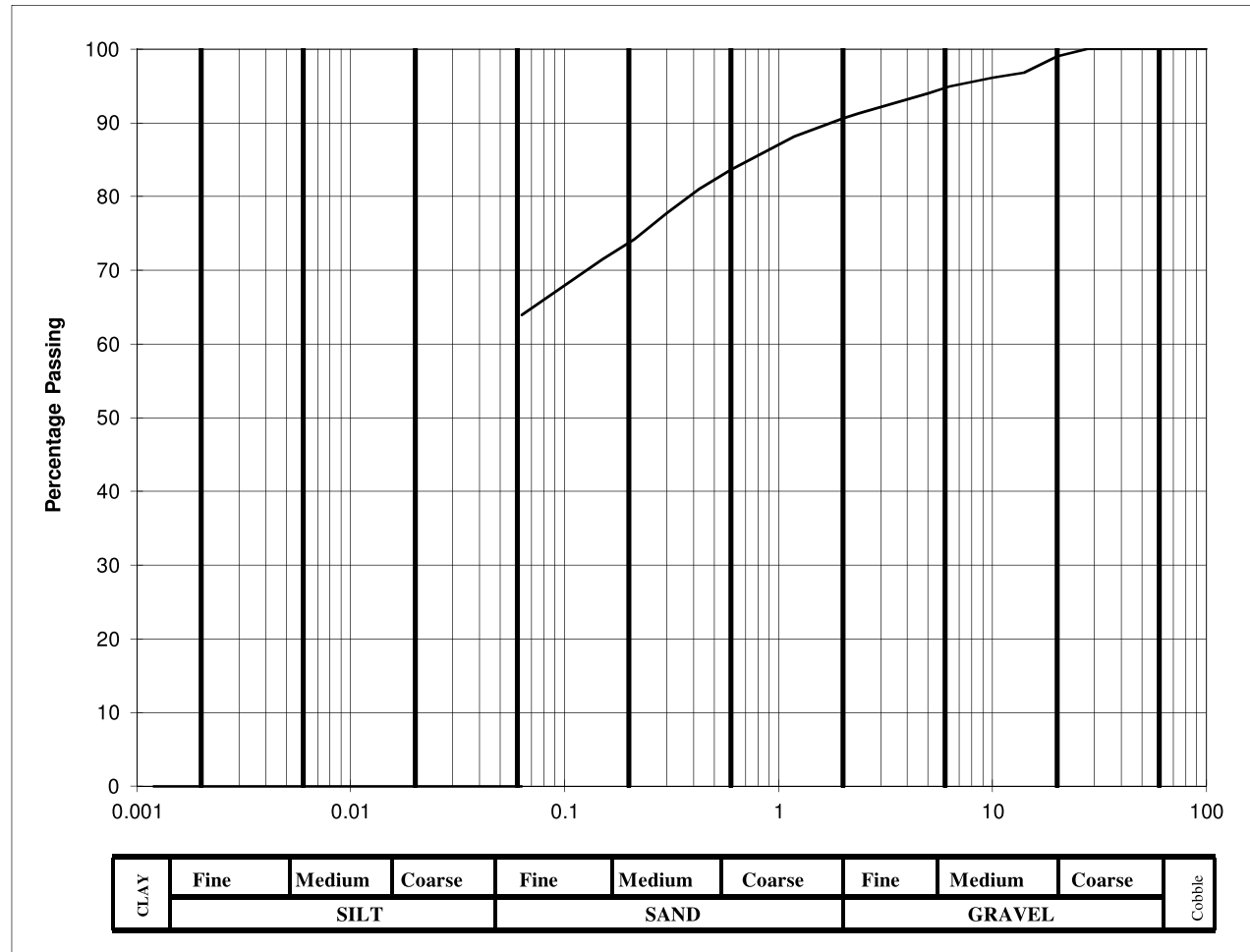
Lab. No :	17/1257
Sample No :	IS48

Hole ID :	BH 01
Depth, m :	5.20

Material description :	slightly gravelly slightly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	99		
14	96.8		
10	96.1		
6.3	94.9		
5.0	94		
2.36	91.3		
2.00	90.6		
1.18	88.1		
0.600	83.6		
0.425	81		
0.300	77.8		
0.212	74.2		
0.150	71.5		
0.063	64		

Cobbles, %	0
Gravel, %	9
Sand, %	27
Clay / Silt, %	64



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

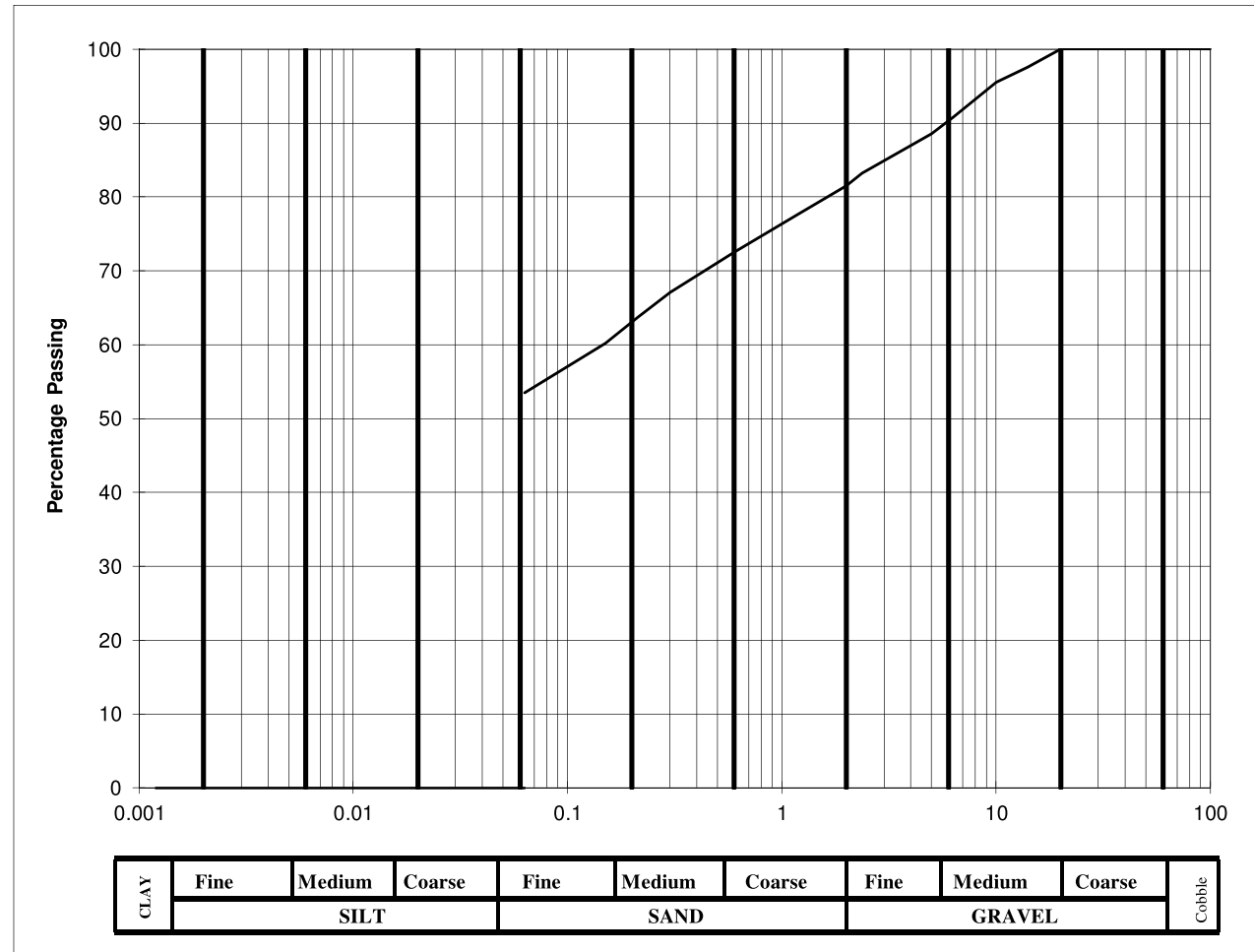
Lab. No :	17/1259
Sample No :	IS42

Hole ID :	BH 02
Depth, m :	4.20

Material description :	slightly gravelly slightly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	100		
14	97.6		
10	95.5		
6.3	90.8		
5.0	88.6		
2.36	83.2		
2.00	81.5		
1.18	77.6		
0.600	72.5		
0.425	69.8		
0.300	67.1		
0.212	63.7		
0.150	60.2		
0.063	54		

Cobbles, %	0
Gravel, %	19
Sand, %	28
Clay / Silt, %	54



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

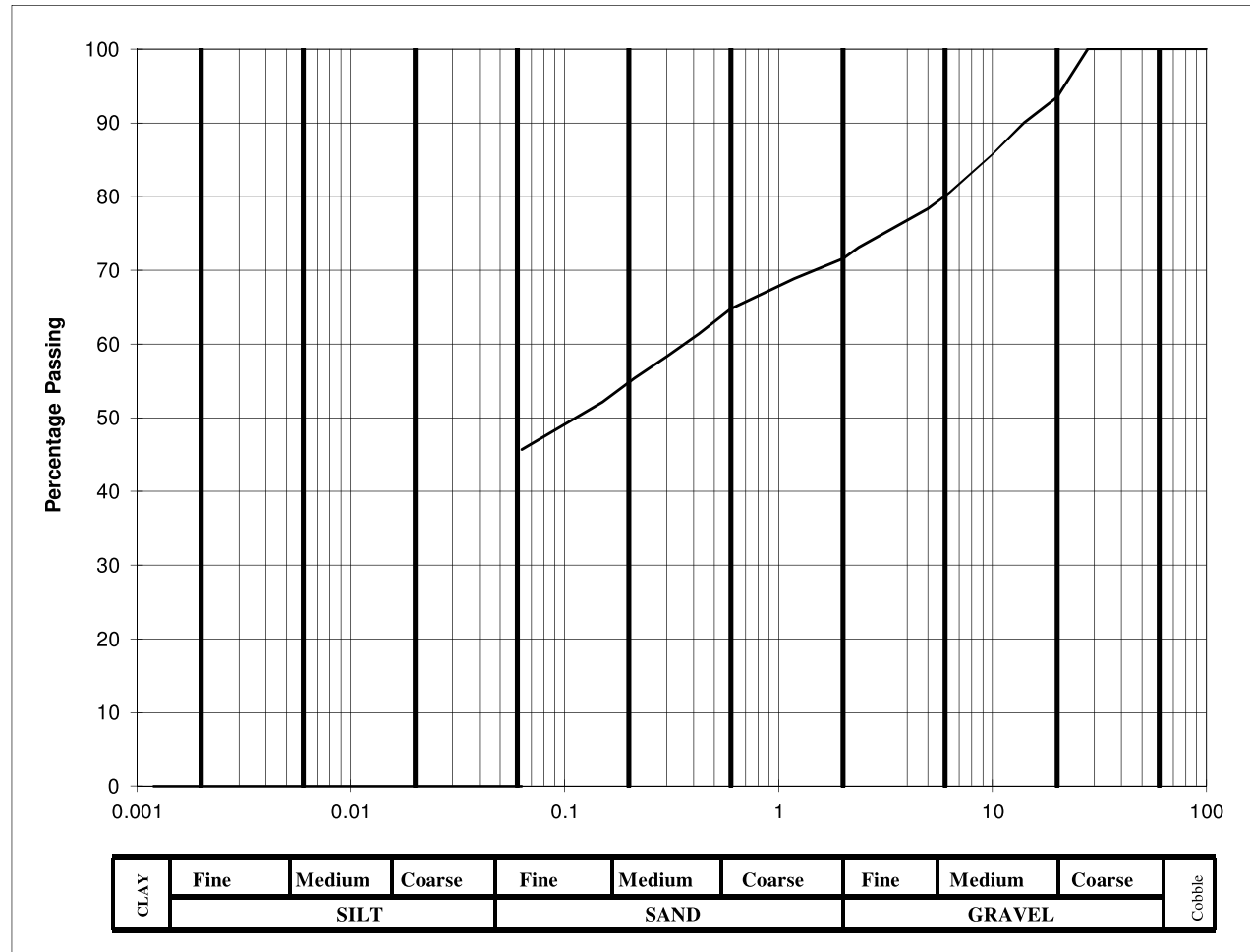
Lab. No :	17/1261
Sample No :	IS33

Hole ID :	BH 03
Depth, m :	5.20

Material description :	slightly gravelly slightly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	93.5		
14	90		
10	85.8		
6.3	80.5		
5.0	78.4		
2.36	73.1		
2.00	71.6		
1.18	68.9		
0.600	64.8		
0.425	61.4		
0.300	58.3		
0.212	55.4		
0.150	52.1		
0.063	46		

Cobbles, %	0
Gravel, %	28
Sand, %	26
Clay / Silt, %	46



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

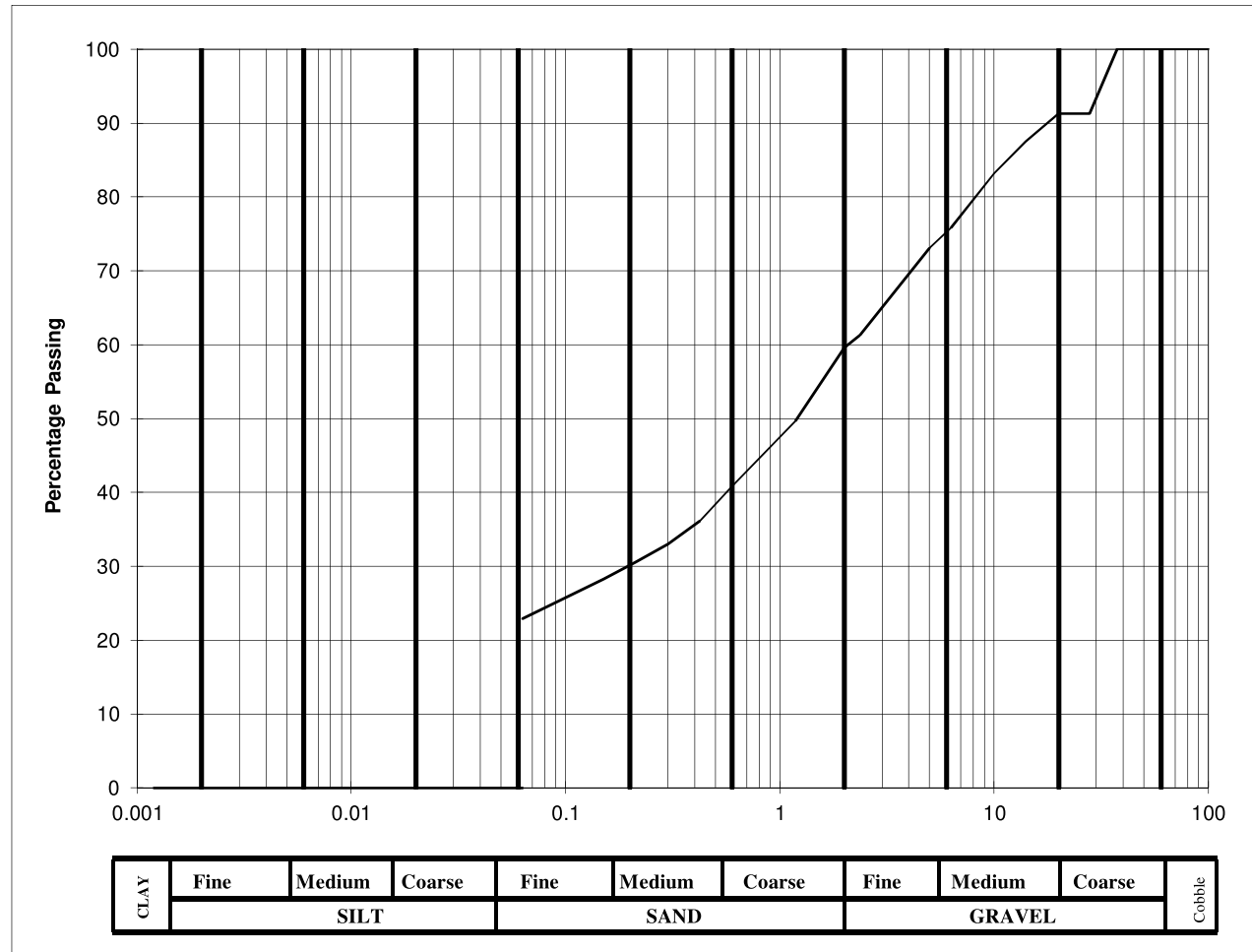
Lab. No :	17/1262
Sample No :	IS25

Hole ID :	BH 04
Depth, m :	1.20

Material description :	slightly sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	91.3		
20	91.3		
14	87.5		
10	83.2		
6.3	75.8		
5.0	73.1		
2.36	61.3		
2.00	59.6		
1.18	49.7		
0.600	40.8		
0.425	36.2		
0.300	33		
0.212	30.6		
0.150	28.3		
0.063	23		

Cobbles, %	0
Gravel, %	40
Sand, %	37
Clay / Silt, %	23



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

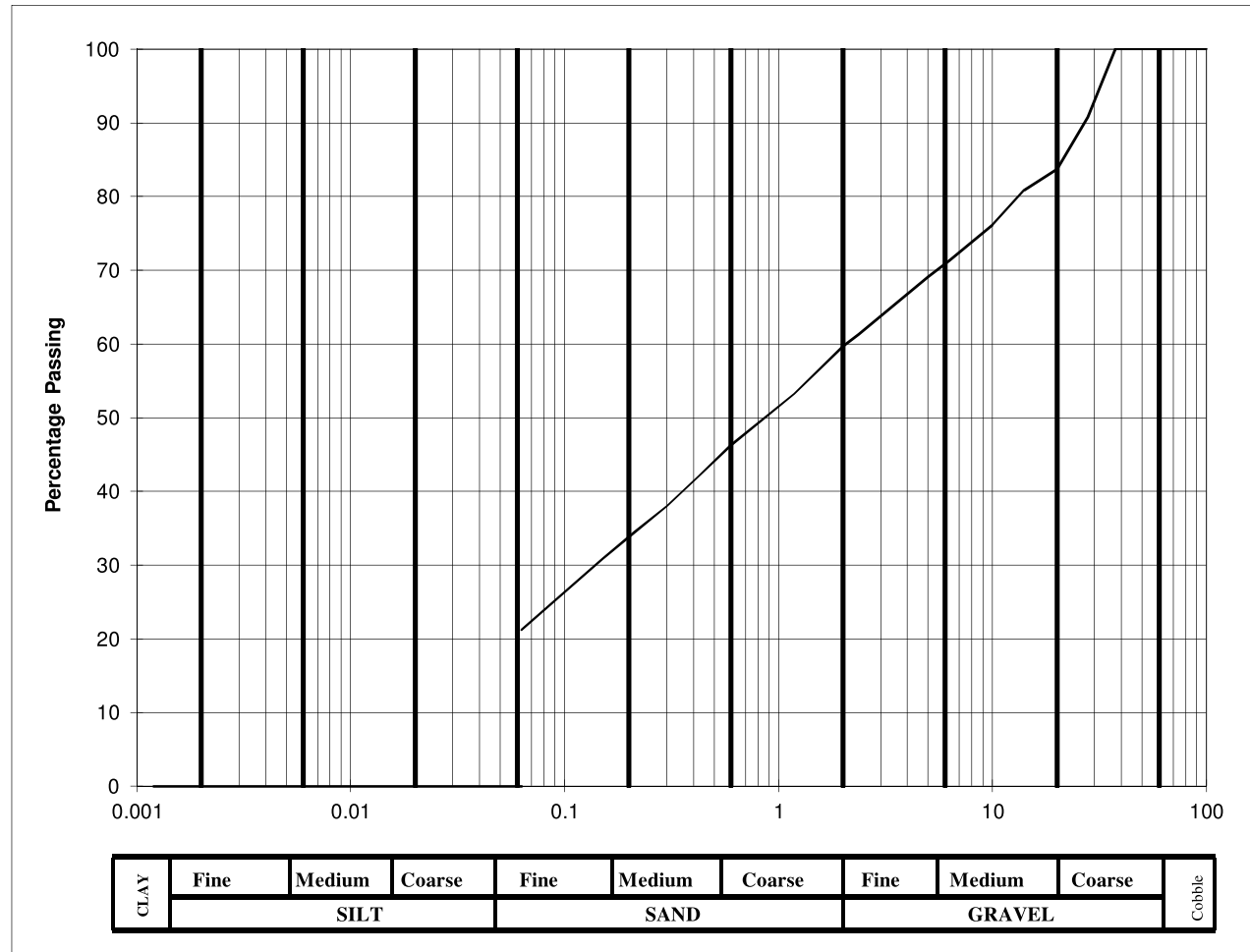
Lab. No :	17/1263
Sample No :	IS22

Hole ID :	BH 06
Depth, m :	1.20

Material description :	sandy gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	90.8		
20	83.7		
14	80.8		
10	76.2		
6.3	71.3		
5.0	69.1		
2.36	61.3		
2.00	59.7		
1.18	53.2		
0.600	46.3		
0.425	42.1		
0.300	38		
0.212	34.5		
0.150	30.8		
0.063	21		

Cobbles, %	0
Gravel, %	40
Sand, %	39
Clay / Silt, %	21



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

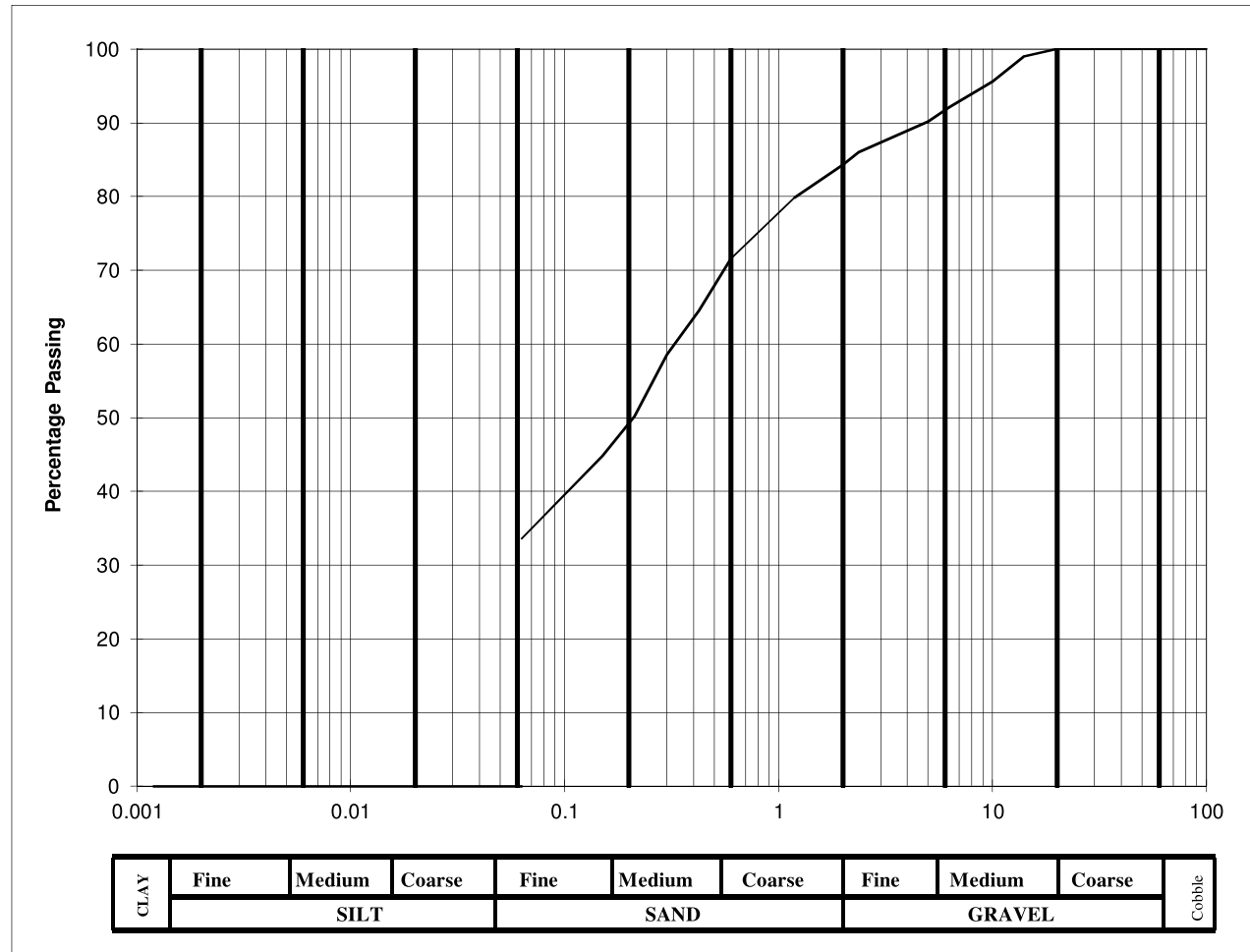
Lab. No :	17/1265
Sample No :	IS19

Hole ID :	BH 07
Depth, m :	1.20

Material description :	sandy gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	95.6		
6.3	92.1		
5.0	90.2		
2.36	86		
2.00	84.3		
1.18	79.8		
0.600	71.6		
0.425	64.5		
0.300	58.6		
0.212	50.2		
0.150	44.8		
0.063	34		

Cobbles, %	0
Gravel, %	16
Sand, %	50
Clay / Silt, %	34



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

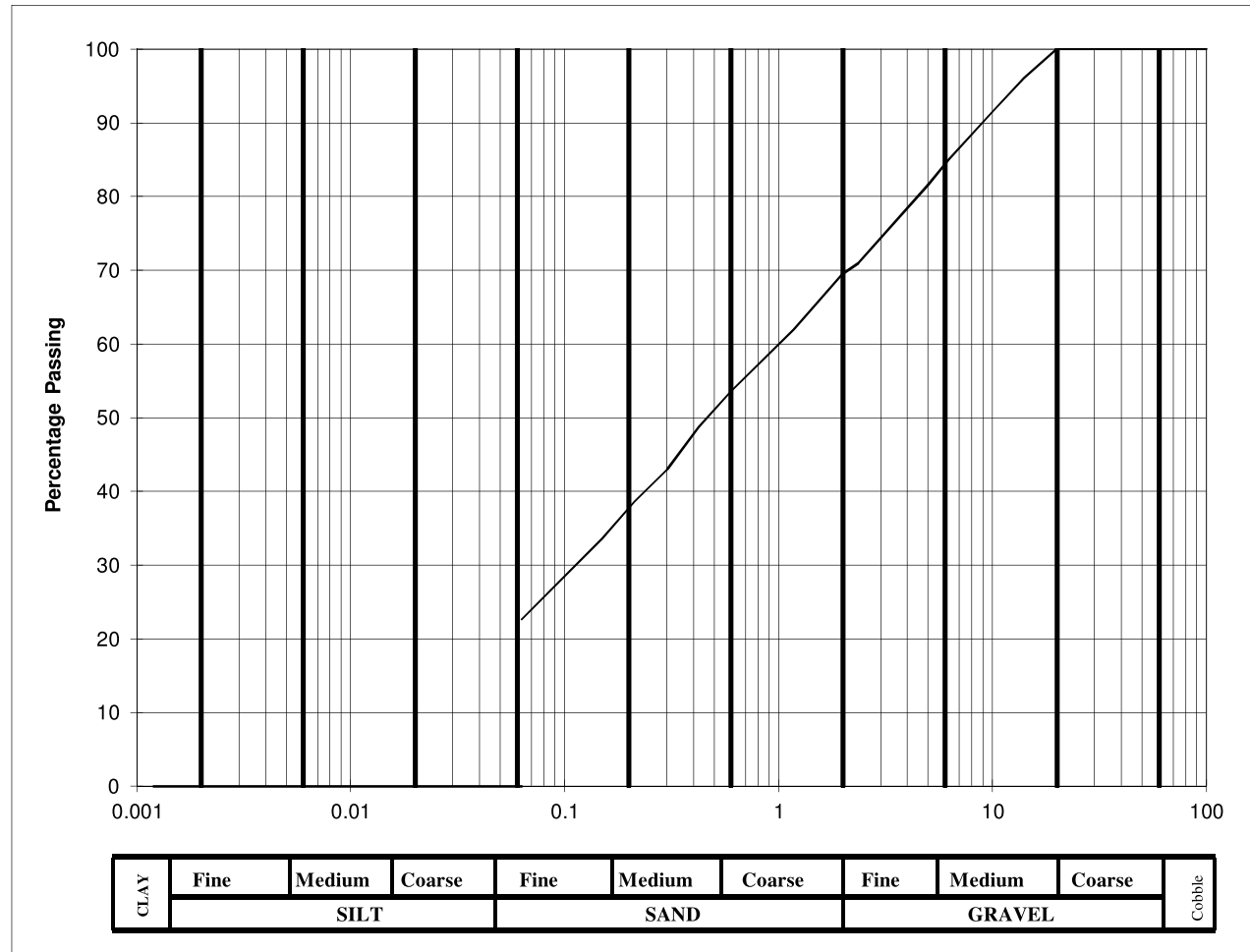
Lab. No :	17/1267
Sample No :	IS17

Hole ID :	BH 08
Depth, m :	3.20

Material description :	slightly gravelly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	100		
14	96		
10	91.5		
6.3	85.1		
5.0	81.6		
2.36	71		
2.00	69.5		
1.18	62		
0.600	53.6		
0.425	48.7		
0.300	43		
0.212	38.6		
0.150	33.6		
0.063	23		

Cobbles, %	0
Gravel, %	31
Sand, %	47
Clay / Silt, %	23



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

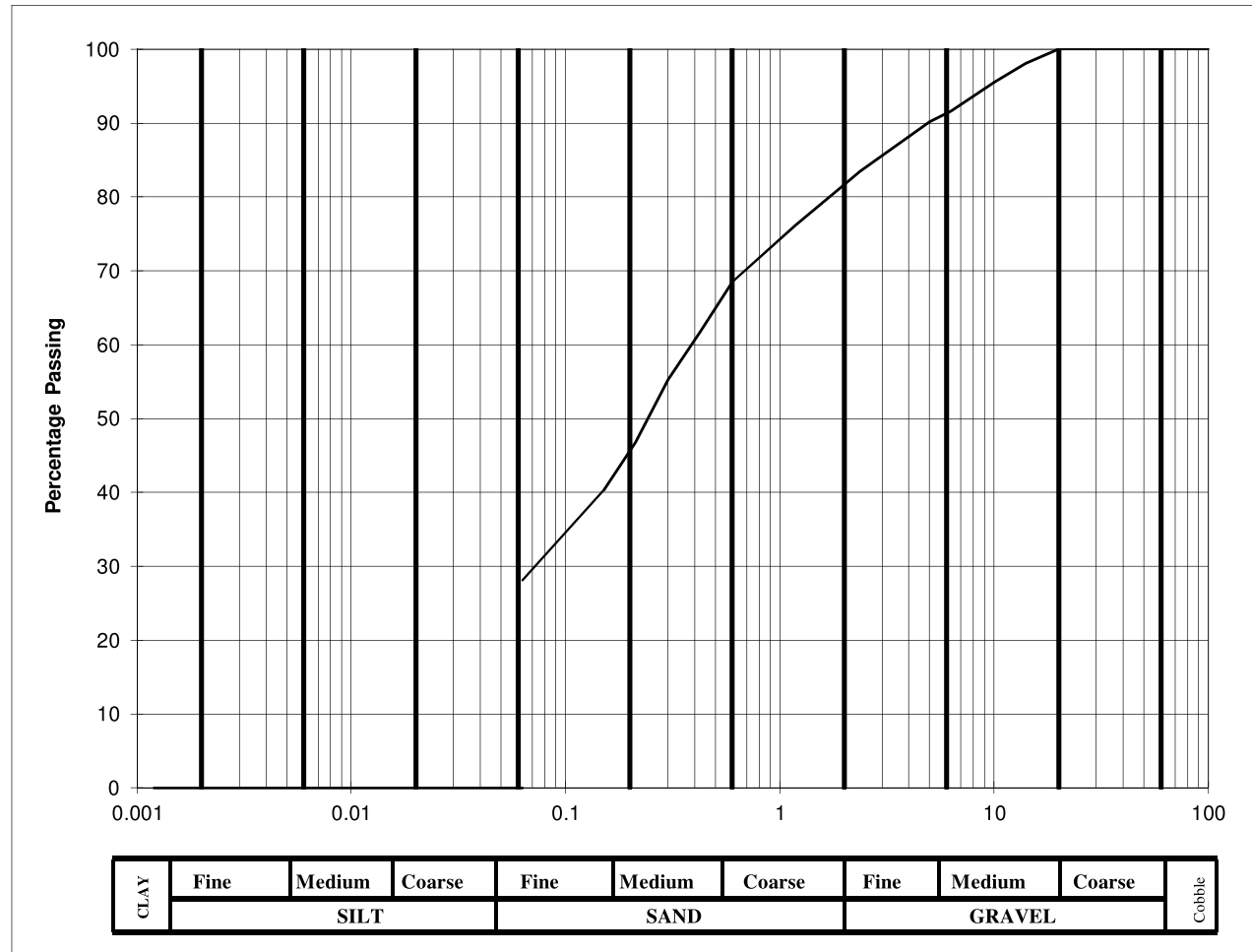
Lab. No :	17/1268
Sample No :	IS02

Hole ID :	BH 10
Depth, m :	1.20

Material description :	slightly gravelly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	100		
14	98.1		
10	95.5		
6.3	91.6		
5.0	90.2		
2.36	83.5		
2.00	81.7		
1.18	76.2		
0.600	68.4		
0.425	61.7		
0.300	55.3		
0.212	46.8		
0.150	40.2		
0.063	28		

Cobbles, %	0
Gravel, %	18
Sand, %	54
Clay / Silt, %	28



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

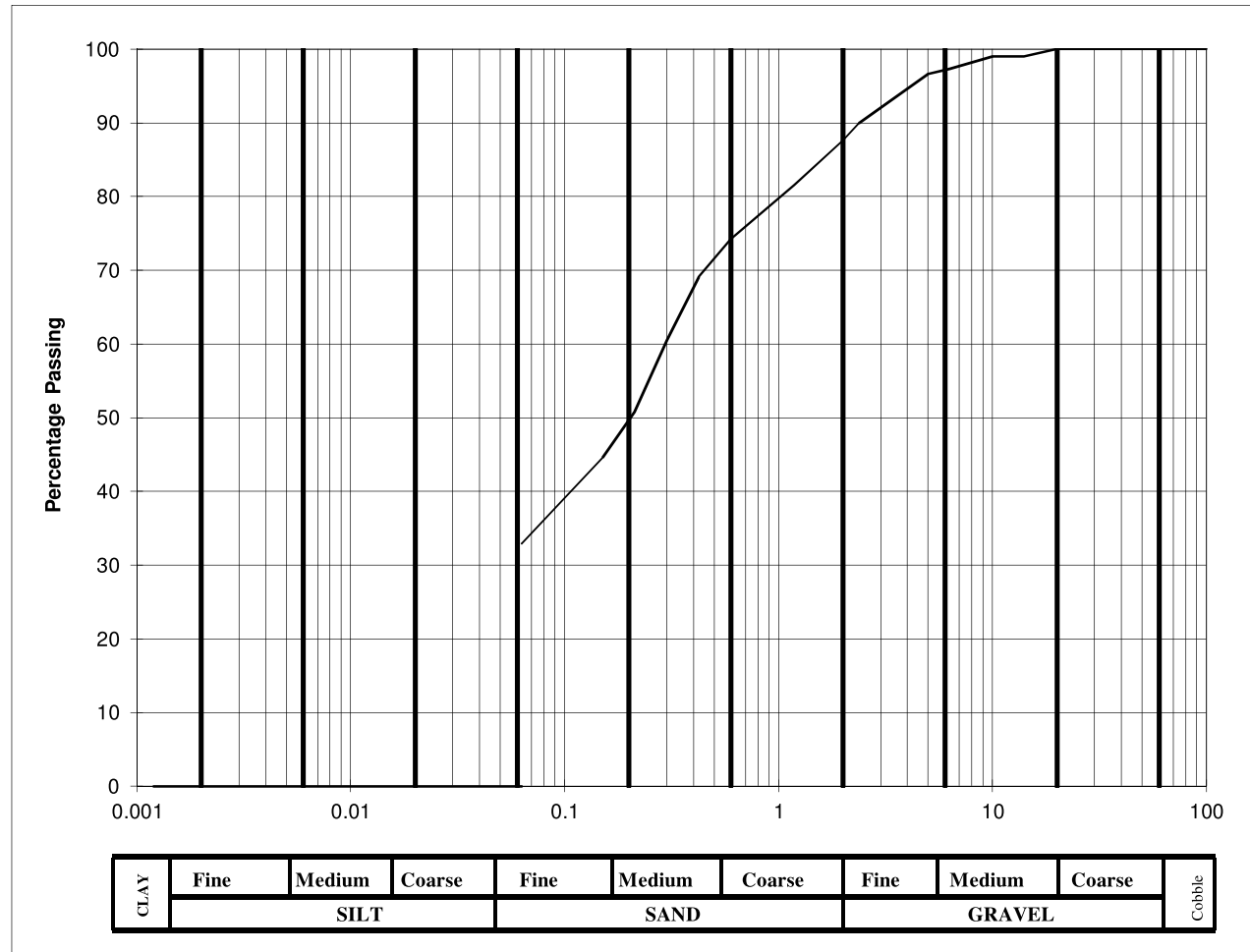
Lab. No :	17/1269
Sample No :	IS05

Hole ID :	BH 10
Depth, m :	4.20

Material description :	slightly gravelly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	99		
6.3	97.3		
5.0	96.6		
2.36	89.9		
2.00	87.6		
1.18	81.5		
0.600	74.2		
0.425	69.1		
0.300	60.5		
0.212	50.8		
0.150	44.6		
0.063	33		

Cobbles, %	0
Gravel, %	12
Sand, %	55
Clay / Silt, %	33



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

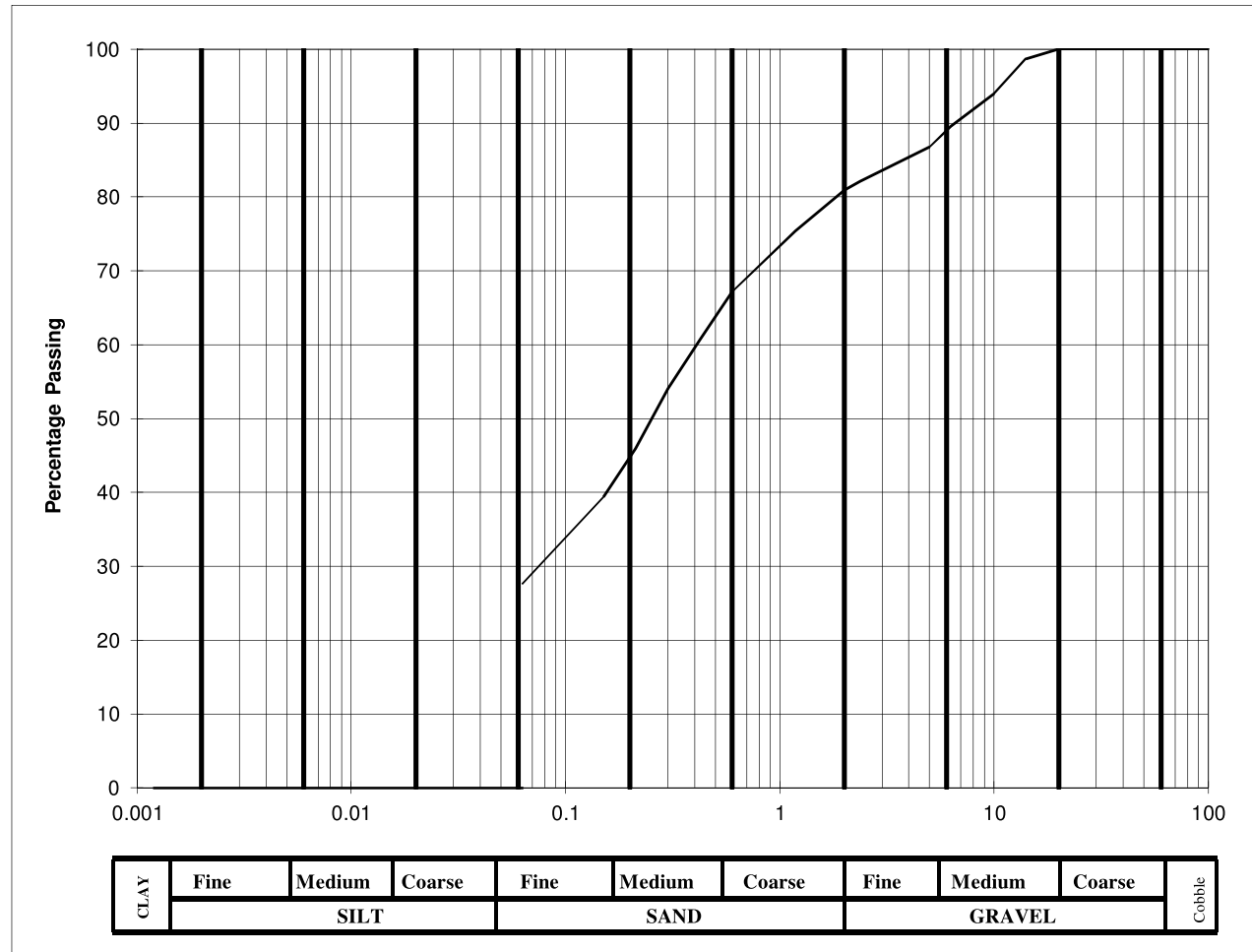
Lab. No :	17/1270
Sample No :	IS08

Hole ID :	BH 10
Depth, m :	8.00

Material description :	slightly gravelly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	100		
14	98.7		
10	94		
6.3	89.6		
5.0	86.8		
2.36	82.1		
2.00	80.9		
1.18	75.4		
0.600	67.2		
0.425	60.7		
0.300	54.1		
0.212	45.9		
0.150	39.4		
0.063	28		

Cobbles, %	0
Gravel, %	19
Sand, %	53
Clay / Silt, %	28



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

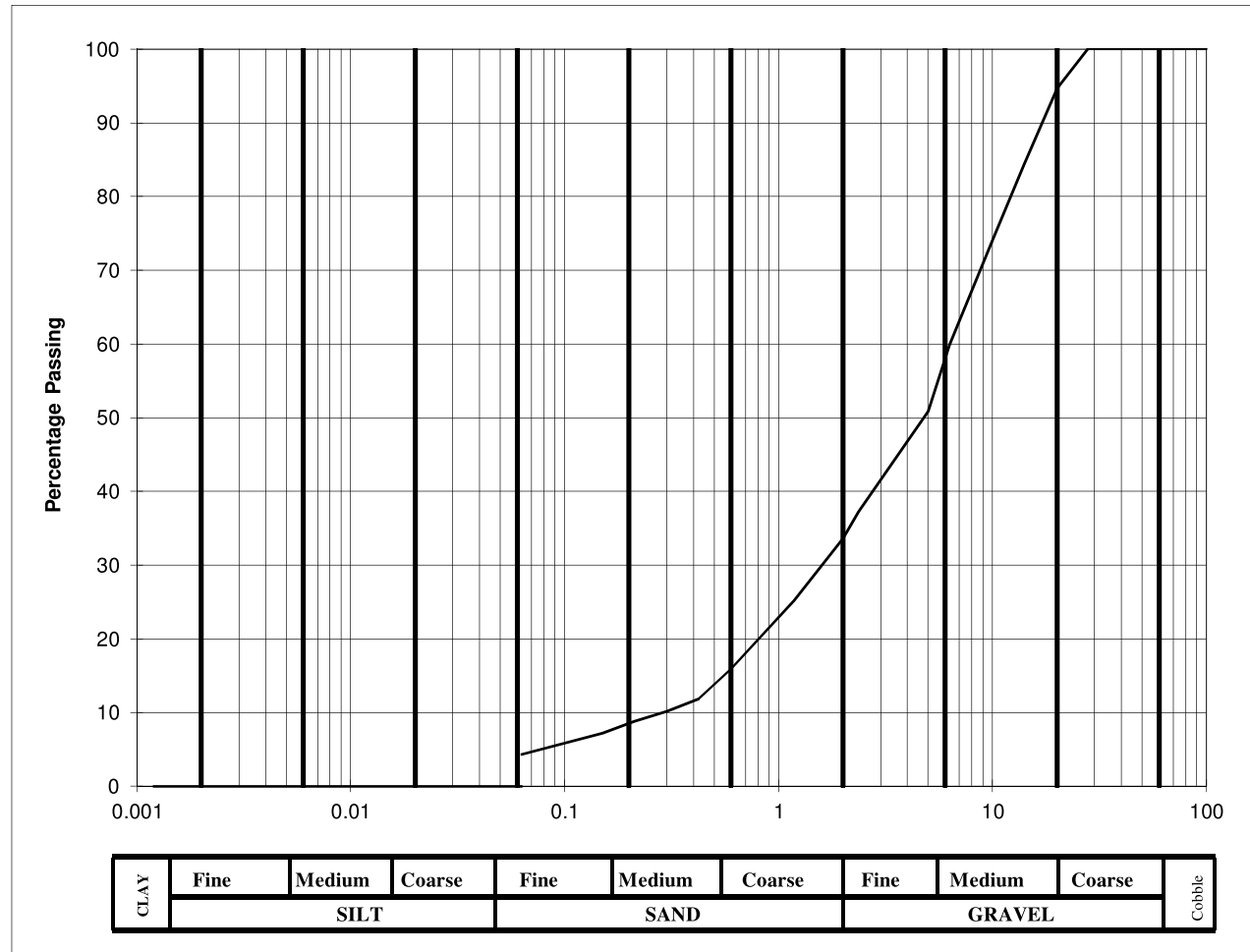
Lab. No :	17/1184
Sample No :	PM03

Hole ID :	TP 01
Depth, m :	1.50

Material description :	slightly gravelly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	94.7		
14	84.3		
10	74.1		
6.3	59.9		
5.0	50.9		
2.36	37.3		
2.00	33.6		
1.18	25.2		
0.600	15.9		
0.425	11.9		
0.300	10.2		
0.212	8.8		
0.150	7.2		
0.063	4		

Cobbles, %	0
Gravel, %	66
Sand, %	30
Clay / Silt, %	4



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

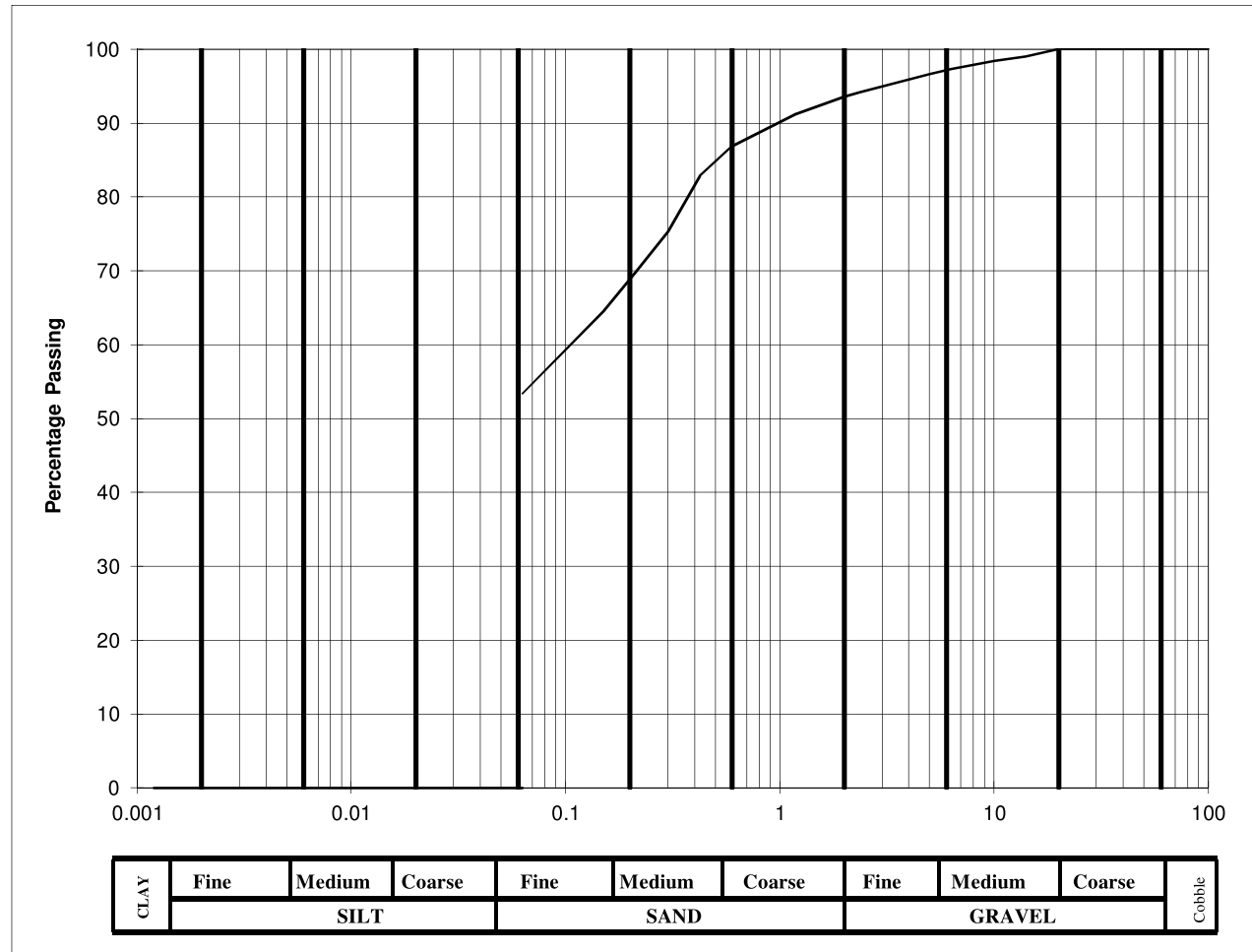
Lab. No :	17/1186
Sample No :	PM08

Hole ID :	TP 02
Depth, m :	2.00

Material description :	slightly silty very sandy GRAVEL
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	98.4		
6.3	97.3		
5.0	96.6		
2.36	94.2		
2.00	93.6		
1.18	91.2		
0.600	86.9		
0.425	82.9		
0.300	75.3		
0.212	69.8		
0.150	64.5		
0.063	53		

Cobbles, %	0
Gravel, %	6
Sand, %	41
Clay / Silt, %	53



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

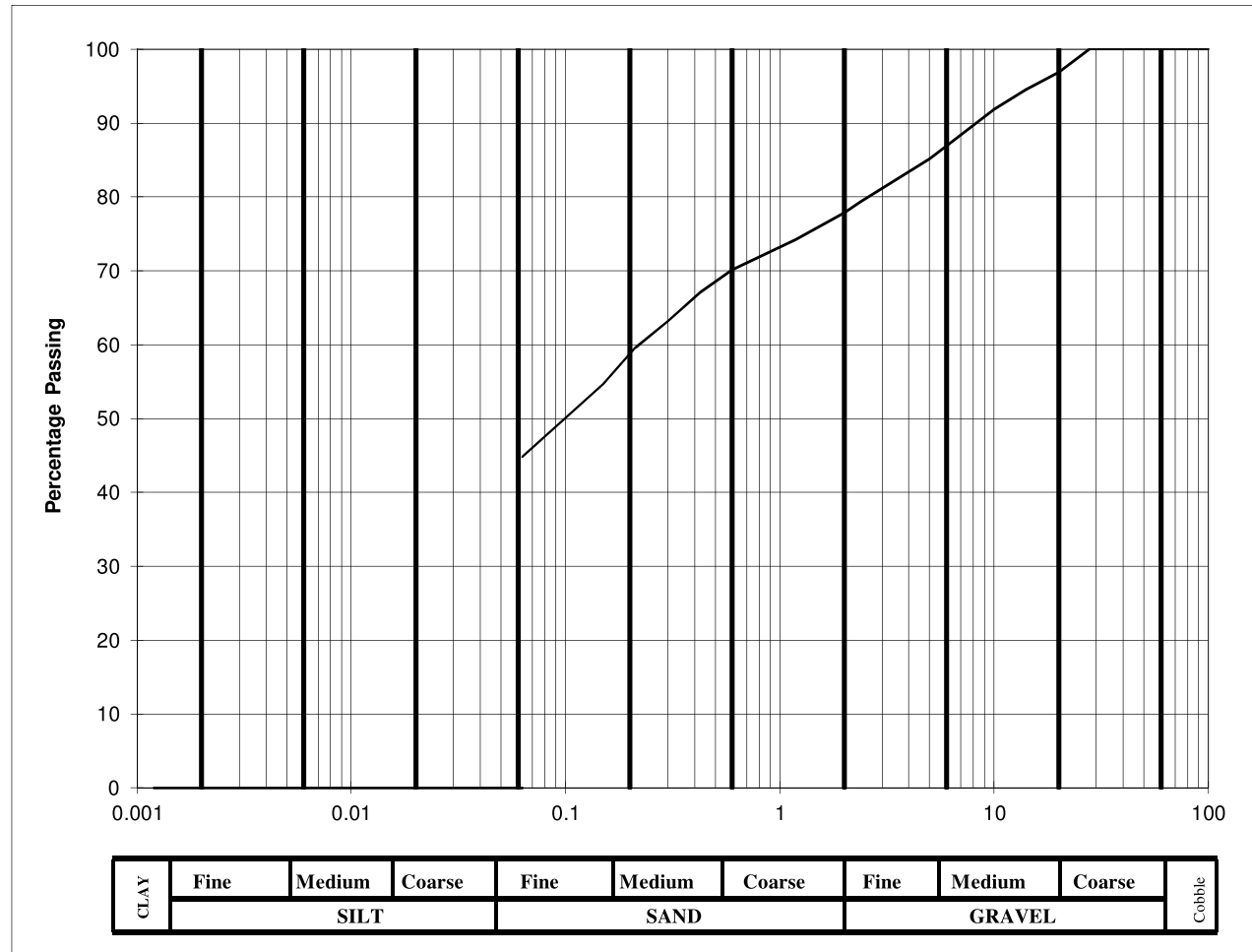
Lab. No :	17/1188
Sample No :	MK25

Hole ID :	TP 03
Depth, m :	2.00

Material description :	slightly gravelly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	96.9		
14	94.5		
10	91.9		
6.3	87.4		
5.0	85.2		
2.36	79.3		
2.00	77.9		
1.18	74.2		
0.600	70.1		
0.425	67.1		
0.300	63.2		
0.212	59.6		
0.150	54.7		
0.063	45		

Cobbles, %	0
Gravel, %	22
Sand, %	33
Clay / Silt, %	45



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

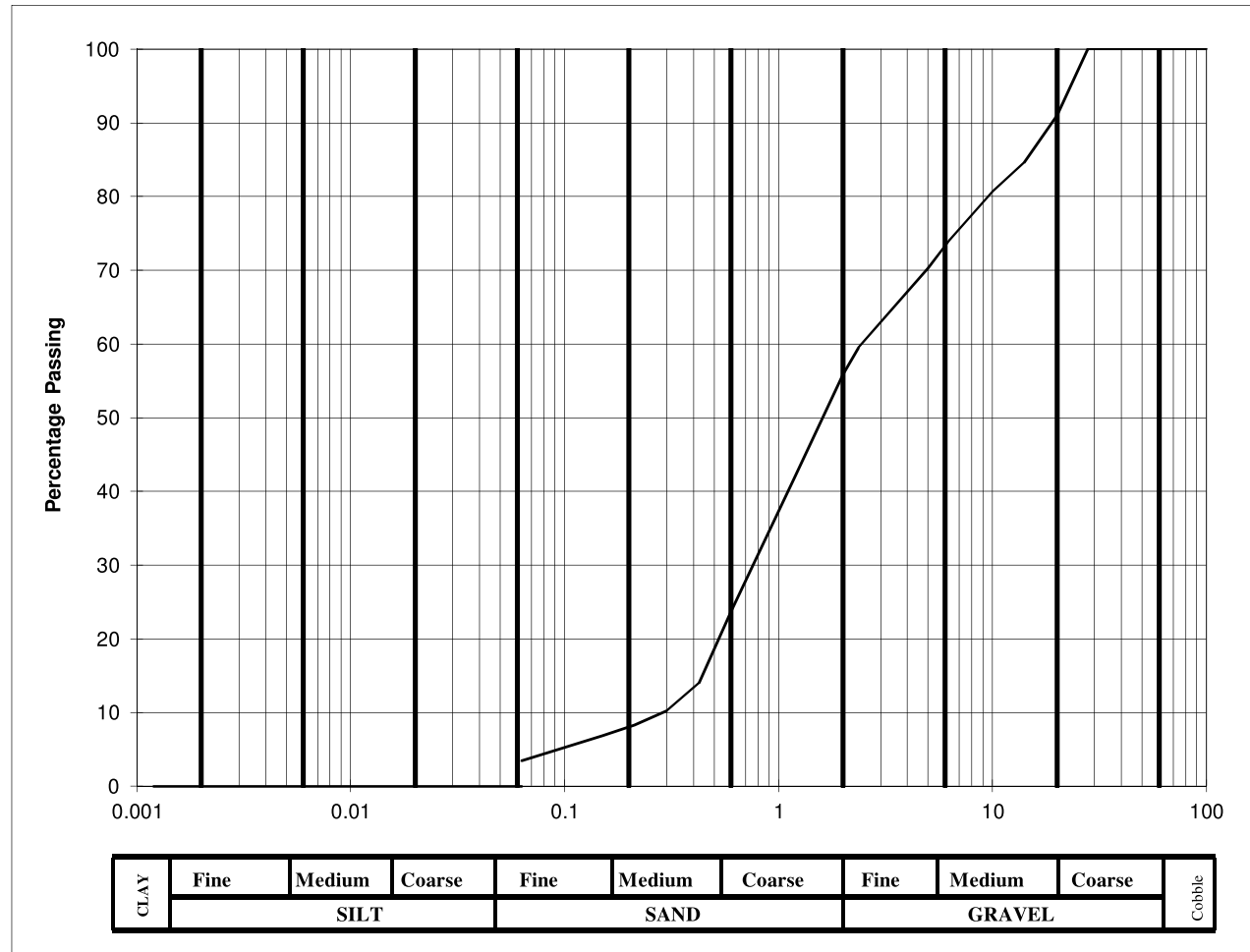
Lab. No :	17/1193
Sample No :	MK06

Hole ID :	TP 07
Depth, m :	1.00

Material description :	slightly gravelly slightly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	91		
14	84.6		
10	80.7		
6.3	74		
5.0	70.3		
2.36	59.5		
2.00	55.9		
1.18	41.8		
0.600	23.7		
0.425	14		
0.300	10.3		
0.212	8.3		
0.150	6.9		
0.063	4		

Cobbles, %	0
Gravel, %	44
Sand, %	52
Clay / Silt, %	4



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

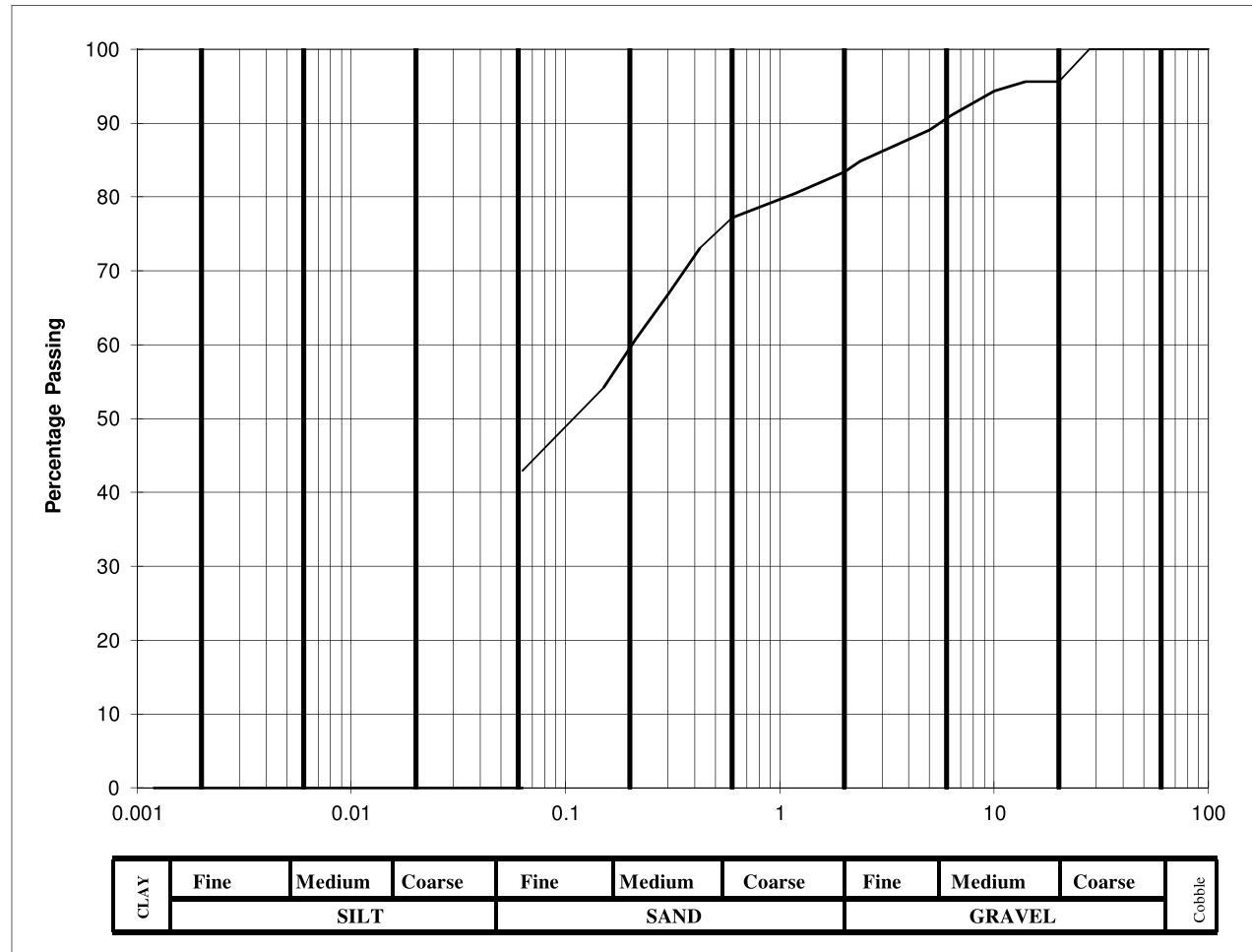
Lab. No :	17/1195
Sample No :	MK09

Hole ID :	TP 08
Depth, m :	2.80

Material description :	slightly silty very gravelly SAND
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	95.6		
14	95.6		
10	94.3		
6.3	91		
5.0	89.1		
2.36	84.8		
2.00	83.4		
1.18	80.5		
0.600	77.2		
0.425	73.1		
0.300	66.8		
0.212	60.7		
0.150	54.2		
0.063	43		

Cobbles, %	0
Gravel, %	17
Sand, %	40
Clay / Silt, %	43



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

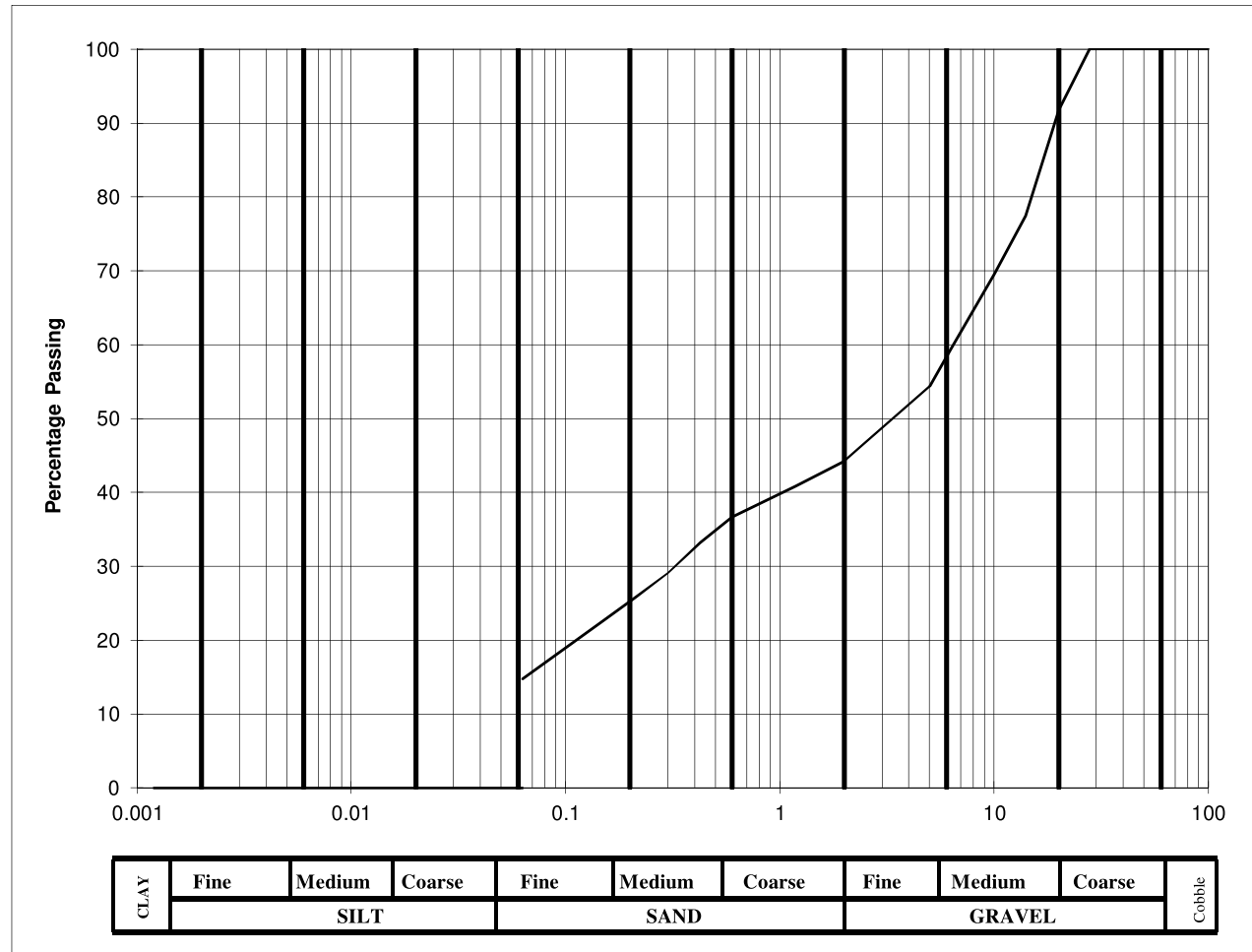
Lab. No :	17/1196
Sample No :	MK13

Hole ID :	TP 09
Depth, m :	1.00

Material description :	slightly gravelly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	91.8		
14	77.4		
10	69.5		
6.3	59.4		
5.0	54.3		
2.36	46.1		
2.00	44.2		
1.18	40.8		
0.600	36.7		
0.425	33.2		
0.300	29.1		
0.212	25.8		
0.150	22.7		
0.063	15		

Cobbles, %	0
Gravel, %	56
Sand, %	29
Clay / Silt, %	15



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

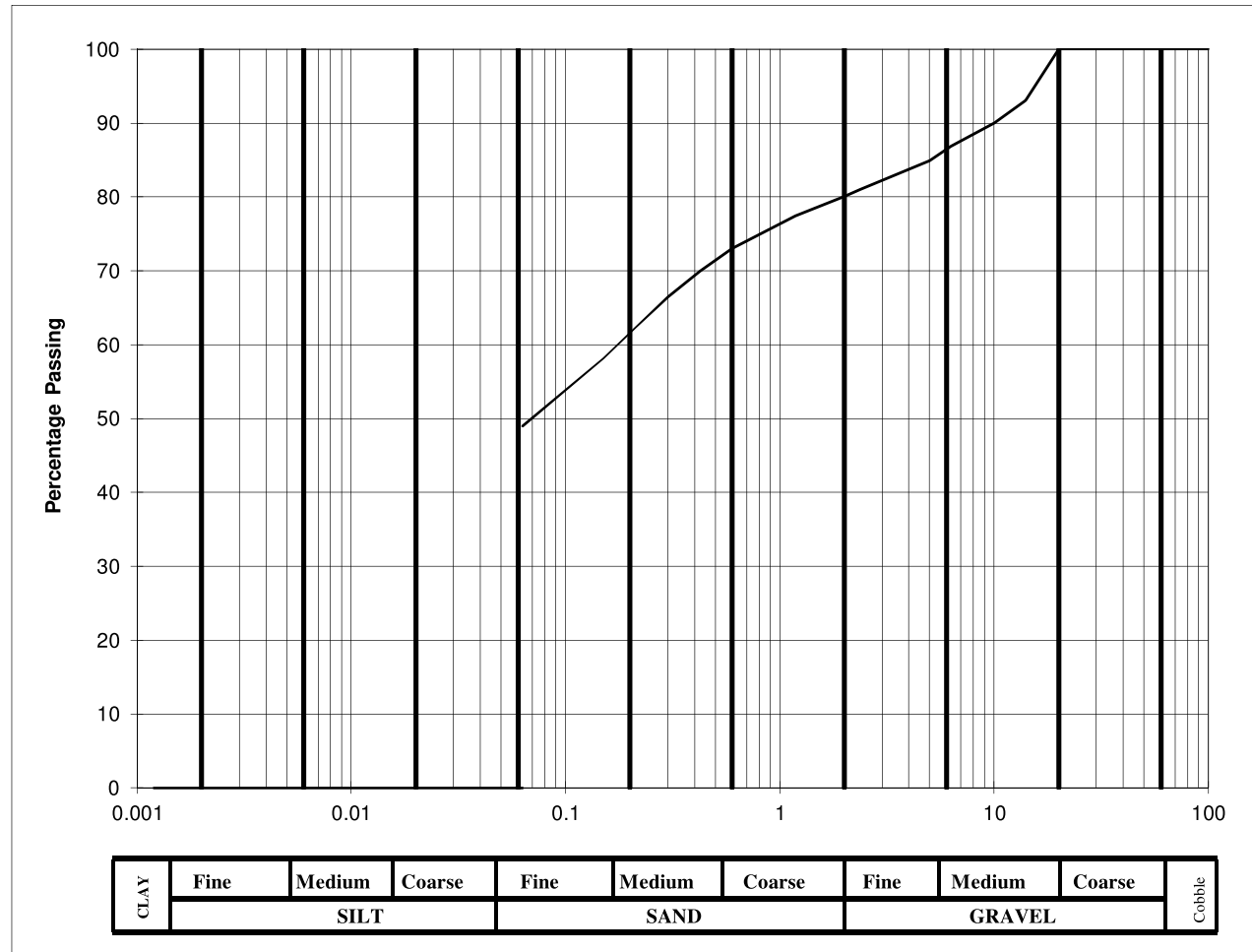
Lab. No :	17/1198
Sample No :	MK15

Hole ID :	TP 09
Depth, m :	2.50

Material description :	silty very sandy GRAVEL
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	100		
14	93.1		
10	90		
6.3	86.9		
5.0	84.9		
2.36	81		
2.00	80.1		
1.18	77.4		
0.600	73		
0.425	70		
0.300	66.5		
0.212	62.3		
0.150	58.2		
0.063	49		

Cobbles, %	0
Gravel, %	20
Sand, %	31
Clay / Silt, %	49



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

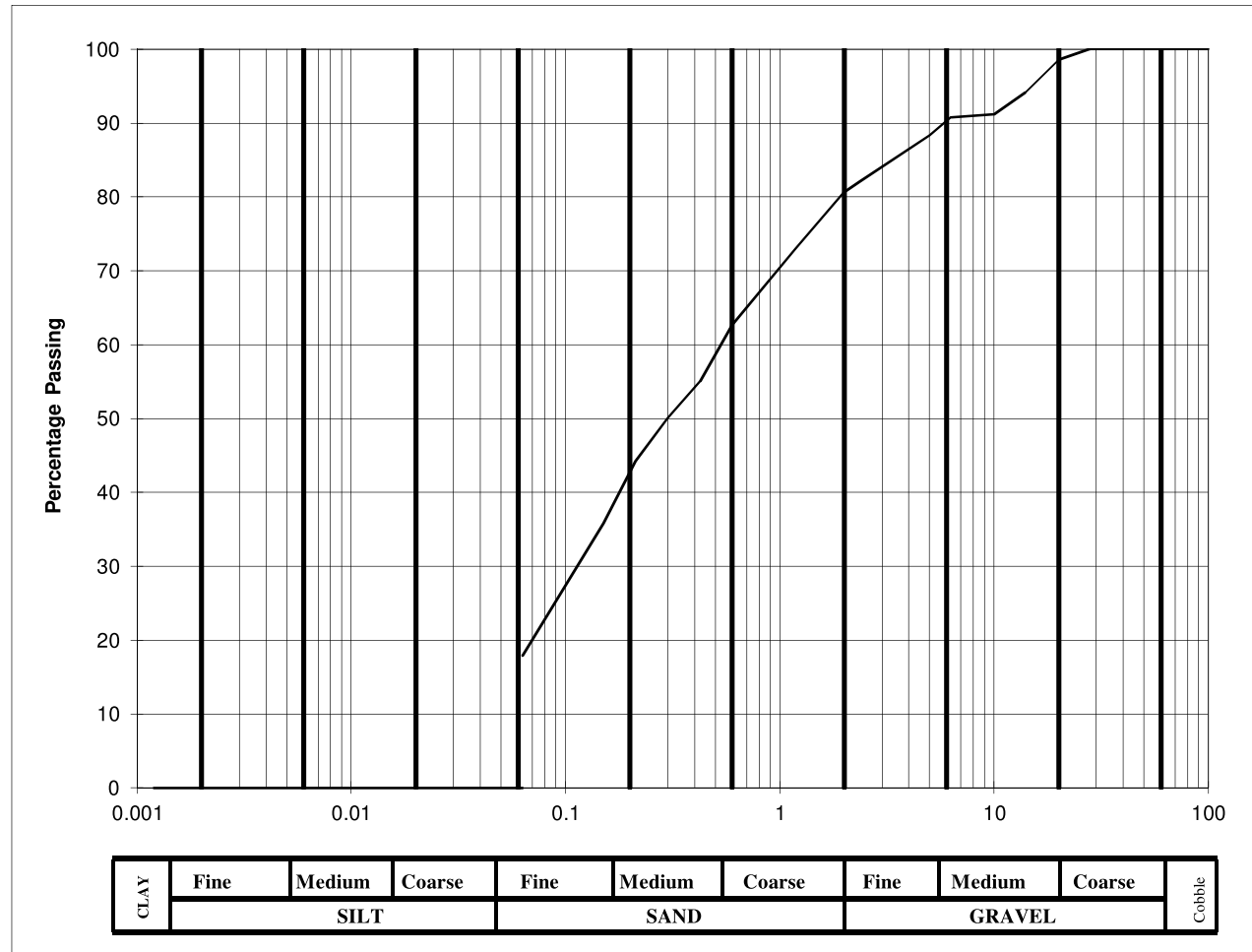
Lab. No :	17/1201
Sample No :	PM24

Hole ID :	TP 11
Depth, m :	1.00

Material description :	slightly gravelly slightly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	98.6		
14	94.2		
10	91.2		
6.3	90.8		
5.0	88.3		
2.36	82.1		
2.00	80.7		
1.18	72.9		
0.600	62.7		
0.425	55		
0.300	50.1		
0.212	44.2		
0.150	35.8		
0.063	18		

Cobbles, %	0
Gravel, %	19
Sand, %	63
Clay / Silt, %	18



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

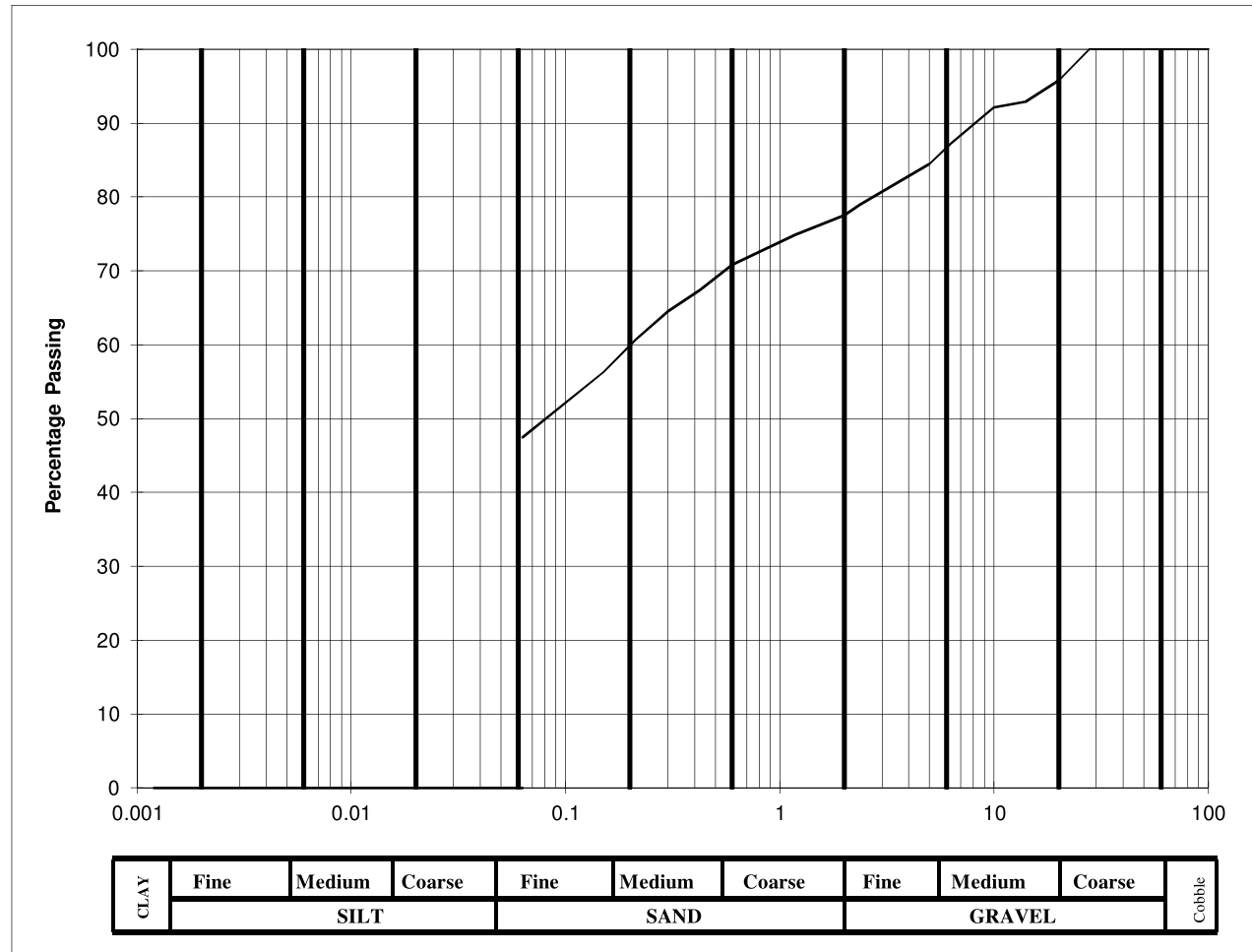
Lab. No :	17/1205
Sample No :	PM14

Hole ID :	TP 14
Depth, m :	1.00

Material description :	slightly gravelly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	0.0630	
90	100	0.0200	
75	100	0.0060	
63	100	0.0020	
50	100		
37.5	100		
28	100		
20	95.8		
14	92.9		
10	92.1		
6.3	87.2		
5.0	84.5		
2.36	79		
2.00	77.5		
1.18	74.9		
0.600	70.8		
0.425	67.4		
0.300	64.5		
0.212	60.6		
0.150	56.3		
0.063	48		

Cobbles, %	0
Gravel, %	23
Sand, %	30
Clay / Silt, %	48



Client :	Columbia Estates Management (IE) Ltd.
Project :	Magee Barracks

Lab. No :	17/1208
Sample No :	PM29

Hole ID :	TP 16
Depth, m :	1.00

Material description :	slightly gravelly slightly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

California Bearing Ratio (CBR) In accordance with BS1377: Part 4: Method 7

Client	Columbia Estates Management (IE) Ltd.
Site	Magee Barracks, Kildare Town
S.I. File No	5362 / 17
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email info@siteinvestigations.ie
Report Date	14th March 2017

CBR No	Depth (mBGL)	Sample No	Sample Type	Lab Ref	Moisture Content (%)	CBR Value (%)	Location / Remarks
TP01	1.00	PM02	CBR	17/1183	24.2	2.4	Brown slightly gravelly slightly sandy silty CLAY
TP02	1.50	PM06	CBR	17/1185	17.9	8.8	Grey silty sandy GRAVEL
TP03	1.00	MK24	CBR	17/1187	25.0	4.7	Black slightly gravelly slightly sandy silty CLAY
TP04	1.00	MK20	CBR	17/1189	6.8	7.4	Grey silty sandy GRAVEL
TP05	1.60	MK18	CBR	17/1190	16.6	3.7	Brown slightly gravelly slightly sandy silty CLAY
TP06	1.00	MK10	CBR	17/1191	9.5	8.2	Grey silty sandy GRAVEL
TP07	1.00	MK02	CBR	17/1192	14.3	2.6	Brown/grey slightly gravelly slightly sandy silty CLAY
TP08	1.00	MK07	CBR	17/1194	17.5	3.3	Brown/grey slightly gravelly slightly sandy silty CLAY
TP09	1.50	MK14	CBR	17/1197	21.1	4.3	Brown/grey slightly gravelly slightly sandy silty CLAY
TP10	1.00	PM10	CBR	17/1199	11.7	5.3	Brown/grey slightly gravelly slightly sandy silty CLAY
TP11	1.00	PM23	CBR	17/1200	17.1	4.2	Brown slightly gravelly slightly sandy silty CLAY
TP12	1.00	PM19	CBR	17/1202	12.7	3.9	Brown slightly gravelly slightly sandy silty CLAY
TP13	1.00	PM16	CBR	17/1203	17.1	3.3	Brown slightly gravelly slightly sandy silty CLAY
TP14	1.00	PM13	CBR	17/1204	19.9	3.1	Brown slightly gravelly sandy silty CLAY
TP15	1.00	PM31	CBR	17/1206	20.2	5.2	Brown/grey slightly gravelly slightly sandy silty CLAY
TP16	1.00	PM28	CBR	17/1207	11.9	4.9	Brown slightly gravelly slightly sandy silty CLAY

Chemical Testing
In accordance with BS 1377: Part 3

Client	Columbia Estates Management (IE) Ltd.
Site	Magee Barracks, Kildare Town
S.I. File No	5362 / 17
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email:info@siteinvestigations.ie
Report Date	13th April 2017

Hole Id	Depth (mBGL)	Sample No	Lab Ref	pH Value	Water Soluble Sulphate Content (2:1 Water-soil extract) (SO ₃) g/L	Water Soluble Sulphate Content (2:1 Water-soil extract) (SO ₃) %	Organic Content %	Chloride ion Content (water:soil ratio 2:1) %	% passing 2mm	Remarks
BH01	0.70	IS43	17/1256	8.13	0.126	0.101			80.3	
BH02	0.50	IS38	17/1258	8.94	0.122	0.097			79.6	
BH03	0.70	IS28	17/1260	8.39	0.117	0.098			83.6	
BH06	1.20	IS22	17/1263	8.75	0.116	0.069			59.6	
BH07	0.70	IS18	17/1264	7.98	0.123	0.095			77.1	
BH08	1.20	IS15	17/1266	8.45	0.127	0.081			63.5	
BH10	1.20	IS02	17/1268	8.58	0.123	0.085			69.5	
TP01	1.00	PM02	17/1183	8.35	0.126	0.093			73.6	
TP03	1.00	MK24	17/1187	7.98	0.129	0.097			75.4	
TP07	1.00	MK03	17/1193	8.02	0.112	0.074			65.9	
TP09	1.00	MK13	17/1196	8.41	0.117	0.098			83.4	
TP11	1.00	PM24	17/1201	7.59	0.115	0.092			80.1	
TP14	1.00	PM14	17/1205	7.86	0.117	0.091			77.5	
TP16	1.00	PM29	17/1208	7.72	0.120	0.093			77.5	



Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenviromental.co.uk

Site Investigations Ltd
The Grange
Carhugar
12th Lock Road
Lucan
Co. Dublin

Attention: Stephen Letch

CERTIFICATE OF ANALYSIS

Date: 06 March 2017
Customer: D_SITEINV_NCS
Sample Delivery Group (SDG): 170221-73
Your Reference: 5362
Location: Magee Barracks
Report No: 399955

We received 6 samples on Tuesday February 21, 2017 and 6 of these samples were scheduled for analysis which was completed on Monday March 06, 2017. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).

Approved By:

Sonia McWhan
Operations Manager





CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
15042417	TP01		0.50	17/02/2017
15042418	TP02		0.50	
15042419	TP07		0.30	
15042420	TP08		0.70	
15042421	TP10		0.50	
15042422	TP16		0.50	

Only received samples which have had analysis scheduled will be shown on the following pages.



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

Soil/Solid (S) Results Legend	Lab Sample No(s)						
	Customer Sample Reference						
	AGS Reference						
	Depth (m)						
	Container						
	15042417	15042418	15042419	15042420	15042421	15042422	
	TP01	TP02	TP07	TP08	TP10	TP16	
	0.50	0.50	0.30	0.70	0.50	0.50	
	250g Amber Jar (ALE21) 1kg TUB	60g VOC (ALE215) 1kg TUB	250g Amber Jar (ALE21) 60g VOC (ALE215) 1kg TUB	250g Amber Jar (ALE21) 60g VOC (ALE215) 1kg TUB	250g Amber Jar (ALE21) 60g VOC (ALE215) 1kg TUB	250g Amber Jar (ALE21) 60g VOC (ALE215) 1kg TUB	
ANC at pH4 and ANC at pH 6	All	NDPs: 0 Tests: 6	X	X	X	X	X
Anions by Kone (w)	All	NDPs: 0 Tests: 6	X	X	X	X	X
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 1	X				
CEN Readings	All	NDPs: 0 Tests: 6	X	X	X	X	X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 6	X	X	X	X	X
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 6	X	X	X	X	X
Fluoride	All	NDPs: 0 Tests: 6	X	X	X	X	X
GRO by GC-FID (S)	All	NDPs: 0 Tests: 6		X	X	X	X
Loss on Ignition in soils	All	NDPs: 0 Tests: 6	X	X	X	X	X
Mercury Dissolved	All	NDPs: 0 Tests: 6	X	X	X	X	X
Mineral Oil	All	NDPs: 0 Tests: 6	X	X	X	X	X
PAH by GCMS	All	NDPs: 0 Tests: 6	X	X	X	X	X
PCBs by GCMS	All	NDPs: 0 Tests: 6	X	X	X	X	X
pH	All	NDPs: 0 Tests: 6	X	X	X	X	X
Phenols by HPLC (W)	All	NDPs: 0 Tests: 6	X	X	X	X	X



CERTIFICATE OF ANALYSIS

Validated

 SDG: 170221-73
 Location: Magee Barracks

 Client Reference: 5362
 Order Number: 21/A/17

 Report Number: 399955
 Superseded Report:

Soil/Solid (S)	Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container						
Results Legend <div style="display: flex; flex-direction: column; gap: 5px;"> <div style="display: flex; align-items: center;"> <div style="width: 15px; height: 15px; background-color: yellow; border: 1px solid black; margin-right: 5px;"></div> Test </div> <div style="display: flex; align-items: center;"> <div style="width: 15px; height: 15px; background-color: red; color: white; border: 1px solid black; margin-right: 5px;"></div> No Determination Possible </div> </div>	15042422	TP16		0.50	60g VOC (ALE215) 250g Amber Jar (ALE21) 1kg TUB						
	15042421	TP10		0.50	60g VOC (ALE215) 250g Amber Jar (ALE21) 1kg TUB						
	15042420	TP08		0.70	60g VOC (ALE215) 250g Amber Jar (ALE21) 1kg TUB						
	15042419	TP07		0.30	60g VOC (ALE215) 250g Amber Jar (ALE21) 1kg TUB						
	15042418	TP02		0.50	60g VOC (ALE215) 250g Amber Jar (ALE21) 1kg TUB						
	15042417	TP01		0.50	60g VOC (ALE215) 250g Amber Jar (ALE21) 1kg TUB						
Sample description	All	NDPs: 0 Tests: 6			<table style="width: 100%; text-align: center;"> <tr> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> </tr> </table>	X	X	X	X	X	X
X	X	X	X	X	X						
Total Dissolved Solids	All	NDPs: 0 Tests: 6			<table style="width: 100%; text-align: center;"> <tr> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> </tr> </table>	X	X	X	X	X	X
X	X	X	X	X	X						
Total Organic Carbon	All	NDPs: 0 Tests: 6			<table style="width: 100%; text-align: center;"> <tr> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> <td style="width: 15%;">X</td> </tr> </table>	X	X	X	X	X	X
X	X	X	X	X	X						



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm
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Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
15042417	TP01	0.50	Dark Brown	Sandy Loam	0.063 - 2.00 mm	Glass	Crushed Brick
15042418	TP02	0.50	Dark Brown	Sand	0.063 - 2.00 mm	Stones	Vegetation
15042419	TP07	0.30	Dark Brown	Sand	0.063 - 2.00 mm	Stones	Vegetation
15042420	TP08	0.70	Dark Brown	Sandy Clay Loam	0.063 - 2.00 mm	Stones	Vegetation
15042421	TP10	0.50	Light Brown	Clay Loam	0.002 - 0.063 mm	Stones	Vegetation
15042422	TP16	0.50	Light Brown	Loamy Sand	0.063 - 2.00 mm	Stones	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.



CERTIFICATE OF ANALYSIS

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

Results Legend			Customer Sample Ref.	TP01	TP02	TP07	TP08	TP10	TP16	
#	ISO17025 accredited.		Depth (m) 0.50 Sample Type Soil/Solid (S) Date Sampled 17/02/2017 Sample Time - Date Received 21/02/2017 SDG Ref 170221-73 Lab Sample No.(s) 15042417 AGS Reference 15042418	0.50	0.50	0.30	0.70	0.50	0.50	
M	mCERTS accredited.			Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
aq	Aqueous / settled sample.			-	-	-	-	-	-	-
diss.filt	Dissolved / filtered sample.			-	-	-	-	-	-	-
tot.unfilt	Total / unfiltered sample.			-	-	-	-	-	-	-
*	Subcontracted test.			-	-	-	-	-	-	-
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery			-	-	-	-	-	-	-
(F)	Trigger breach confirmed			-	-	-	-	-	-	-
1-5&+\$\$@	Sample deviation (see appendix)			-	-	-	-	-	-	-
Component	LOD/Units	Method		Method						
Moisture Content Ratio (% of as received sample)	%	PM024		14	20	10	15	19	10	
Loss on ignition	<0.7 %	TM018	4.86 M	18 \$ M	2.68 \$ M	9.5 \$ M	4.46 \$ M	1.63 \$ M		
Mineral oil >C10-C40	<1 mg/kg	TM061	27.1	70.9	2.24	47.5	224	4.72		
Mineral Oil Surrogate % recovery**	%	TM061	98.3	94.8	101	96.6	96.5	103		
Organic Carbon, Total	<0.2 %	TM132	0.676 M	18 \$ M	0.666 \$ M	6.97 \$ M	2.13 \$ M	0.349 \$ M		
pH	1 pH Units	TM133	8.55 M	8.09 \$ M	8.73 \$ M	8.39 \$ M	8.2 \$ M	8.86 \$ M		
PCB congener 28	<3 µg/kg	TM168	<3 M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M		
PCB congener 52	<3 µg/kg	TM168	<3 M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M		
PCB congener 101	<3 µg/kg	TM168	<3 M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M		
PCB congener 118	<3 µg/kg	TM168	<3 M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M		
PCB congener 138	<3 µg/kg	TM168	<3 M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M		
PCB congener 153	<3 µg/kg	TM168	<3 M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M		
PCB congener 180	<3 µg/kg	TM168	<3 M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M	<3 \$ M		
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168	<21	<21	<21	<21	<21	<21		
ANC @ pH 4	<0.03 mol/kg	TM182	0.614	2.43	5.29	2.43	0.105	5.87		
ANC @ pH 6	<0.03 mol/kg	TM182	0.122	0.244	0.652	0.242	0.042	0.739		



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

GRO by GC-FID (S)

Results Legend			Customer Sample Ref.	TP01	TP02	TP07	TP08	TP10	TP16
#	ISO17025 accredited.			0.50	0.50	0.30	0.70	0.50	0.50
M	mCERTS accredited.		Depth (m)	0.50	0.50	0.30	0.70	0.50	0.50
aq	Aqueous / settled sample.		Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
diss.filt	Dissolved / filtered sample.		Date Sampled	17/02/2017	-	-	-	-	-
tot.unfilt	Total / unfiltered sample.		Sample Time	-	-	-	-	-	-
*	Subcontracted test.		Date Received	21/02/2017	21/02/2017	21/02/2017	21/02/2017	21/02/2017	21/02/2017
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery		SDG Ref	170221-73	170221-73	170221-73	170221-73	170221-73	170221-73
(F)	Trigger breach confirmed		Lab Sample No.(s)	15042417	15042418	15042419	15042420	15042421	15042422
1-5&*\$@	Sample deviation (see appendix)		AGS Reference						
Component	LOD/Units	Method							
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089	<5	<5	<5	<5	<5	<5	<5
			#	#	#	#	#	#	#
Benzene	<10 µg/kg	TM089	<10	<10	<10	<10	<10	<10	<10
			M	M	M	M	M	M	M
Toluene	<2 µg/kg	TM089	<2	<2	<2	<2	<2	<2	<2
			M	M	M	M	M	M	M
Ethylbenzene	<3 µg/kg	TM089	<3	<3	<3	<3	<3	<3	<3
			M	M	M	M	M	M	M
m,p-Xylene	<6 µg/kg	TM089	<6	<6	<6	<6	<6	<6	<6
			M	M	M	M	M	M	M
o-Xylene	<3 µg/kg	TM089	<3	<3	<3	<3	<3	<3	<3
			M	M	M	M	M	M	M
sum of detected mpo xylene by GC	<9 µg/kg	TM089	<9	<9	<9	<9	<9	<9	<9
			\$	\$	\$	\$	\$	\$	\$
sum of detected BTEX by GC	<24 µg/kg	TM089	<24	<24	<24	<24	<24	<24	<24
			\$	\$	\$	\$	\$	\$	\$



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

PAH by GCMS

Table with columns for Results Legend, Customer Sample Ref., TP01, TP02, TP07, TP08, TP10, TP16, Component, LOD/Units, Method, and numerical results for PAH total 17.



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Received SDG Original Sample Method Number	TP01 0.50 SOLID 17/02/2017 00:00:00 03/03/2017 06:19:31 170221-73 15042417 TM048	6/3/17	Neville Mann	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference	
Mass Sample taken (kg)	0.105
Mass of dry sample (kg)	0.090
Particle Size <4mm	>95%

Site Location	Magee Barracks
Natural Moisture Content (%)	16.3
Dry Matter Content (%)	86

Case	
SDG	170221-73
Lab Sample Number(s)	15042417
Sampled Date	17-Feb-2017
Customer Sample Ref.	TP01
Depth (m)	0.50

**Landfill Waste Acceptance
Criteria Limits**

Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
3	5	6
-	-	10
6	-	-
1	-	-
500	-	-
100	-	-
-	>6	-
-	-	-
-	-	-

Solid Waste Analysis	Result
Total Organic Carbon (%)	0.676
Loss on Ignition (%)	4.86
Sum of BTEX (mg/kg)	<0.024
Sum of 7 PCBs (mg/kg)	<0.021
Mineral Oil (mg/kg)	27.1
PAH Sum of 17 (mg/kg)	<10
pH (pH Units)	8.55
ANC to pH 6 (mol/kg)	0.122
ANC to pH 4 (mol/kg)	0.614

Eluate Analysis	C ₂ Conc ⁿ in 10:1 eluate (mg/l)		A ₂ 10:1 conc ⁿ leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	0.00192	<0.00051	0.0192	<0.0051	0.5	2	25
Barium	0.0198	<0.0002	0.198	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	0.00171	<0.0012	0.0171	<0.012	0.5	10	70
Copper	0.00224	<0.00085	0.0224	<0.0085	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	0.00231	<0.00062	0.0231	<0.0062	0.5	10	30
Nickel	0.000714	<0.00044	0.00714	<0.0044	0.4	10	40
Lead	0.000832	<0.0001	0.00832	<0.001	0.5	10	50
Antimony	0.00058	<0.00016	0.0058	<0.0016	0.06	0.7	5
Selenium	<0.00081	<0.00081	<0.0081	<0.0081	0.1	0.5	7
Zinc	0.00251	<0.0013	0.0251	<0.013	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	78.7	<5	787	<50	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	<3	<3	<30	<30	500	800	1000

Leach Test Information

Date Prepared	27-Feb-2017
pH (pH Units)	8.31
Conductivity (µS/cm)	97.50
Temperature (°C)	18.30
Volume Leachant (Litres)	0.885

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference	
Mass Sample taken (kg)	0.137
Mass of dry sample (kg)	0.090
Particle Size <4mm	>95%

Site Location	Magee Barracks
Natural Moisture Content (%)	52.3
Dry Matter Content (%)	65.7

Case	
SDG	170221-73
Lab Sample Number(s)	15042418
Sampled Date	
Customer Sample Ref.	TP02
Depth (m)	0.50

**Landfill Waste Acceptance
Criteria Limits**

Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
3	5	6
-	-	10
6	-	-
1	-	-
500	-	-
100	-	-
-	>6	-
-	-	-
-	-	-

Solid Waste Analysis	Result
Total Organic Carbon (%)	18
Loss on Ignition (%)	18
Sum of BTEX (mg/kg)	<0.024
Sum of 7 PCBs (mg/kg)	<0.021
Mineral Oil (mg/kg)	70.9
PAH Sum of 17 (mg/kg)	<10
pH (pH Units)	8.09
ANC to pH 6 (mol/kg)	0.244
ANC to pH 4 (mol/kg)	2.43

Eluate Analysis	C ₂ Conc ⁿ in 10:1 eluate (mg/l)		A ₂ 10:1 conc ⁿ leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	0.00469	<0.00051	0.0469	<0.0051	0.5	2	25
Barium	0.071	<0.0002	0.71	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	0.00485	<0.0012	0.0485	<0.012	0.5	10	70
Copper	0.00321	<0.00085	0.0321	<0.0085	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	0.00514	<0.00062	0.0514	<0.0062	0.5	10	30
Nickel	0.000461	<0.00044	0.00461	<0.0044	0.4	10	40
Lead	0.00358	<0.0001	0.0358	<0.001	0.5	10	50
Antimony	0.00449	<0.00016	0.0449	<0.0016	0.06	0.7	5
Selenium	<0.00081	<0.00081	<0.0081	<0.0081	0.1	0.5	7
Zinc	0.00827	<0.0013	0.0827	<0.013	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	102	<5	1020	<50	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	<3	<3	<30	<30	500	800	1000

Leach Test Information

Date Prepared	27-Feb-2017
pH (pH Units)	8.15
Conductivity (µS/cm)	127.00
Temperature (°C)	19.20
Volume Leachant (Litres)	0.853

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference	
Mass Sample taken (kg)	0.107
Mass of dry sample (kg)	0.090
Particle Size <4mm	>95%

Site Location	Magee Barracks
Natural Moisture Content (%)	19.3
Dry Matter Content (%)	83.8

Case	
SDG	170221-73
Lab Sample Number(s)	15042419
Sampled Date	
Customer Sample Ref.	TP07
Depth (m)	0.30

**Landfill Waste Acceptance
Criteria Limits**

Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
3	5	6
-	-	10
6	-	-
1	-	-
500	-	-
100	-	-
-	>6	-
-	-	-
-	-	-

Solid Waste Analysis	Result
Total Organic Carbon (%)	0.666
Loss on Ignition (%)	2.68
Sum of BTEX (mg/kg)	<0.024
Sum of 7 PCBs (mg/kg)	<0.021
Mineral Oil (mg/kg)	2.24
PAH Sum of 17 (mg/kg)	<10
pH (pH Units)	8.73
ANC to pH 6 (mol/kg)	0.652
ANC to pH 4 (mol/kg)	5.29

Eluate Analysis	C ₂ Conc ⁿ in 10:1 eluate (mg/l)		A ₂ 10:1 conc ⁿ leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	0.00194	<0.00051	0.0194	<0.0051	0.5	2	25
Barium	0.00767	<0.0002	0.0767	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	0.00148	<0.0012	0.0148	<0.012	0.5	10	70
Copper	0.00247	<0.00085	0.0247	<0.0085	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	0.00324	<0.00062	0.0324	<0.0062	0.5	10	30
Nickel	0.00096	<0.00044	0.0096	<0.0044	0.4	10	40
Lead	0.00047	<0.0001	0.0047	<0.001	0.5	10	50
Antimony	0.00145	<0.00016	0.0145	<0.0016	0.06	0.7	5
Selenium	<0.00081	<0.00081	<0.0081	<0.0081	0.1	0.5	7
Zinc	0.00305	<0.0013	0.0305	<0.013	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	66.3	<5	663	<50	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	3.7	<3	37	<30	500	800	1000

Leach Test Information

Date Prepared	27-Feb-2017
pH (pH Units)	8.76
Conductivity (µS/cm)	82.30
Temperature (°C)	19.00
Volume Leachant (Litres)	0.883

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference	
Mass Sample taken (kg)	0.106
Mass of dry sample (kg)	0.090
Particle Size <4mm	>95%

Site Location	Magee Barracks
Natural Moisture Content (%)	17.4
Dry Matter Content (%)	85.2

Case	
SDG	170221-73
Lab Sample Number(s)	15042420
Sampled Date	
Customer Sample Ref.	TP08
Depth (m)	0.70

**Landfill Waste Acceptance
Criteria Limits**

Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
3	5	6
-	-	10
6	-	-
1	-	-
500	-	-
100	-	-
-	>6	-
-	-	-
-	-	-

Solid Waste Analysis	Result
Total Organic Carbon (%)	6.97
Loss on Ignition (%)	9.5
Sum of BTEX (mg/kg)	<0.024
Sum of 7 PCBs (mg/kg)	<0.021
Mineral Oil (mg/kg)	47.5
PAH Sum of 17 (mg/kg)	<10
pH (pH Units)	8.39
ANC to pH 6 (mol/kg)	0.242
ANC to pH 4 (mol/kg)	2.43

Eluate Analysis	C ₂ Conc ⁿ in 10:1 eluate (mg/l)		A ₂ 10:1 conc ⁿ leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	0.016	<0.00051	0.16	<0.0051	0.5	2	25
Barium	0.0204	<0.0002	0.204	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.0012	<0.0012	<0.012	<0.012	0.5	10	70
Copper	0.00159	<0.00085	0.0159	<0.0085	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	0.00355	<0.00062	0.0355	<0.0062	0.5	10	30
Nickel	0.000668	<0.00044	0.00668	<0.0044	0.4	10	40
Lead	0.000688	<0.0001	0.00688	<0.001	0.5	10	50
Antimony	0.0016	<0.00016	0.016	<0.0016	0.06	0.7	5
Selenium	<0.00081	<0.00081	<0.0081	<0.0081	0.1	0.5	7
Zinc	0.00157	<0.0013	0.0157	<0.013	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	12.9	<2	129	<20	1000	20000	50000
Total Dissolved Solids	86	<5	860	<50	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	<3	<3	<30	<30	500	800	1000

Leach Test Information

Date Prepared	27-Feb-2017
pH (pH Units)	8.38
Conductivity (µS/cm)	111.00
Temperature (°C)	19.10
Volume Leachant (Litres)	0.884

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference	
Mass Sample taken (kg)	0.116
Mass of dry sample (kg)	0.090
Particle Size <4mm	>95%

Site Location	Magee Barracks
Natural Moisture Content (%)	29
Dry Matter Content (%)	77.5

Case	
SDG	170221-73
Lab Sample Number(s)	15042421
Sampled Date	
Customer Sample Ref.	TP10
Depth (m)	0.50

**Landfill Waste Acceptance
Criteria Limits**

Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
3	5	6
-	-	10
6	-	-
1	-	-
500	-	-
100	-	-
-	>6	-
-	-	-
-	-	-

Solid Waste Analysis	Result
Total Organic Carbon (%)	2.13
Loss on Ignition (%)	4.46
Sum of BTEX (mg/kg)	<0.024
Sum of 7 PCBs (mg/kg)	<0.021
Mineral Oil (mg/kg)	224
PAH Sum of 17 (mg/kg)	<10
pH (pH Units)	8.2
ANC to pH 6 (mol/kg)	0.042
ANC to pH 4 (mol/kg)	0.105

Eluate Analysis	C ₂ Conc ⁿ in 10:1 eluate (mg/l)		A ₂ 10:1 conc ⁿ leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	<0.00051	<0.00051	<0.0051	<0.0051	0.5	2	25
Barium	0.00416	<0.0002	0.0416	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.0012	<0.0012	<0.012	<0.012	0.5	10	70
Copper	0.0011	<0.00085	0.011	<0.0085	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	0.00223	<0.00062	0.0223	<0.0062	0.5	10	30
Nickel	0.000949	<0.00044	0.00949	<0.0044	0.4	10	40
Lead	0.000227	<0.0001	0.00227	<0.001	0.5	10	50
Antimony	0.000889	<0.00016	0.00889	<0.0016	0.06	0.7	5
Selenium	<0.00081	<0.00081	<0.0081	<0.0081	0.1	0.5	7
Zinc	0.00223	<0.0013	0.0223	<0.013	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	72	<5	720	<50	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	<3	<3	<30	<30	500	800	1000

Leach Test Information

Date Prepared	27-Feb-2017
pH (pH Units)	7.89
Conductivity (µS/cm)	92.00
Temperature (°C)	19.00
Volume Leachant (Litres)	0.874

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference	
Mass Sample taken (kg)	0.103
Mass of dry sample (kg)	0.090
Particle Size <4mm	>95%

Site Location	Magee Barracks
Natural Moisture Content (%)	14.5
Dry Matter Content (%)	87.4

Case	
SDG	170221-73
Lab Sample Number(s)	15042422
Sampled Date	
Customer Sample Ref.	TP16
Depth (m)	0.50

**Landfill Waste Acceptance
Criteria Limits**

Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
3	5	6
-	-	10
6	-	-
1	-	-
500	-	-
100	-	-
-	>6	-
-	-	-
-	-	-

Solid Waste Analysis	Result
Total Organic Carbon (%)	0.349
Loss on Ignition (%)	1.63
Sum of BTEX (mg/kg)	<0.024
Sum of 7 PCBs (mg/kg)	<0.021
Mineral Oil (mg/kg)	4.72
PAH Sum of 17 (mg/kg)	<10
pH (pH Units)	8.86
ANC to pH 6 (mol/kg)	0.739
ANC to pH 4 (mol/kg)	5.87

Eluate Analysis	C ₂ Conc ⁿ in 10:1 eluate (mg/l)		A ₂ 10:1 conc ⁿ leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	<0.00051	<0.00051	<0.0051	<0.0051	0.5	2	25
Barium	0.00251	<0.0002	0.0251	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.0012	<0.0012	<0.012	<0.012	0.5	10	70
Copper	0.000853	<0.00085	0.00853	<0.0085	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	0.00102	<0.00062	0.0102	<0.0062	0.5	10	30
Nickel	<0.00044	<0.00044	<0.0044	<0.0044	0.4	10	40
Lead	0.00014	<0.0001	0.0014	<0.001	0.5	10	50
Antimony	0.000841	<0.00016	0.00841	<0.0016	0.06	0.7	5
Selenium	<0.00081	<0.00081	<0.0081	<0.0081	0.1	0.5	7
Zinc	<0.0013	<0.0013	<0.013	<0.013	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	50.2	<5	502	<50	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	<3	<3	<30	<30	500	800	1000

Leach Test Information

Date Prepared	27-Feb-2017
pH (pH Units)	8.41
Conductivity (µS/cm)	61.60
Temperature (°C)	18.80
Volume Leachant (Litres)	0.887

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample ¹	Surrogate Corrected
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM018	BS 1377: Part 3 1990	Determination of Loss on Ignition		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH, Massachusetts Dept. of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser		
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM168	EPA Method 8082, Polychlorinated Biphenyls by Gas Chromatography	Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Soils		
TM182	CEN/TC 292 - WI 292046-characterization of waste-leaching Behaviour Tests- Acid and Base Neutralization Capacity Test	Determination of Acid Neutralisation Capacity (ANC) Using Autotitration in Soils		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers		
TM218	Determination of PAH by GCMS Microwave extraction	The determination of PAH in soil samples by microwave extraction and GC-MS		
TM259	by HPLC	Determination of Phenols in Waters and Leachates by HPLC		

¹ Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Environmental Hawarden (Method codes TM) or ALS Environmental Aberdeen (Method codes S).



CERTIFICATE OF ANALYSIS

Validated

SDG: 170221-73
Location: Magee Barracks

Client Reference: 5362
Order Number: 21/A/17

Report Number: 399955
Superseded Report:

Test Completion Dates

Lab Sample No(s)
Customer Sample Ref.
AGS Ref.
Depth
Type

	15042417	15042418	15042419	15042420	15042421	15042422
	TP01	TP02	TP07	TP08	TP10	TP16
	0.50	0.50	0.30	0.70	0.50	0.50
	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
ANC at pH4 and ANC at pH 6	01-Mar-2017	01-Mar-2017	28-Feb-2017	01-Mar-2017	28-Feb-2017	01-Mar-2017
Anions by Kone (w)	28-Feb-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
Asbestos ID in Solid Samples	06-Mar-2017					
CEN 10:1 Leachate (1 Stage)	27-Feb-2017	28-Feb-2017	28-Feb-2017	28-Feb-2017	28-Feb-2017	28-Feb-2017
CEN Readings	28-Feb-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
Dissolved Metals by ICP-MS	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
Dissolved Organic/Inorganic Carbon	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
Fluoride	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
GRO by GC-FID (S)	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
Loss on Ignition in soils	06-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
Mercury Dissolved	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
Mineral Oil	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
PAH by GCMS	02-Mar-2017	28-Feb-2017	28-Feb-2017	01-Mar-2017	02-Mar-2017	28-Feb-2017
PCBs by GCMS	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
pH	01-Mar-2017	28-Feb-2017	28-Feb-2017	28-Feb-2017	01-Mar-2017	28-Feb-2017
Phenols by HPLC (W)	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
Sample description	24-Feb-2017	24-Feb-2017	24-Feb-2017	26-Feb-2017	25-Feb-2017	24-Feb-2017
Total Dissolved Solids	28-Feb-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017	01-Mar-2017
Total Organic Carbon	01-Mar-2017	01-Mar-2017	28-Feb-2017	01-Mar-2017	28-Feb-2017	01-Mar-2017



CERTIFICATE OF ANALYSIS

SDG: 170221-73	Client Reference: 5362	Report Number: 399955
Location: Magee Barracks	Order Number: 21/A/17	Superseded Report:

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35°C) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethylphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before preservation was performed
§	Sampled on date not provided
◆	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Aste stos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

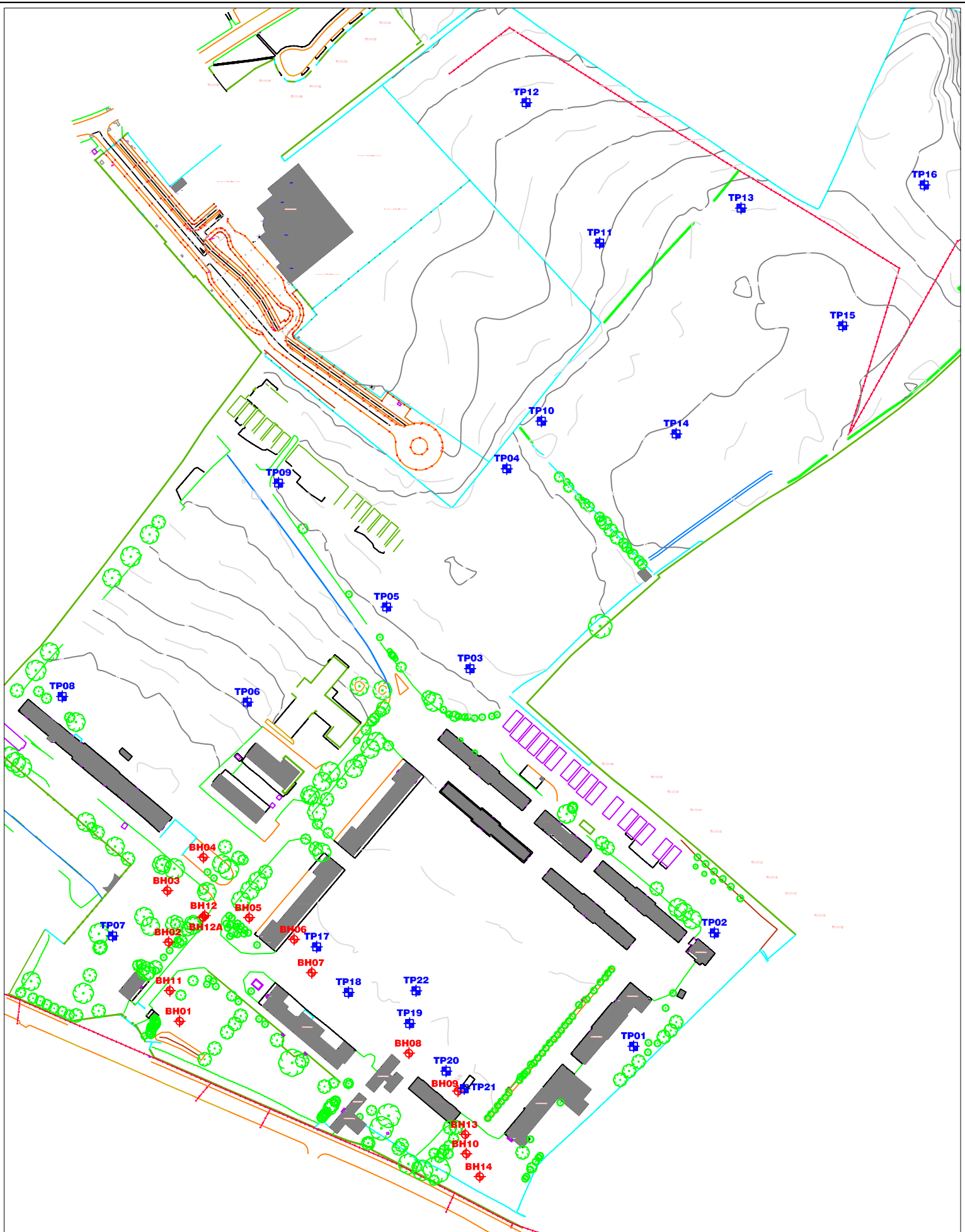
Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Appendix 4
Survey Data

Site Survey



Location	Irish National Grid		Level	Irish Transverse Mercator	
	Easting	Northing		Easting	Northing
Boreholes					
BH01	273415.111	212157.436	100.21	673349.757	712188.727
BH02	273408.630	212204.181	101.94	673343.278	712235.461
BH03	273407.825	212234.682	102.27	673342.473	712265.956
BH04	273429.227	212254.404	103.25	673363.870	712285.673
BH05	273456.285	212218.674	101.52	673390.922	712249.951
BH06	273482.897	212205.844	101.33	673417.528	712237.124
BH07	273493.364	212186.155	101.33	673427.993	712217.439
BH08	273550.877	212138.475	101.29	673485.493	712169.769
BH09	273579.868	212116.036	101.33	673514.478	712147.335
BH10	273584.805	212078.978	102.09	673519.414	712110.285
BH11	273409.321	212175.534	100.53	673343.968	712206.821
BH12	273430.028	212219.890	101.84	673364.671	712251.167
BH12A	273428.994	212218.952	101.82	673363.637	712250.229
BH13	273584.183	212090.437	101.95	673518.792	712121.741
BH14	273592.771	212065.539	102.17	673527.378	712096.849
Trial Pits					
TP01	273683.921	212142.530	101.99	673618.508	712173.822
TP02	273731.697	212209.637	100.97	673666.274	712240.915
TP03	273587.111	212365.977	97.74	673521.721	712397.221
TP04	273608.746	212484.235	97.34	673543.352	712515.454
TP05	273537.646	212402.486	97.99	673472.267	712433.723
TP06	273455.146	212346.177	101.90	673389.784	712377.426
TP07	273375.498	212207.892	102.07	673310.153	712239.172
TP08	273345.580	212349.531	103.43	673280.242	712380.780
TP09	273473.720	212475.788	97.99	673408.355	712507.009
TP10	273629.307	212512.392	96.74	673563.908	712543.604
TP11	273663.874	212617.834	98.30	673598.468	712649.023
TP12	273620.290	212700.887	100.26	673554.894	712732.058
TP13	273747.438	212638.417	96.53	673682.014	712669.601
TP14	273709.093	212504.922	96.01	673643.677	712536.136
TP15	273807.656	212568.844	95.83	673742.219	712600.043
TP16	273856.024	212652.212	98.35	673790.577	712683.393
TP17	273496.293	212201.409	101.48	673430.921	712232.690
TP18	273515.128	212174.494	101.51	673449.752	712205.780
TP19	273551.275	212156.099	101.52	673485.891	712187.389
TP20	273572.936	212127.899	101.46	673507.547	712159.195
TP21	273583.620	212117.467	101.36	673518.229	712148.765
TP22	273555.143	212175.440	101.65	673489.759	712206.726



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Client : Columbia Estates Management (IE) Ltd	
Engineer : Garland	
Project : Magee Barracks	
Date : 09-05-2017	Scale : Not to Scale
Description : Site Investigation Plan	Rev : 2
Drawing Number : SIL5362:01	Drawn by : SL

Legend:
 Cable Percussion Borehole
 Trial Pit



APPENDIX 8.2 - GROUND INVESTIGATION REPORT



**GROUND
INVESTIGATIONS
IRELAND**

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Ground Investigations Ireland

Magee Barracks

Ground Investigation Report

DOCUMENT CONTROL SHEET

Project Title	Magee Barracks
Engineer	Garland Consultancy
Client	Formation Group PLC
Project No	6109-08-16
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A	Final	A McDonnell	F McNamara	F McNamara	Dublin	31/08/16



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Magee Barracks Ground Investigation Report

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APPENDICES

Appendix 1	Site Location Plan
Appendix 2	Trial Pit Records
Appendix 3	Trial Pit Photographs
Appendix 4	Soakaway Test Records

1.0 Preamble

On the instructions of Garland Consultancy, a site investigation was carried out by Ground Investigations Ireland Ltd., in August 2016 at the site. It is proposed to construct approximately 480 residential units, a Hotel, some commercial units and petrol station the construction is envisaged to be undertaken in 2 phases.

2.0 Overview

2.1. Background

It is proposed to construct a new residential and commercial development with associated services, access roads and car parking at the proposed site. The site is currently an abandoned army barracks and attached green field site. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant with drainage on site an important factor due to the limitations of capacity within Kildare town surface water sewers.

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 10 No. Trial Pits to a maximum depth of 1.8m BGL
- Carry out 10 No. Soakaways to determine a soil infiltration value to BRE digest 365
- 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. Trial Pits

The trial pits were excavated using a 13T tracked 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 a Geotechnical Engineer/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 with associated photos in Appendix 3 of this Report.

3.3. 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.

4.0 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/Surfacing
- Made Ground
- Granular Deposits
- Cohesive Deposits

TOPSOIL: Topsoil was encountered in all but three of the trial pits and was present to a maximum depth of 0.2m BGL. Tarmac surfacing was present in SA03, SA04 and SA06 typically to a depth of 0.10m BGL.

MADE GROUND: Made Ground deposits were encountered beneath the Topsoil or Surfacing of all but SA01, SA09 and SA10 and was present to a depth of between 0.3m and 0.7m BGL. These deposits were described generally as *brown slightly sandy gravelly CLAY with frequent cobbles and contained occasional fragments of concrete, red brick, glass and plastic.*

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Made Ground or Topsoil at depths of between 0.20m and 0.70m BGL and were described typically as *brown slightly sandy slightly gravelly CLAY with occasional cobbles.* The strength of the cohesive deposits typically increased with depth and was firm to stiff or stiff below 0.7m BGL in the majority of the exploratory holes. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

GRANULAR DEPOSITS: The granular deposits were encountered mainly in SA01 and SA03 at depths of between 0.20m and 0.30m BGL and interbedded with the cohesive deposits in SA07 and SA08 encountered at a depth of 1.10m and extending to depths of 1.30m BGL. They were typically described as *Brownish grey clayey gravelly fine to coarse SAND or GRAVEL with occasional cobbles and varying minor constituents.* The secondary sand and gravel constituents varied across the site and with depth while occasional or frequent cobble and boulder content were also present where noted on the exploratory hole logs. It should be noted that many of the trial pits where granular deposits were encountered, remained quite stable for the duration of the soakaway test.

4.2. 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.

5.0 Recommendations & Conclusions

5.1. General

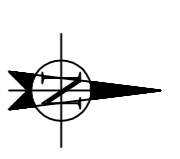
The recommendations given and opinions expressed in this report are based on the findings as detailed in the trial pit and soakaway records. Where an opinion is expressed on the material between trial pit locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility 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 trial pit logs.

5.2. Soakaway Design

Infiltration rates of 6.78×10^{-5} , 2.63×10^{-4} , 7.0×10^{-6} , 2.07×10^{-5} and 1.17×10^{-5} m/s respectively were calculated for the soakaway locations SA01, SA03, SA04, SA06 and SA07. SA03 could not be filled completely as water flowed too quickly out of it. At the locations of SA02, SA05, SA08, SA09 and SA10 the water level dropped too slowly to allow calculation of 'f' the soil infiltration rate. These locations are therefore unsuitable for soakaway design and construction.

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



INFILTRATION TEST No		IRISH TRANSVERSE MERCATOR (ITM)	
TEST No	X VALUE	Y VALUE	
01	6737689	712859	
02	6737224	712524	
03	673544	712106	
04	673517	712286	
05	673379	712174	
06	673416	712399	
07	673595	712436	
08	673601	712517	
09	673640	712885	
10	673783	712744	

REV	DATE	DESCRIPTION	BY	CHK
A		TABLE OF COORDINATES ADDED	JC	AM

ARCHITECT:
R&D ARCHITECTS
 100, GARDINER STREET, WATERSFORD, CO. WICK
 T: +353 (0)51 853322 F: +353 (0)51 853323
 E: info@rands.com W: www.rands.com

PROJECT:
 MAGEE BARRACKS DEVELOPMENT

TITLE:
 INFILTRATION TEST LOCATIONS

STATUS:
FOR CONSTRUCTION

DRAWN: JC DES: BT AM
 CHK: AM APP: BT AM
 DATE: 14/07/18 JOB No:
 A1 SCALE: 1:2000 **R1831**
 DRG. No. **002** REV. **A**

APPENDIX 2 – Trial Pit Records



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Site
Magee Barracks

Trial Pit Number
SA01

Machine : 3 T mini digger Method : Trial Pit	Dimensions L X W 0.4 X 1.8	Ground Level (mOD)	Client Garland Consulting	Job Number 6109-08-16
	Location Kildare	Dates 09/08/2016	Project Contractor Ground Investigation Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00	LB				0.20	TOPSOIL: Dark brown slightly sandy slightly gravelly Clay with grass rootlets		
					0.30	Brownish grey clayey gravelly fine to medium SAND with many sub rounded cobbles		
					0.50	Brownish grey gravelly fine to coarse SAND with many sub rounded to sub angular cobbles and some boulders		
					0.80			
					1.30	Complete at 1.30m		

Plan	<p>Remarks</p> <p>Trial Pit stable No Groundwater encountered Trial Pit backfilled on completion</p>		
	Scale (approx) 1:25	Logged By G Kelliher	Figure No. 6109-08-16.SA03



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Site
Magee Barracks

Trial Pit Number
SA02

Machine : 3 T mini digger	Dimensions L X W 0.4 X 1.5	Ground Level (mOD)	Client Garland Consulting	Job Number 6109-08-16
Method : Trial Pit	Location Kildare	Dates 09/08/2016	Project Contractor Ground Investigation Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30	SB				0.10 0.10 0.20 0.30	<p>TOPSOIL: Dark brown slightly sandy slightly gravelly Clay with grass rootlets</p> <p>MADE GROUND: Dark brown sligtly sandy slightly gravelly CLAY with occasional sub rounded cobbles and rare plastic fragment</p> <p>Firm to stiff brown slightly sandy gravelly CLAY with occasional sub rounded to sub angular cobbles</p>		
1.10	LB				0.90 (0.40) 1.30	<p>Stiff light brown slightly gravelly sandy CLAY</p> <p>Complete at 1.30m</p>		

Plan	<p>Remarks</p> <p>Trial Pit stable No Groundwater encountered Trial Pit backfilled on completion</p>		
	Scale (approx) 1:25	Logged By G Kelliher	Figure No. 6109-08-16.SA03



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Site
Magee Barracks

Trial Pit Number
SA03

Machine : 3 T mini digger	Dimensions L X W 0.42 X 1.4	Ground Level (mOD)	Client Garland Consulting	Job Number 6109-08-16
Method : Trial Pit	Location Kildare	Dates 08/08/2016	Project Contractor Ground Investigation Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.60	SB				0.10	Tarmacadam		
					0.20	MADE GROUND: Brown gravelly cobbly Sand with many brick fragments		
1.30	SB				0.30	Greyish brown slightly clayey very gravelly medium to coarse SAND with some sub rounded cobbles and boulders		
					0.70	Greyish brown very sandy sub rounded to sub angular GRAVEL with some sub rounded cobbles and boulders		
					1.40	Complete at 1.40m		

Plan	Remarks						
<p>• • • • •</p> <p>• • • • •</p> <p>• • • • •</p> <p>• • • • •</p> <p>• • • • •</p> <p>• • • • •</p>	<p>Could not fill Trial Pit, water flowing too quickly out of pit</p> <p>Trial pit slightly unstable</p> <p>No Groundwater encountered</p> <p>Trial Pit backfilled on completion</p>						
	<table border="1"> <tr> <td>Scale (approx)</td> <td>Logged By</td> <td>Figure No.</td> </tr> <tr> <td align="center">1:25</td> <td align="center">G Kelliher</td> <td align="center">6109-08-16.SA03</td> </tr> </table>	Scale (approx)	Logged By	Figure No.	1:25	G Kelliher	6109-08-16.SA03
Scale (approx)	Logged By	Figure No.					
1:25	G Kelliher	6109-08-16.SA03					



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Site
Magee Barracks

Trial Pit Number
SA04

Machine : 3 T mini digger	Dimensions L X W 0.40 X 1.55	Ground Level (mOD)	Client Garland Consulting	Job Number 6109-08-16
Method : Trial Pit	Location Kildare	Dates 08/08/2016	Project Contractor Ground Investigation Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.60	LB				(0.10) - (0.10)	Tarmacadam		
					(0.20) - (0.30)	MADE GROUND: Brown gravelly SAND with some red brick fragments		
1.40	SB				(0.30) - (0.50)	MADE GROUND: Grey slightly sandy slightly gravelly CLAY with some fragments of red brick		
					(0.50) - (0.66)	Firm to stiff light brown slightly sandy gravelly CLAY with occasional sub rounded to sub angular cobbles		
					(1.16) - (1.44)	Firm to stiff light brown slightly sandy gravelly CLAY with occasional sub rounded to sub angular cobbles		
					1.60	Complete at 1.60m		

Plan	Remarks		
.	Trial Pit stable		
.	No Groundwater encountered		
.	Trial Pit backfilled on completion		
.			
.			
.			
.			
.			
.			
	Scale (approx)	Logged By	Figure No.
	1:25	G Kelliher	6109-08-16.SA03



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Site
Magee Barracks

Trial Pit Number
SA05

Machine : 3 T mini digger Method : Trial Pit	Dimensions L X W 0.40 X 1.5	Ground Level (mOD)	Client Garland Consulting	Job Number 6109-08-16
	Location Kildare	Dates 08/08/2016	Project Contractor Ground Investigation Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	LB				0.10	TOPSOIL: Brown gravelly sandy SILT with some rootlets		
					(0.60)	MADE GROUND: Brown slightly sandy gravelly CLAY with many cobbles and brick fragments		
1.30	SB				0.70	Firm to stiff brown to light brown slightly sandy slightly gravelly CLAY		
					(0.80)			
					1.50	Stiff brown slightly sandy slightly gravelly CLAY with some sub rounded to sub angular cobbles		
					(0.30)			
					1.80	Complete at 1.80m		

Plan .	Remarks Trial Pit stable No Groundwater encountered Trial Pit backfilled on completion	
		Scale (approx) 1:25



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Site
Magee Barracks

Trial Pit Number
SA06

Machine : 3 T mini digger	Dimensions L X W 0.45 X 1.30	Ground Level (mOD)	Client Garland Consulting	Job Number 6109-08-16
Method : Trial Pit	Location Kildare	Dates 08/08/2016	Project Contractor Ground Investigation Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20	SB				(0.09) (0.09) (0.18)	Tarmacadam MADE GROUND: Brown sandy very gravelly CLAY		
					(0.15) 0.33	MADE GROUND: Dark grey slightly sandy CLAY with some sub rounded cobbles and rare glass fragments		
0.70	SB				(1.12)	Firm to stiff light brown slightly sandy slightly gravelly CLAY with occasional sub rounded to sub angular cobbles		
					1.45	Complete at 1.45m		

Plan	Remarks		
.	Trial Pit stable		
.	No Groundwater encountered		
.	Trial Pit backfilled on completion		
.	Scale (approx)	Logged By	Figure No.
.	1:25	G Kelliher	6109-08-16.SA03



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Site
Magee Barracks

Trial Pit Number
SA07

Machine : 3 T mini digger	Dimensions L X W 0.43 X 1.60	Ground Level (mOD)	Client Garland Consulting	Job Number 6109-08-16
Method : Trial Pit	Location Kildare	Dates 08/08/2016	Project Contractor Ground Investigation Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
1.00	LB				(0.15) - 0.15	TOPSOIL: Brown slightly sandy gravelly Clay with some sub angular cobbles		
					(0.35) - 0.50	MADE GROUND: Dark brown slightly sandy gravelly CLAY with some brick and concrete fragments		
					(0.40) - 0.90	Firm brown slightly sandy slightly gravelly CLAY with sub rounded cobbles		
					(0.20) - 1.10	Firm dark brown slightly sandy CLAY		
					(0.20) - 1.30	Brownish grey slightly clayey gravelly SAND with some sub rounded cobbles and boulders		
					(0.30) - 1.60	Stiff brown slightly sandy slightly gravelly CLAY		
					Complete at 1.60m			

Plan	<p>Remarks</p> <p>Trial Pit stable No Groundwater encountered Trial Pit backfilled on completion</p>								
	Scale (approx)	Logged By	Figure No.						
	1:25	G Kelliher	6109-08-16.SA03						



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Site
Magee Barracks

Trial Pit Number
SA08

Machine : 3 T mini digger	Dimensions L X W 0.4 X 1.70	Ground Level (mOD)	Client Garland Consulting	Job Number 6109-08-16
Method : Trial Pit	Location Kildare	Dates 08/08/2016	Project Contractor Ground Investigation Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.80	LB				0.20	TOPSOIL: Brown slightly sandy gravelly Clay with some sub angular cobbles		
					0.20	MADE GROUND: Brown slightly sandy gravelly CLAY with some sub rounded cobbles and charcoal fragments		
					0.50			
					0.70	Firm brown slightly sandy gravelly CLAY		
					0.40			
					1.10 (0.10) 1.20	Brownish grey clayey gravelly fine to medium SAND		
			0.60	Firm to stiff brown slightly sandy slightly gravelly CLAY with some sub rounded to sub angular cobbles				
			1.80	Complete at 1.80m				

Plan .	Remarks Trial Pit stable No Groundwater encountered Trial Pit backfilled on completion		
	<table border="1"> <tr> <td>Scale (approx) 1:25</td> <td>Logged By G Kelliher</td> <td>Figure No. 6109-08-16.SA03</td> </tr> </table>	Scale (approx) 1:25	Logged By G Kelliher
Scale (approx) 1:25	Logged By G Kelliher	Figure No. 6109-08-16.SA03	



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Site
Magee Barracks

Trial Pit Number
SA09

Machine : 3 T mini digger Method : Trial Pit	Dimensions L X W 0.4 X 1.4	Ground Level (mOD)	Client Garland Consulting	Job Number 6109-08-16
	Location Kildare	Dates 09/08/2016	Project Contractor Ground Investigation Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30	B				(0.20)	TOPSOIL: Dark brown slightly sandy slightly gravelly Clay		
					0.20	Firm dark greyish brown slightly sandy slightly gravelly CLAY		
					(0.30)	Firm brown slightly sandy slightly gravelly CLAY with occasional sub rounded to sub angular cobbles		
1.30	B				0.50	Firm to stiff light to medium brown slightly sandy gravelly CLAY with some sub rounded to sub angular cobbles and rare boulders		
					(0.50)	Complete at 1.50m		

Plan	Remarks			
<p>• • • • •</p> <p>• • • • •</p> <p>• • • • •</p> <p>• • • • •</p> <p>• • • • •</p> <p>• • • • •</p>	<p>Trial Pit stable No Groundwater encountered Trial Pit backfilled on completion</p>			
	<table border="1"> <tr> <td>Scale (approx) 1:25</td> <td>Logged By G Kelliher</td> <td>Figure No. 6109-08-16.SA03</td> </tr> </table>	Scale (approx) 1:25	Logged By G Kelliher	Figure No. 6109-08-16.SA03
Scale (approx) 1:25	Logged By G Kelliher	Figure No. 6109-08-16.SA03		



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Site
Magee Barracks

Trial Pit Number
SA10

Machine : 3 T mini digger	Dimensions L X W 0.36 X 1.7	Ground Level (mOD)	Client Garland Consulting	Job Number 6109-08-16
Method : Trial Pit	Location Kildare	Dates 09/08/2016	Project Contractor Ground Investigation Ireland	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50	LB				(0.20)	TOPSOIL: Dark brown slightly sandy slightly gravelly Clay with grass rootlets		
					0.20	Firm brown slightly gravelly sandy CLAY with occasional sub rounded to sub angular cobbles		
1.30	SB				(0.80)			
					1.00	Firm to stiff light brown slightly sandy slightly gravelly silty CLAY		
					1.30	Complete at 1.30m		

Plan .	Remarks Trial Pit stable No Groundwater encountered Trial Pit backfilled on completion		
		<table border="1"> <tr> <td>Scale (approx) 1:25</td> <td>Logged By G Kelliher</td> <td>Figure No. 6109-08-16.SA03</td> </tr> </table>	Scale (approx) 1:25
Scale (approx) 1:25	Logged By G Kelliher	Figure No. 6109-08-16.SA03	

APPENDIX 3 – Trial Pit Photographs

Magee Barracks – Trial pit photos



SA1



SA1



SA1



SA2



SA2



SA3



SA3



SA3



SA4



SA4



SA4



SA5



SA5



SA5



SA6



SA6



SA6



SA7



SA7



SA7



SA8



SA8



SA8



SA8



SA8



SA10



SA10



SA10



SA10

APPENDIX 4 – Soakaway Test Records

Magee Barracks - Soakaway Tests

Elapsed Time (mins)	Fall of Water (m)	Start depth to water
0	-0.200	
5	-0.380	
10	-0.480	
15	-0.560	
20	-0.600	
25	-0.740	
35	-0.860	
40	-1.000	
45	-1.100	
60	-1.300	

Start depth to water
0.20

Depth of Hole
1.300

Length of pit (m)
1.800

Width of pit (m)
0.400

Length of pit (m)
1.800

Width of pit (m)
0.400

Diff
1.100

75% full
0.475

25%full
1.025

75-25Ht (m)
0.550

Vp75-25 (m3)
0.40

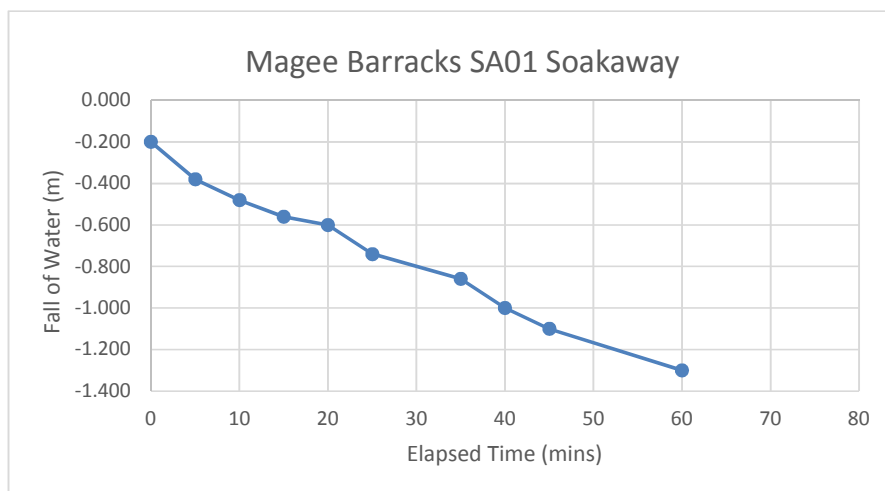
50%Eff Dpth
0.550

ap50 (m2)
3.14

1860

tp75-25 seconds (from graph)

f = 0.0000678 m/s



Magee Barracks - Soakaway Tests

Elapsed Time (mins)	Fall of Water (m)
0	-0.330
8	-0.360
18	-0.380
28	-0.400
43	-0.430
58	-0.470
78	-0.470
108	-0.490
123	-0.490
138	-0.490
153	-0.500
168	-0.500
183	-0.500
198	-0.500
213	-0.500

Start depth to water

Start depth to water
0.33

Depth of Hole
1.300

Length of pit (m)
1.500

Width of pit (m)
0.400

Length of pit (m)
1.500

Width of pit (m)
0.400

Diff
0.970

75% full
0.5725

25%full
1.0575

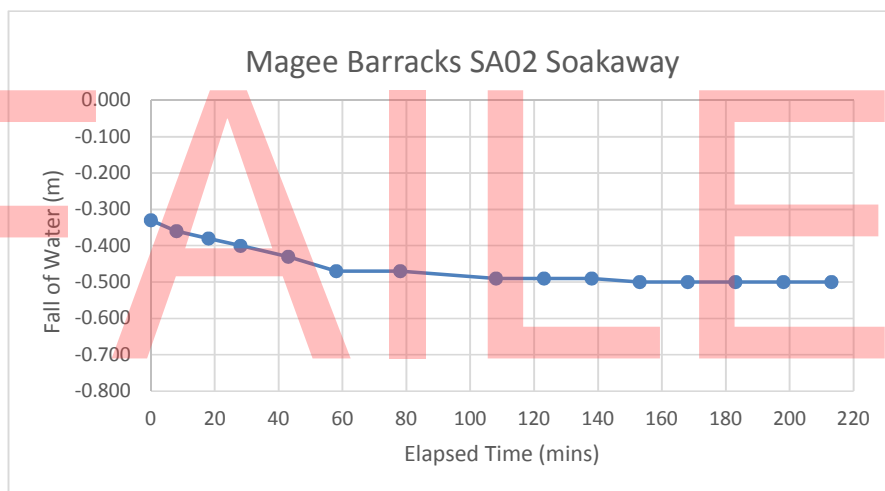
75-25Ht (m)
0.485

Vp75-25 (m3)
0.29

50%Eff Dpth
0.485

ap50 (m2)
2.443

tp75-25 seconds (from graph)



Magee Barracks - Soakaway Tests

Elapsed Time (mins)	Fall of Water (m)	Start depth to water
0	-0.870	
1	-0.930	
2	-1.000	
3	-1.050	
4	-1.100	
6	-1.150	
8	-1.200	
11	-1.300	

Start depth to water Depth of Hole
 0.87 1.300

Length of pit (m) Width of pit (m)
 1.400 0.420

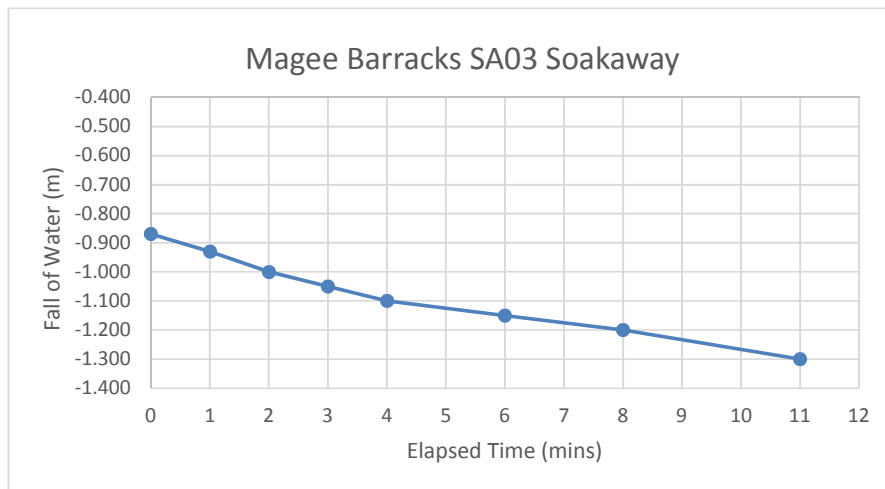
Length of pit (m) Width of pit (m) Diff **75% full** **25%full**
 1.400 0.420 0.430 **0.9775** **1.1925**

75-25Ht (m) **Vp75-25 (m3)**
 0.215 **0.13**

50%Eff Dpth **ap50 (m2)**
 0.215 **1.3706**

351 **tp75-25 seconds (from graph)**

f = 0.0002628 m/s



Magee Barracks - Soakaway Tests

Elapsed Time (mins)	Fall of Water (m)
0	-0.590
20	-0.720
40	-0.850
60	-0.890
80	-0.900
105	-1.000
120	-1.080
140	-1.120
150	-1.160
170	-1.200
190	-1.230
200	-1.260
210	-1.270
220	-1.270
250	-1.290
300	-1.320
340	-1.350

Start depth to water

Start depth to water
0.59

Depth of Hole
1.600

Length of pit (m)
1.550

Width of pit (m)
0.400

Length of pit (m)
1.550

Width of pit (m)
0.400

Diff
1.010

75% full
0.8425

25%full
1.3475

75-25Ht (m)
0.505

Vp75-25 (m3)
0.31

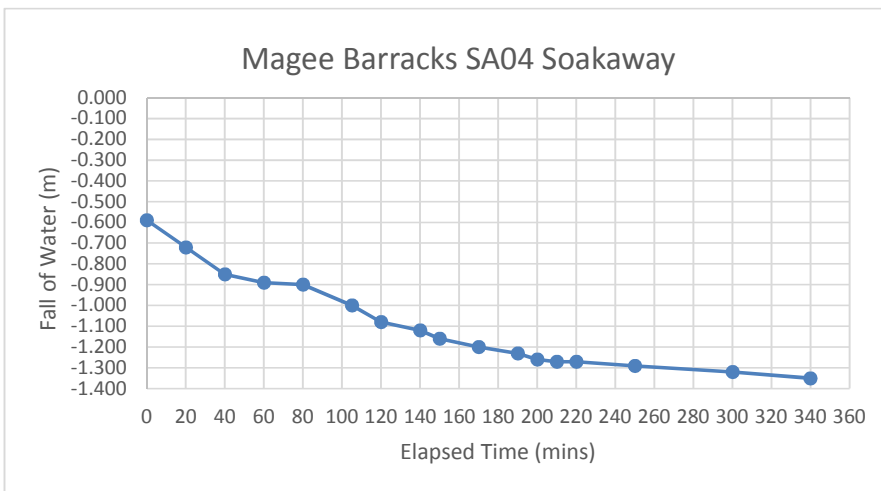
50%Eff Dpth
0.505

ap50 (m2)
2.5895

17280

tp75-25 seconds (from graph)

f = 0.0000070 m/s



Magee Barracks - Soakaway Tests

Elapsed Time (mins)	Fall of Water (m)
0	-0.700
5	-0.740
10	-0.780
15	-0.800
20	-0.830
35	-0.860
55	-0.870
80	-0.910
95	-0.960
105	-0.980
125	-1.010
145	-1.050
180	-1.060
195	-1.080
220	-1.080
235	-1.080

Start depth to water

Start depth to water
0.70

Depth of Hole
1.800

Length of pit (m)
1.500

Width of pit (m)
0.400

Length of pit (m)
1.500

Width of pit (m)
0.400

Diff
1.100

75% full
0.975

25%full
1.525

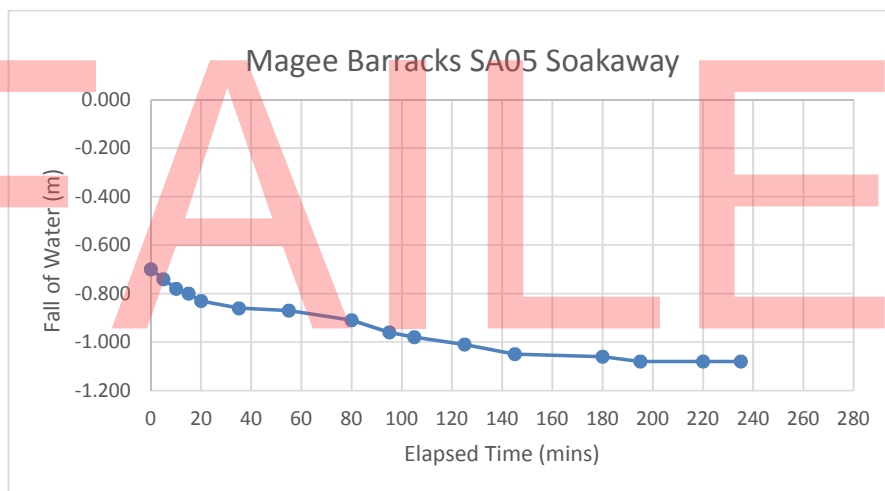
75-25Ht (m)
0.550

Vp75-25 (m3)
0.33

50%Eff Dpth
0.550

ap50 (m2)
2.69

tp75-25 seconds (from graph)



Magee Barracks - Soakaway Tests

Elapsed Time (mins)	Fall of Water (m)
0	-0.400
15	-0.490
25	-0.620
35	-0.720
50	-0.800
65	-0.840
80	-0.870
95	-0.900
110	-0.940
125	-0.970
140	-0.980
150	-1.000
160	-1.000
170	-1.010
200	-1.010
250	-1.010

Start depth to water

Start depth to water
-0.40

Depth of Hole
1.450

Length of pit (m)
1.300

Width of pit (m)
0.450

Length of pit (m)
1.300

Width of pit (m)
0.450

Diff
1.850

75% full
0.0625

25%full
0.9875

75-25Ht (m)
0.925

Vp75-25 (m3)
0.54

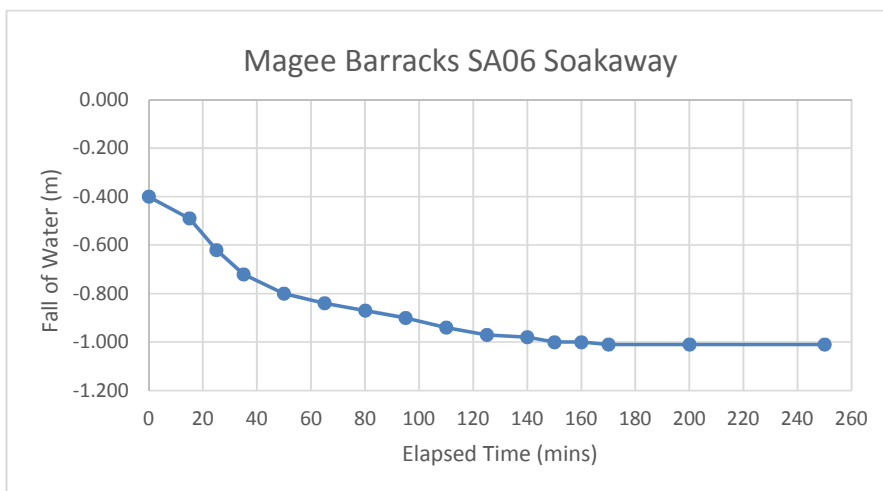
50%Eff Dpth
0.925

ap50 (m2)
3.8225

6840

tp75-25 seconds (from graph)

f = 0.0000207 m/s



Magee Barracks - Soakaway Tests

Elapsed Time (mins)	Fall of Water (m)	Start depth to water
0	-0.600	
10	-0.720	
20	-0.850	
40	-0.910	
50	-0.980	
60	-1.070	
70	-1.150	
80	-1.200	
90	-1.250	
100	-1.280	
130	-1.300	
200	-1.350	
240	-1.360	

Start depth to water
0.60

Depth of Hole
1.600

Length of pit (m)
1.600

Width of pit (m)
0.430

Length of pit (m)
1.600

Width of pit (m)
0.430

Diff
1.000

75% full
0.85

25%full
1.35

75-25Ht (m)
0.500

Vp75-25 (m3)
0.34

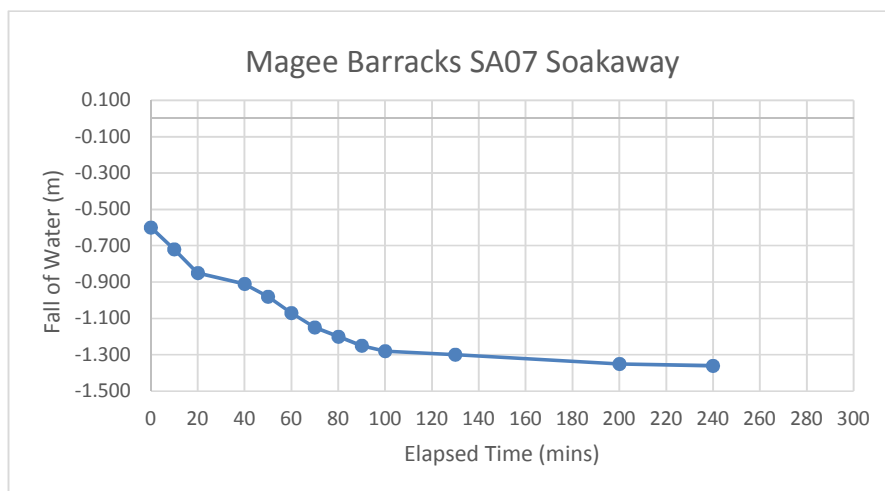
50%Eff Dpth
0.500

ap50 (m2)
2.718

10800

tp75-25 seconds (from graph)

f = 0.0000117 m/s



Magee Barracks - Soakaway Tests

Elapsed Time (mins)	Fall of Water (m)
0	-0.800
15	-0.900
30	-0.970
40	-1.010
55	-1.050
90	-1.120
110	-1.200
135	-1.200
160	-1.230
180	-1.240
195	-1.250
210	-1.250
225	-1.250
240	-1.260
270	-1.260
300	-1.260

Start depth to water

Start depth to water
0.80

Depth of Hole
1.800

Length of pit (m)
1.700

Width of pit (m)
0.400

Length of pit (m)
1.700

Width of pit (m)
0.400

Diff
1.000

75% full
1.05

25%full
1.55

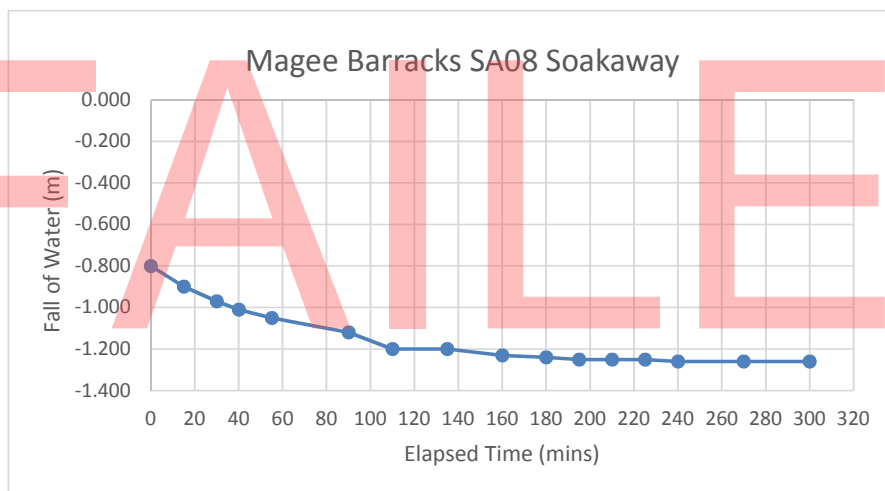
75-25Ht (m)
0.500

Vp75-25 (m3)
0.34

50%Eff Dpth
0.500

ap50 (m2)
2.78

tp75-25 seconds (from graph)



Magee Barracks - Soakaway Tests

Elapsed Time (mins)	Fall of Water (m)
0	-0.500
12	-0.520
22	-0.540
42	-0.560
62	-0.580
87	-0.590
102	-0.590
132	-0.590
162	-0.600
192	-0.600
212	-0.600
232	-0.600
252	-0.600
272	-0.600
292	-0.600

Start depth to water

Start depth to water
0.50

Depth of Hole
1.500

Length of pit (m)
1.400

Width of pit (m)
0.400

Length of pit (m)
1.400

Width of pit (m)
0.400

Diff
1.000

75% full
0.75

25%full
1.25

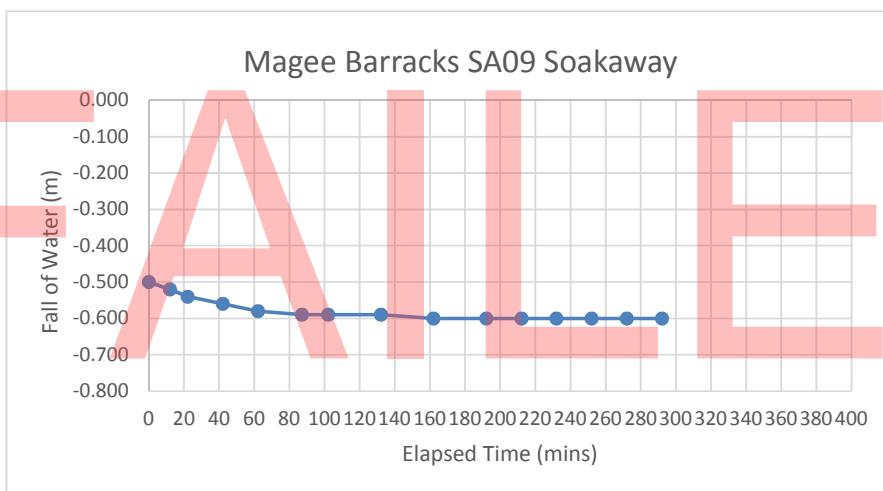
75-25Ht (m)
0.500

Vp75-25 (m3)
0.28

50%Eff Dpth
0.500

ap50 (m2)
2.36

tp75-25 seconds (from graph)



Magee Barracks - Soakaway Tests

Elapsed Time (mins)	Fall of Water (m)
0	-0.300
10	-0.340
20	-0.360
30	-0.400
40	-0.420
50	-0.450
55	-0.470
80	-0.490
105	-0.520
135	-0.550
165	-0.580
195	-0.600
210	-0.620
230	-0.650
245	-0.670
275	-0.670

Start depth to water

Start depth to water
0.30

Depth of Hole
1.300

Length of pit (m)
1.700

Width of pit (m)
0.360

Length of pit (m)
1.700

Width of pit (m)
0.360

Diff
1.000

75% full
0.55

25%full
1.05

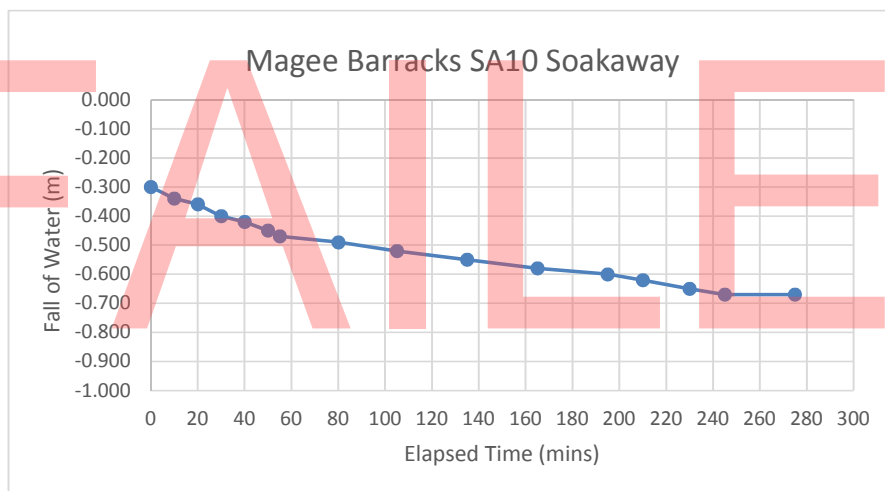
75-25Ht (m)
0.500

Vp75-25 (m3)
0.31

50%Eff Dpth
0.500

ap50 (m2)
2.672

tp75-25 seconds (from graph)



FAILED