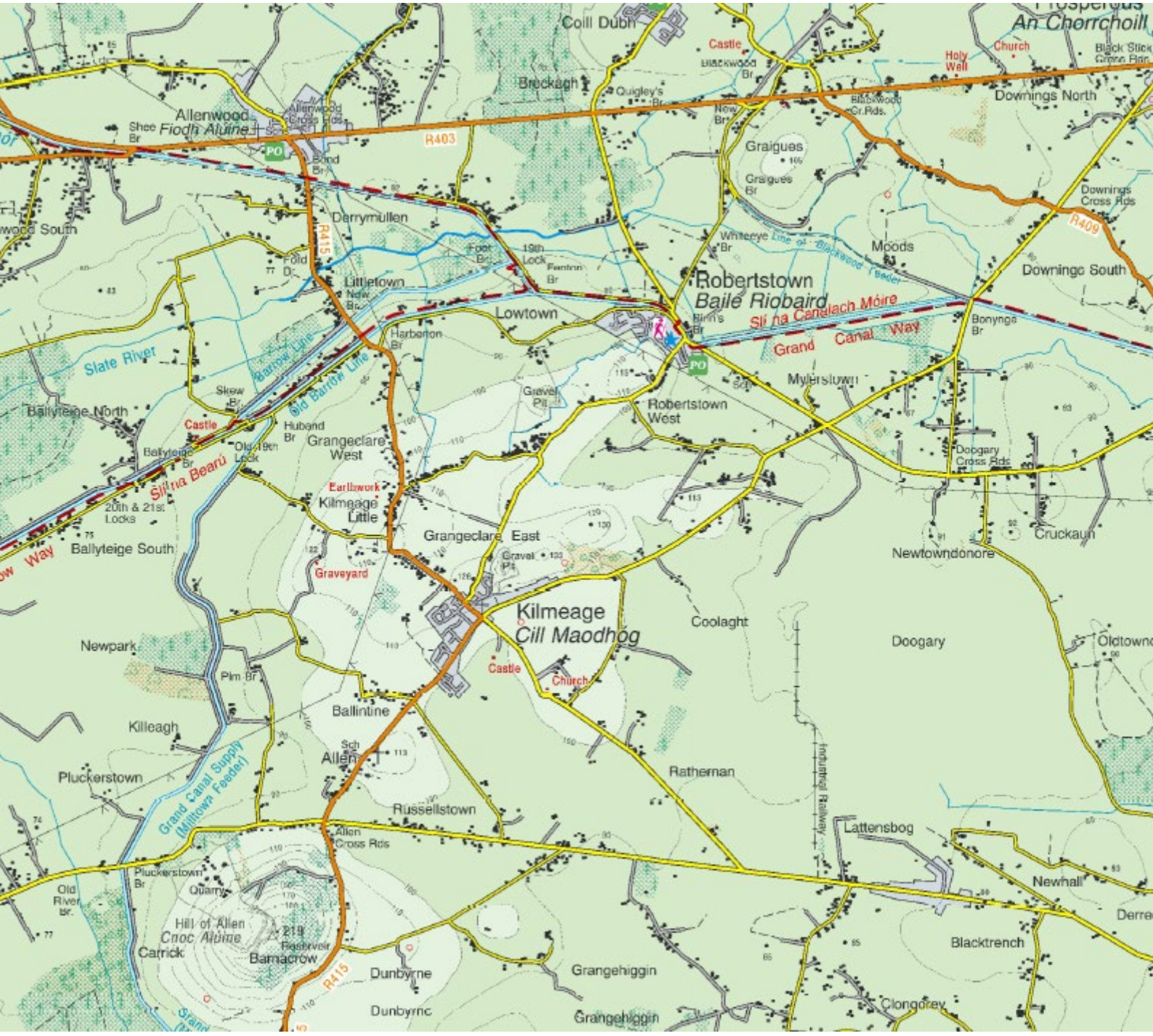
CHAPTER 7

LAND, SOILS AND GEOLOGY



QUARRY CONSULTING

Contents

CHAPTER 7: Land, Soils and Geology

Introduction

Background

7.1 Hydro-Environmental Services (HES) was engaged by Quarry Consulting, to carry out an assessment of the likely and potential significant effects of a proposed sand and gravel pit and inert waste recovery facility (proposed development) at Kilmeague, Co. Kildare on the land, soil, and geological environment.

7.2 This report provides a baseline assessment of the environmental setting of the proposed development in terms of land, soils, and geology, and discusses the potential impacts that the construction, operational and restoration phases of the proposed development will have.

7.3 Where required, appropriate mitigation measures to limit any identified likely and significant effects to land, soils and geology are recommended and an assessment of residual effects and significance of effects provided.

7.4 Where the 'proposed development' is referred to, this relates to all the project components described in in detail in Chapter 3 of this EIAR.

7.5 Where the 'proposed development site' or 'site' is referred to, this relates to everything inside the application site boundary (13.2ha).

Proposed Development Overview

7.6 In summary, the proposed development will involve:

- The removal of woodland, vegetation and overlying topsoils (site preparation);
- Extraction of sand and gravel (4 million tonnes) on a phased basis from an area of c. 8.5 ha to a final floor level at 95m above OD (Ordnance Datum);
- Infilling of the lands using inert waste (3.2 million tonnes) on a phased basis during and following the extraction of sand and gravel;
- Restoration of the lands back to original ground level and the establishment of native woodland planting;
- All related ancillary development and associated site works including processing (crushing, screening and washing) and stockpiling of materials; installation of infrastructure for the management of surface water runoff on site and all other related activities.

Statement of Authority

7.7 Hydro-Environmental Services (HES) are a specialist hydrological, hydrogeological and environmental practice that delivers a range of water and environmental management consultancy services to the private and public sectors across Ireland and Northern Ireland. HES was established in 2005, and our office is located in Dungarvan, County Waterford.

7.8 Our core areas of expertise and experience include soils, subsoils and geology. We routinely complete impact assessments for land soils and geology, hydrology and hydrogeology for a large variety of project types such as quarries, sand and gravel pits along with infill/restoration projects.

7.9 This chapter of the EIAR was prepared by Michael Gill, David Broderick and Jenny Law.

7.10 Michael Gill P.Geo (BA, BAI, Dip Geol., MSc, MIEI) is an Environmental Engineer and Hydrogeologist with over 21 years' environmental consultancy experience in Ireland. Michael has completed numerous geological, hydrological and hydrogeological impact assessments of quarry/pit infill developments in Ireland. He has worked on the following quarry infill assessments: Clasheen Pit (Killarney), Garyhesta (Cork), Middleton (Cork), Killarney East, Kilmeague (Kildare), and Kilmessan (Meath).

7.11 David Broderick P.Geo (BSc, H. Dip Env Eng, MSc) is a Hydrogeologist with 17 years environmental consultancy experience in Ireland. David has completed numerous hydrological and hydrogeological assessments for various developments across Ireland. David has significant experience in quarry assessments, surface water drainage issues, SUDs design, flood risk assessment and modelling. He has worked on the following quarry infill assessments: Garyhesta (Cork), Middleton (Cork), Carrolls Cross (Waterford), and Kilmessan (Meath).

7.12 Jenny Law (BSc, MSc) is an Environmental Geoscientist holding a first honours degree in Applied Environmental Geosciences from the University College Cork. Jenny has assisted in the preparation of the land, soils and geology and hydrology/hydrogeology chapters for various environmental impact assessment reports, hydrological impact assessments, Water Framework Directive Assessment reports and Flood Risk Assessment reports for a variety of projects including wind farm developments and strategic housing developments.

Legislative and Policy Context

Relevant Legislation

7.13 The following European Union (EU) Directive relates to Land, Soils and Geology at the site in this EIAR:

- Environmental Impact Assessment Directive (2011/92/EU);
- Environmental Impact Assessment Directive (2014/52/EU);
- The management of waste from extractive industries (2006/21/EC); and,
- Environmental Liability Directive (2004/35/EC).

7.14 The EU EIA Directive regulates the information impact assessment process and information in this EIAR. The Waste Framework Directive (2008/98/EC) and the Environmental Liability Directive (2004/35/EC) regulate the activities at the site.

7.15 The requirements of the following legislation are complied with:

- S.I. No. 349 of 1989: European Communities (Environmental Impact Assessment) Regulations, and subsequent Amendments (S.I. No. 84 of 1995, S.I. No. 352 of 1998, S.I. No. 93 of 1999, S.I. No. 450 of 2000 and S.I. No. 538 of 2001), S.I. No. 30 of 2000, the Planning and Development Act, and S.I. 600 of 2001 Planning and Development

Regulations and subsequent Amendments. These instruments implement EU Directive 85/373/EEC and subsequent amendments, on the assessment of the effects of certain public and private projects on the environment;

- Directives 2011/92/EU and 2014/52/EU on the assessment of the effects of certain public and private projects on the environment, including Circular Letter PL 1/2017: Implementation of Directive 2014/52/EU on the effects of certain public and private projects on the environment (EIA Directive);
- Planning and Development Act, 2000, as amended; and,
- S.I. No 296 of 2018: S.I. No. 296 of 2018: European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 which transposes the provisions of Directive 2014/52/EU into Irish law.

Relevant Guidance

7.16 The Land, Soils and Geology section of the EIAR has been prepared with regard to the following guidelines:

- Environmental Protection Agency (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. Environmental Protection Agency, Johnstown Castle Estate, Co. Wexford;
- DoEHLG (2010) Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities;
- Geological Survey of Ireland, Irish Concrete Federation (2008) Geological Heritage Guidelines for the Extractive Industry;
- Institute of Geologists of Ireland (2002) Geology in Environmental Impact Statements, A Guide;
- Institute of Geologists of Ireland (2007) Recommended collection, presentation and interpretation of geological and hydrogeological information for quarry developments;
- Institute of Geologists of Ireland (2013) Guidelines for the preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements;
- National Roads Authority (2008) Environmental Impact Assessment of National Road Schemes - A Practical Guide;
- National Roads Authority (2008) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes;
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (DoHPLG, 2018);
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU), (European Union, 2017);
- EPA Guidance on Soil Recovery Waste Acceptance Criteria (2020); and,

- Consultation Paper Regulation 27(7) National By-Product Criteria for Greenfield Soil and Stone used in Developments" (2022).

Scoping and Consultation

7.17 The scope for this chapter of the EIAR has also been informed by consultation with statutory consultees, bodies with environmental responsibility and other interested parties. This consultation process is outlined in Chapter 2 of this EIAR. Matters raised with respect to the land, soils and geology environment are summarised in **Table 7-1** below.

7.18 The Geological Survey of Ireland (GSI) and Kildare Co. Co. were the only bodies to respond with regard land, soils geology and the response is summarised below.

Table 7-1: Land, Soils and Geology Related Scoping Responses

Consultee	Relevant Matters Raised	Reference in Text
Kildare Co. Co.	"The applicant will be required to submit site investigation details to confirm the location of sand and gravel on the site and that there is no rock within the site which may involve blasting and noise issues".	Paragraph 7.20
Geological Survey of Ireland (GSI)	"*The audit for Co. Kildare was carried out in 2005. The full report details can be found here. Our records show that there are no CGSs in the vicinity of the proposed sand and gravel pit".*	Paragraphs 7.64 to 7.68

Schedule of Works

Desk Study

7.19 A desk study of the site and the receiving environment was completed in advance of undertaking the initial site walkover survey and site investigations. The desk study involved collecting all the relevant geological data for the proposed development and land, soils and geology receiving environment. This included consultation with the following:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Sheet 16 (Geology of Kildare - Wicklow). Geological Survey of Ireland (GSI, 1997);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets;
- General Soil Map of Ireland 2nd edition (www.epa.ie);
- OSI historical 6" and 25" mapping; and,

- OSI Aerial photography.

Site Investigations

7.20 A geological resource assessment of the site was carried out by John Colthurst PhD PGeo (July, 2020) which included the following investigations:

- Investigation drilling (5 no. BHs) by down hole hammer method/reverse circulation;
- Trial pit (1 no.);
- Particle Size Distribution (PSD) analysis (5 no.);
- Mineral soils and subsoils were logged according to BS: 5930:2015 Code of Practice for Ground Investigations.

7.21 The geological resource assessment report by John Colthurst PhD P.Geo is attached as **Appendix 7-1**.

7.22 A geophysical survey of the site was carried out by APEX Ltd (2022) on 15th December 2022 involving 7 no. 2D resistivity profiles and 1 no. seismic refraction profile. Geophysics report attached as **Appendix 7-2**.

7.23 Walkovers, ground surveys and geological mapping were carried out by David Broderick of HES on 11th August 2021, 2nd February 2023 and 4th May 2023.

7.24 Drilling of an additional investigation borehole (BH6) in November 2023.

Assessment Methodology and Significance Criteria

7.25 Refer to Chapter 2.0 of the EIAR for details on the impact assessment methodology (EPA, 2022). In addition to the above methodology, the importance of the land, soils and geological environment receptors was assessed on completion of the desk study and baseline study.

7.26 Using information from the desk study and data from the site investigation, an estimation of the importance of the soil and geological environment within the receiving environment is assessed using the criteria set out in **Table 7-2** (NRA, 2008).

7.27 The statutory criteria for the assessment of likely significant effects then requires that likely effects are described with respect to their extent, magnitude, type (i.e. negative, positive or neutral) probability, duration, frequency, reversibility, and transfrontier nature (if applicable).

7.28 The impact descriptors used in this assessment are those set out in (the EIA Directive) in the Glossary of effects as shown in Chapter 2.0 of this EIAR.

7.29 In addition, the two impact characteristics proximity and probability are described for each impact and these are defined in **Table 7-3**.

Table 7-2: Estimation of Importance of Soil and Geology Criteria (NRA, 2008).

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying site is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site). Well-drained and/or highly fertility soils. Moderately sized existing quarry or pit Marginally economic extractable mineral resource.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying site is moderate on a local scale.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed Wastes. Moderately drained and/or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable Mineral Resource.
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying site is small on a local scale.	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable Mineral Resource.

7.30 In order to provide an understanding of this descriptive system in terms of the geological/hydrological environment, elements of this system of description of impacts are related to examples of potential impacts on the geology and morphology of the existing environment, as listed in **Table 7-4**.

Table 7-3: Additional Impact Characteristics (EPA, 2022)

Impact Characteristic	Degree/ Nature	Description
Proximity	Direct	An impact which occurs within the area of the proposed project, as a direct result of the proposed project.
	Indirect	An impact which is caused by the interaction of effects, or by off-site developments.
Probability	Likely	The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
	Unlikely	The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.

Table 7-4: Additional Impact Characteristics

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
Negative only	Profound	Widespread permanent impact on: • The extent or morphology of a cSAC. • Regionally important aquifers. • Extents of floodplains. Mitigation measures are unlikely to remove such impacts.
Positive or Negative	Significant	Local or widespread time-dependent impacts on: • The extent or morphology of a cSAC / ecologically important area. • A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). • Extent of floodplains. Widespread permanent impacts on the extent or morphology of an NHA/ecologically important area. Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.
Positive or Negative	Moderate	Local time-dependent impacts on: • The extent or morphology of a cSAC / NHA / ecologically important area. • A minor hydrogeological feature.

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
		• Extent of floodplains. Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends
Positive, Negative or Neutral	Slight	Local perceptible time-dependent impacts not requiring mitigation.
Neutral	Imperceptible	No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

Limitations and Difficulties Encountered

7.31 No limitations or difficulties were encountered during the preparation of the Land, Soils and Geology Chapter of the EIAR.

Baseline Conditions

Site Description and Topography

7.32 The site is located in the townland of Coolaght, Kilmeague, Co. Kildare, situated approximately 900m northeast of the centre of Kilmeague village. The site is 8.8km north of Newbridge and 11km northwest of Naas (see Planning Drawing 1).

7.33 The site is extensively covered in mixed woodland (predominately deciduous) that was planted between the years 2002 and 2004. The site is bordered mainly by agricultural lands along with some forestry to the southwest.

7.34 The surrounding landscape is rural in character, consisting of a mix of pasture and arable land, with extensive areas of low grade agricultural land and raised bog in the wider area. The latter has predominately been cutover. The wider area also has several quarries and sand and gravel pits, the nearest of which is immediately northeast of Kilmeague village and discussed below (paragraph 7.40).

7.35 Access to the site is from the L7081 local road to the south. This is an existing forestry track that runs from the existing site entrance to the top of the hill where a telecom mast and associated compound is located.

7.36 Ground levels within the site range from approximately 94m above OD in the southeast near the site entrance to 130m above OD in the north-west where the proposed extraction area/infill area is located.

7.37 The site is located on a local hill where the ground slopes away on all sides with the steepest slopes to the north and south. The top of the hill (130m above OD) roughly aligns with the centre of the proposed extraction area/infill area.

Land & Land-Use

7.38 According to the Corine mapping, the site is mapped as "forest and semi-natural areas". There is also an area of rough grassland located on the southeast off the site as noted on the aerial photography and follow up site walkovers.

7.39 The site is predominately used for forestry as described above. There is also a telecom mast on the north of the site along with some agricultural land and associated buildings on the southeast.

7.40 Landuse in the wider surrounding area is largely agricultural with discontinuous urban fabric mapped to the west at Kilmeague village and to the northeast at Robertstown. A large and heavily cut peat bog is situated roughly 1km to the southeast of the proposed site. There are several residential dwellings located along the L7081 road that borders the site to the south and towards the townland of Kilmeague to the southwest.

7.41 A large gravel pit (Hanlon Concrete Products) is situated 1km north of the site and approximately 0.4km west of the site is the N&C Enterprises Limited pit that is an exhausted sand and gravel pit and currently being infilled and restored (under the waste licence number W0292-01).

Local Soils and Subsoils

Published Mapping

7.42 The published soils map (www.epa.ie) for the area shows that the site is mapped to be overlain by shallow well drained mineral soil (BminSW) while deep well drained mineral soils (BminDW) are mapped in the surrounding lower lying land areas.

7.43 Based on the GSI subsoils map (www.gsi.ie), gravels derived from limestones are mapped within the site and these deposits are mapped to extend further to the east and west of the site also. Refer to **Figure 7-1** for GSI subsoil mapping.

7.44 Tills derived from limestones are mapped in the surrounding areas with cutover raised bogs further afield. The closest bogs are located approximately 1km to the southeast.

Geophysical Survey

7.45 APEX Geophysics Limited conducted a geophysical survey of the site on 15th December 2022 which consisted of 2D Electrical resistivity Tomography (ERT) and Seismic Refraction profiling EM31. Refer to **Appendix 7-2** for the geophysical report.

7.46 The geophysical data indicates soils comprising of 'clean' SAND/GRAVEL, silty SAND/GRAVEL in the centre of the overall site with clayey SAND/GRAVEL and sandy gravelly CLAY across the southeast of the site near the site entrance.

7.47 The 'clean' SAND/GRAVEL and the silty SAND/GRAVEL were estimated to have an average thickness of 24.5m at the survey locations.

7.48 No geophysics was carried out on the highest point of the site (where the sand and gravel deposits are deepest) due to forestry coverage.

Investigation Drilling

7.49 5 no. investigation boreholes were drilled by Peterson Drilling Services Ltd close to the boundaries of the site between the 12th and 23rd March 2020. An additional borehole (BH6) was drilled near the centre of the site on 6th November 2023 Refer to **Table 7-5** below for summary logs and for detailed logs refer to **Appendix 7-3.** The borehole locations are shown on **Figure 7-1**.

7.50 Clean sand and gravel deposits with minor silty horizons was encountered in all boreholes. Bedrock was also encountered in all 6 no. boreholes.

7.51 The thickness of sand and gravel deposits varied between 15.8m (@BH5 where the ground level is approximately 101m OD) and 46m (@BH6 where the ground level is at approximately 129m OD).

7.52 BH6 is located close to the central area of the proposed extraction area/infill area where the ground level is highest (i.e. 130m OD on top of hill).

7.53 The Particle Size Distribution (PSD) analysis report sand and gravels with overall fines of <10%.

Table 7-5: Investigation Drilling Summary Logs

Monitoring Well	Total Depth of Drilling (m)	Depth to Bedrock (m)	Bedrock Elevation (m OD)	Bedrock Geology Description	Depth Interval (m)
BH1	23	20.7	80.5	Topsoil Silty sand Sand and Gravel Red MUDSTONE	0 – 0.25 0.25 – 3.20 3.20 - 20.70 20.70 - 23
BH2	38	32.8	89.03	Topsoil Sand and Gravel Silty horizon Sand and Gravel Reddish gravelly sand, could be partly broken bedrock Fine grained weathered red SANDSTONE	0 – 0.3 0.3 – 13.3 13.3 - 13.5 13.5 - 29.5 29.5 - 32.8 32.8 - 38
BH3	35	33.6	85.11	Topsoil Silty Clay Sand and Gravel Reddish brown sandy gravel, could be partly broken bedrock Fine grained red SANDSTONE	0 – 0.3 0.3 – 0.8 0.8 - 31.0 31.0 - 33.6 33.6 - 35

Monitoring Well	Total Depth of Drilling (m)	Depth to Bedrock (m)	Bedrock Elevation (m OD)	Bedrock Geology Description	Depth Interval (m)
BH4	35	33.2	83.91	Topsoil Sand and Gravel Reddish sand and gravel, could be partly broken bedrock Fine grained reddish SANDSTONE	0 – 0.3 0.3 – 30.8 30.8 - 33.2 33.2 - 35
BH5	20	15.8	85.38	Topsoil Sand and Gravel Silty sand and gravel Grey shaly calcareous MUDSTONE	0 – 0.2 0.2 – 11.5 11.5 - 15.8 15.8 - 20
BH6	47.5	46	83.0	Topsoil Slightly gravelly SAND gravelly SAND SAND and GRAVEL Sandy SILT Sandy GRAVEL Weathered red SANDSTONE	0 - 0.3 0.3 - 19.0 19.0 - 27.4 27.4 - 30.5 30.5 - 31.0 31 - 46.1 46.1 - 47.5

Bedrock Geology

Published Mapping

7.54 Based on the GSI bedrock geology map (www.gsi.ie), the bedrock is mapped as Devonian aged Old Red Sandstone rocks for the majority of the site while the Ferbane Mudstone Formation (Dinantian (early) Sandstones) and Cloghan Sandstone Formation are mapped to underlie the far eastern portion of the site. GSI bedrock mapping is shown as **Figure 7-2**.

7.55 The Devonian aged Old Red Sandstone consists of red conglomerate, sandstone & mudstone. The basal Carboniferous Ferbane Mudstone, mapped directly east of the site is described as laminated & burrowed shale & sandstone and further east the Cloghan Sandstone comprises thick-bedded grey sandstone with shale.

7.56 There are no faults mapped by the GSI in the area of the proposed development site. The closest fault is mapped 1.2km to northwest of the site. The fault exists between Old Red Sandstones and the muddy limestones which extend westerly from the Old Red Sandstones.

Site Investigations

7.57 The bedrock encountered at the 6 no. boreholes was logged as reddish SANDSTONE (@BH2, BH3, BH4 & BH6) or grey/red MUDSTONE (@BH1 & BH5).

7.58 The GSI mapped geology at BH2, BH3, BH4 & BH6 is SANDSTONE and the mapped geology at BH1 and BH5 is MUDSTONE, which is consistent with the findings of the drilling.

7.59 The upper few meters of the SANDSTONE and MUDSTONE is described as weak and weathered.

7.60 At the borehole locations, top of bedrock elevation across the site varies between 89m OD on the northwest of the site (@BH2) to 80.5m OD on the south of the site (@BH1). The top of bedrock elevation across the north and east of the site range between 83 and 85m OD.

7.61 The top of bedrock below the highest point of the site (i.e. central area of the proposed extraction/ infill) was met at 83m OD (BH6).

Economic Geology

7.62 The GSI database[1] shows that the site is located in an area of High Potential for granular aggregate and Moderate Potential for crushed aggregate.

7.63 The sand and gravels at the site could be classified as having a high importance (refer to **Table 7-2**). The sand and gravel deposits are a proven economically extractable mineral resource for construction purposes, and this is supported by the long history of aggregate extraction in the area.

Geological Heritage Sites and Designated Sites

7.64 The proposed site is not located within any geological heritage site. The closest geological heritage site is the Hill of Allen (site code KE003) at approximately 3km southwest of the site. The Hill of Allen has been quarried on its northwest face. The quarry has exposed part of the Allen Andesite Formation, a massive andesitic lava, which in places within the quarry is porphyritic. Refer to **Figure 7-3** for local designated sites and geological heritage sites.

7.65 Designated sites include Natural Heritage Areas (NHAs), proposed Natural Heritage Areas (pNHAs), Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs). The closest designated site to the proposed development site is the Grand Canal pNHA (Site Code: 002104) which is located ~1.7km to the north of the site and Ballynafagh Lake SAC (Site Code: 001387) which is situated approximately 2.9km northeast of the site.

7.66 Ballynafagh Bog SAC (Site Code: 000391) is situated south of Ballynafagh Lake approximately 5km northeast of the site, whilst Hodgestown Bog NHA (Site Code: 001393) is located northwest of Ballynafagh Lake approximately 5.5km north of the proposed site.

7.67 Approximately 3.3km south of the site is the Mouds Bog SAC (Site Code: 002331) and pNHA (Site Code: 000395). The site comprises a raised bog that includes both areas of high bog and cutover bog. Pollardstown Fen SAC and pNHA (Site Code: 000396) is situated on the northern margin of the Curragh of Kildare, approximately 6.5km south of the site.

7.68 No direct or indirect effects on local geological heritage sites or designated sites are expected from a land, soils and geology perspective. Potential indirect hydrological/hydrogeological effects are assessed in Chapter 8 – Water.

[1] Source: GSI online Aggregate Potential Mapping Database

Soil Contamination

7.69 There are no known areas of soil contamination at the site or in the surrounding area. During the site walkover and site investigations, no areas of contamination concern were identified and the results from the groundwater sampling (refer to Chapter 8 – Water) also indicate no soil contamination issues.

7.70 According to the EPA online mapping (http://gis.epa.ie/Envision), N&C Enterprises Limited is an exhausted sand and gravel pit located 0.4km to the west of the site that is currently being infilled (under the licence number W0292-01). The pit is being infilled with inert soil and stone.

7.71 As the proposed development is largely a greenfield site, no historical contamination issues would be expected. According to historic 25" mapping a historic gravel pit was located in the southern section of the Proposed site. There are no known historic mines at or in the immediate vicinity of the proposed development, that could potentially have contaminated tailings.

Geohazards

7.72 The GSI Landslide database (www.gsi.ie) does not record any historic landslides in the vicinity of the site or in the surrounding lands.

7.73 The GSI Landslide Susceptibility Map (www.gsi.ie) classifies the probability of a landslide occurring at a given location. The probability of a landslide occurring at the proposed development site is mapped as being Low.

7.74 Based on EPA Radon Risk mapping, the Site is located in a "Medium Risk" area. The proposed development of the Site is not expected to alter the baseline EPA risk rating.

Characteristics of the Proposed Development

Construction Phase – Aggregate Extraction

7.75 Construction phase activities include:

- The removal of woodland, vegetation and topsoil.
- Approximately 93,000m^3 of topsoils will be removed which will be used to create screening berms within the site.
- Extraction of sand and gravel on a phased basis from an area of c. 8.65 ha to a final floor level at 95m above OD which is above the highest recorded bedrock level (~89m above OD @BH2) and groundwater level (refer to Chapter 8 Water).

Operation Phase – Soil Recovery Facility and Aggregate Extraction

7.76 It is proposed to fill the pit void with either:

- Inert soil and stone classified as a waste (imported inert greenfield and non-greenfield soils and stone, and river dredge spoil) operating as a soil recovery facility that will require a waste management licence authorised by the EPA or initially a waste permit authorised by the Local Authority; or,

- Soil and stone by-product (i.e. virgin soil or equivalent to virgin soil and stone and dredge material) which will be notified to the EPA as an Article 27 by-product at the source location, and the Site will be authorised by the Local Authority planning conditions.

Restoration Phase

7.77 Restoration phase activities include:

- The extraction area will be infilled on a phased basis with ground levels ultimately being restored back to original levels pre extraction;
- The restored ground will be planted with a suitable mix of woodland planting;
- All existing boundary fences and hedgerows will be retained to ensure that the site is secure; and,
- All plant and machinery will be removed from the pit void.

Potential Significant and Likely Effects

Construction Phase Effects

Extraction of Soil and Subsoils

7.78 The proposed development will involve the relocation and storage of approximately 93,000m^3 of topsoil and the extraction of 4 million tonnes of sand and gravel down to a level of 95m above OD over an area of 8.65ha.

7.79 The topsoil will be removed in phases and this will be used to construct a temporary berm along the site boundary and then ultimately used in the restoration of the site post extraction. For example, overburden material removed during the construction phase will be used to restore the pit floor during the restoration phase. This will continue to be the case with further phases of extraction.

7.80 Receptor: Soils and subsoils

7.81 Pathway/Mechanism: Site preparation works and aggregate extraction.

7.82 Pre-mitigation Effect: Negative, irreversible, moderate, direct, likely, permanent effect on soil and subsoils.

Contamination of Soil and Subsoils from Oil / Fuel Spills and Leaks

7.83 Excavation, processing and transporting of aggregate at the site will be completed using machinery. Such machinery is powered by diesel engines and operated using hydraulics. Unless managed carefully such plant and machinery have the potential to leak hydraulic oils or cause fuel leaks during refuelling operations.

7.84 Only small volumes of fuel/oils will be present on-site and therefore no significant effects are expected as long at standard mitigation is implemented.

7.85 Receptor: Soil and Subsoils.

7.86 Pathway: Soil and bedrock pore space.

7.87 Pre-mitigation Impact: Negative, reversible, slight, direct / indirect, unlikely, long term effect on soil and subsoils.

Land Use Change Effects

7.88 The construction phase will result in the temporary loss of approximately 8.5ha of forestry/mixed woodland. The extraction will result in local topographic changes with the removal of sand and gravel deposits down to 95m OD from a maximum original ground level of 130m OD. There will be no effects on the lands adjoining the proposed development site.

7.89 Receptor: Land and Landuse.

7.90 Pathway: Aggregate extraction.

7.91 Pre-mitigation Impact: Negative, moderate, direct, likely, temporary effect on land and landuse.

Erosion of Exposed Soil and Subsoil

7.92 There is a high likelihood of erosion of soil and subsoil during its excavation and during extraction works. The main impacts associated with this aspect is to the water environment, and therefore this aspect is further assessed in detail in Chapter 8.

7.93 Receptor: Soil and Subsoil

7.94 Pathway: Vehicle movement, surface water and wind action.

7.95 Pre-mitigation Impact: Negative, slight, direct, short-term, likely effect on soil and subsoils by erosion and wind action.

Operational Phase Effects

Contamination Effects due to Unsuitable Imported Material

7.96 The imported material will comprise either;

- Inert soil and stone classified as a waste (imported inert greenfield and non-greenfield soils and stone, and river dredge spoil) operating as a soil recovery facility which will require a waste management licence authorised by the EPA; or
- Soil and stone by-product (i.e., virgin soil or equivalent to virgin soil and stone and dredge material) which will be notified to the EPA as an Article 27 by-product at the source location and with the Site authorised by the Local Authority planning conditions.

7.97 Infilling of the proposed site with inert soil and stone or Article 27 by-product will pose a very low contamination risk as no harmful contaminants will be present. In addition, the proposed infill material will not contain either organic matter or liquids that will form a source of organic contamination.

7.98 Receptor: Soil, subsoil and bedrock pore space at the proposed development site.

7.99 Pathway: Soil, subsoil and bedrock

7.100 Pre-mitigation Potential Impact: Negative, slight, direct / indirect, likely, long term effect on soil, subsoil and bedrock.

Contamination of Soil/Bedrock by Leakages and Spillages

7.101 Similar to the construction phase, plant and machinery will also be required during the operational phase. Accidental spillage during refuelling of construction plant with hydrocarbons is a pollution risk.

7.102 Only small volumes of fuel/oils will be present on-site and therefore no significant effects are expected as long at standard mitigation is implemented.

7.103 Receptor: Soil, subsoil and bedrock at the site

7.104 Pathway: Transport through soil, subsoil and bedrock pore space

7.105 Pre-mitigation Potential Impact: Negative, slight, direct, long term, unlikely impact on soil, subsoil and bedrock.

Restoration Phase

Reinstatement of the Quarry Ground Profile and Land-use Change

7.106 Once operational works are completed, the extraction area will be restored using the topsoil removed and stored during the construction phase

7.107 The restored ground will be planted with a suitable mix of woodland planting. All existing boundary fences and hedgerows will be retained to ensure that the site is secure. All plant and machinery will be removed from the pit void.

7.108 Receptor: Land, soils and geology at the proposed development site.

7.109 Pathway: Importation and infilling of quarry void at the proposed development site.

7.110 Pre-mitigation Potential Impact: Positive, moderate, direct, likely, permanent effect on land, soils and geology.

Mitigation Measures

Construction Phase

Extraction of Soil and Subsoils

7.111 Mitigation measures are as follows:

- Site earthworks and aggregate extraction will result in a direct impact on the local geological environment, albeit this is an acceptable and unavoidable part of the proposed sand and gravel pit development. These impacts will be localised (i.e. only at the point of extraction) and will be mostly mitigated through the adoption of a suitable landscape and restoration plan which will be undertaken after the operational phase and on completion of infilling.
- The soil and subsoil which will be removed are not notable from a geological heritage point of view and are widely abundant in the area. The stripped topsoil will be used to form a berm along the western and southeastern boundary and for the ultimate restoration of the site.

Contamination of Soil and Subsoils from Oil / Fuel Spills and Leaks

7.112 Mitigation measures are as follows:

- All plant and machinery will be serviced before being mobilised to site;
- Refuelling will be completed in a controlled manner using drip trays (bunded container trays) at all times;
- Drip-trays will be used for fixed or mobile plant in order to retain oil leaks and spills;
- Only designated trained operators will be authorised to refuel plant on site;
- Oils and lubricants will be stored on drip pallets in a designated hardstand area that will drain to an oil interceptor;
- Procedures and contingency plans will be set up to deal with emergency accidents and spills; and,
- An emergency spill kit with oil boom, absorbers etc. will be kept on site for use in the event of an accidental spillage.

Erosion of Exposed Soil and Subsoil

7.113 Mitigation measures are as follows:

- Soil removed from extraction areas to be used to create a boundary berm around the application site;
- Any potential for erosion will be contained within the pit;
- Pit wall slope angles have been designed in accordance with industry standard parameters to prevent slope failure;
- Where possible, the upper vegetative layer (where still present) will be stored with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation at the surface of the stored soil within the soil storage areas; and,
- Re-seeding and spreading/planting will also be carried out in these areas.

Operational Phase

Contamination Effects due to Unsuitable Imported Material

7.114 The following proposed mitigation measures are applicable to the site under both forms of operation (Inert soil and stone importation and Article 27 by-product material importation).

7.115 If inert soil and stone waste materials are being accepted acceptance criteria for the incoming materials would need to be adhered to as per the EPA Guidance on Soil Recovery Waste Acceptance Criteria.

7.116 If by-product materials are being accepted then - then the proposed development would be operated in accordance with the document titled "*Consultation Paper Regulation 27(7) National By-Product Criteria for Greenfield Soil and Stone used in Developments*".

7.117 Proposed mitigation measures include:

- Sourcing material that is proven to be inert prior to transport to the site;
- Pre-agreed source sites for inert material ensuring; no pollutants, unauthorised material, invasive species;
- Regular checks of incoming loads to ensure suitability of imported material;
- The site will be operated under an Environmental Management System;
- All required pollution prevention measures will be implemented at the site;
- The operator will prepare and implement an Emergency response procedure;
- The operator will complete environmental monitoring, including local groundwater and surface water monitoring;
- A phased restoration of the site will be implemented, with species rich grassland and woodland;
- The operator will have a documented waste recording procedure for all material entering the site; and,
- No unauthorised dumping of waste will be allowed at the site as the site will be secured top prevent access.

Contamination of Soil and Subsoils from Oil / Fuel Spills and Leaks

7.118 Refer to the construction phase mitigation for measures relating oils and fuels.

Restoration Phase

Reinstatement of the Ground Profile and Land-use Change

7.119 The reinstatement of the site is seen as a positive effect with respect to land, soils and geology. The mitigation will include the adoption of suitable restoration plan which considers the natural local topography and land-use.

7.120 The restoration will comprise of the placement of the topsoil and subsequent tree planting to establish a habitat similar to that which existed prior to the development. The restoration of the site will only cover the extraction/infill area. Livestock proof fencing will be installed along the boundaries of the infill area.

7.121 The intention for the site is to introduce a suitable mix of woodland planting.

7.122 All plant and equipment will be removed from the site.

'Do-Nothing' Scenario

7.123 If the proposed development does not go ahead, the site will remain as a greenfield site with forestry and mixed woodland.

Cumulative Effects

7.124 The other land use activities in the immediate area are mainly agricultural, plantation forestry, quarries/sand and gravel pits, farming and residential land uses.

7.125 Off-site activities and projects will have no potential to interact with the proposed development from a cumulative impact perspective relating to land, soils and geology.

7.126 Due to the relatively small scale of the proposed development and the lack of significant residual impacts from the development that would affect the wider environment, there will be no significant cumulative impacts to land, soils and geology resulting from this project and other local existing developments, projects and plans. All effects on land, soils and geology relating to the proposed project will be localised and within the development site.

7.127 Off-site hydrological cumulative effects are dealt with in Chapter 8 (Water).

Human Health Effects

7.128 Potential health effects arise mainly through the potential for soil and ground contamination. The proposed development site is not a recognized source of pollution (e.g. it's not a hazardous waste management site, or a chemical plant), and so the potential for negative effects is negligible.

7.129 Proper sourcing of inert material prior to transport to the site, pre-agreed source sites for inert material and regular load checks of incoming loads will ensure the safety of imported material.

7.130 Hydrocarbons will be used onsite particularly during construction and operational phase; and will be handled and stored in accordance with best practice mitigation measures. The potential residual effects associated with soil or ground contamination and subsequent health effects are imperceptible.

Unplanned Events

7.131 Accidents, malfunctions and unplanned events refer to events or upset conditions that are not part of any activity or normal operation of the planned development.

7.132 Most accidents, malfunctions and unplanned events are, however, preventable and can be readily addressed or prevented by good planning, design, emergency response planning, and mitigation.

7.133 In terms of the land, soils and geology environment, the impacts of any unplanned events are considered to be negligible. The mitigation measures in relation to leakages/spillages will mean that there will be no significant effects on the land, soils and geology environment in the event of an unplanned event/accident.

7.134 Pit wall slope angles have been designed in accordance with industry standard parameters to prevent slope failure.

Residual Effects

Construction Phase

Extraction of Soil and Subsoils

7.135 Site earthworks and aggregate extraction will result in a direct impact on the local geological environment, albeit this is an acceptable and unavoidable part of the proposed sand and gravel pit development. These impacts will be localised (i.e., only at the point of extraction)

and will be mostly mitigated through the adoption of a suitable landscape and restoration plan which will be undertaken during the extraction phase and on completion of extraction.

7.136 The residual effect is negative, irreversible, moderate, direct, likely, permanent effect on soil and subsoils.

7.137 No significant effects on soils and subsoils are anticipated.

Contamination of Soil and Subsoils from Oil / Fuel Spills and Leaks

7.138 The use and storage of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks have been proposed above and will break the pathway between the potential source and the receptor.

7.139 The residual effect will be negative, reversible, imperceptible, direct, short-term, unlikely effect on soils, subsoils and bedrock.

7.140 No significant effects on soil or subsoil are anticipated.

Erosion of Exposed Soil and Subsoil

7.141 Soils and spoil can be eroded by vehicle movements, wind action and by water movement. To prevent this, all excavation works and soil storage will be completed in accordance with best practice methods, material will be moved the least possible distance, and reseeding and planting will be completed.

7.142 Following implementation of these measures the residual effect will be negative, imperceptible, direct, short-term, likely effect on soils and subsoils by erosion and wind action.

7.143 No significant effects on soil or subsoil are anticipated.

Operational Phase

Contamination Effects due to Unsuitable Imported Material

7.144 The importation of soil and subsoil (either as inert soil and stone waste or Article 27 by-product material importation) is an integral part of the proposed development. Proven and effective control measures to mitigate the risk of contaminated soils being imported to the Site are outlined above. Application of these controls will break the pathway between the potential source and the receptor.

7.145 The residual effect will be neutral, imperceptible, direct / indirect, likely, long term effect on the land, soil and geology environment.

Contamination of Soil/Bedrock by Leakages and Spillages

7.146 The use of hydrocarbons and small volumes of chemicals is a standard risk associated with all construction sites. Proven and effective measures to mitigate the risk of spills and leaks

have been proposed above and will break the pathway between the potential source and the receptor.

7.147 The residual effect will be negative, imperceptible, direct, short term, unlikely effect on the land soils and geology environment.

Restoration Phase

Reinstatement of the Quarry Ground Profile and Land-use Change

7.148 Restoration of pre-quarrying topography and land-use will occur, and this will result in a positive, moderate, direct, permanent, likely effect on the land, soils and geology environment.

References

British Standards Institution (BSI). (2015) BS5930 - Code of Practice for Site Investigations.

Department of Housing, Planning and local Government, 2018: Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment.

Environmental Protection Agency (2022): Guidelines on the Information to be contained in Environmental Impact Assessment Reports.

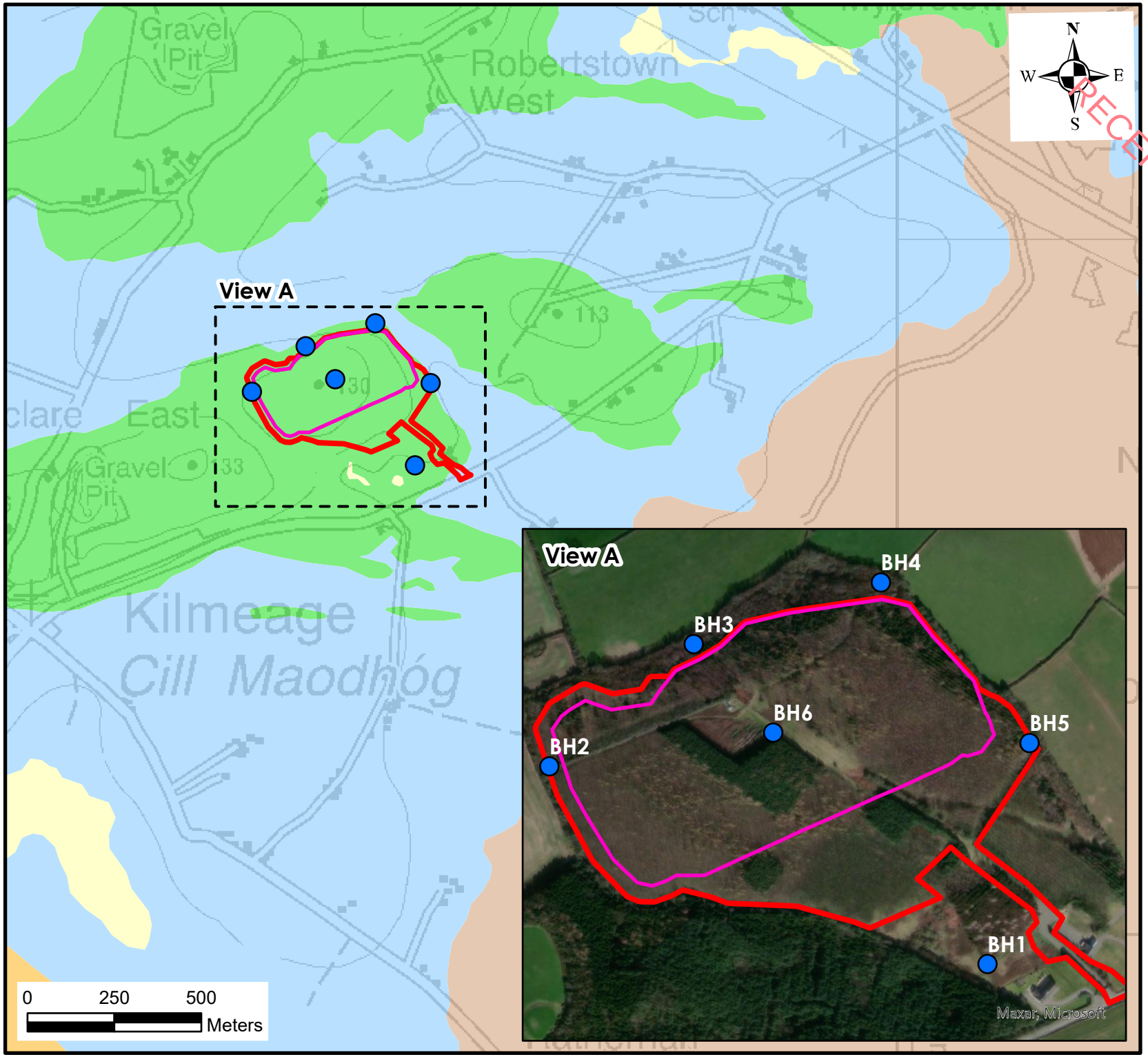
European Union, 2017: Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU).

Geological Survey of Ireland (GSI). (1997) Geology of Kildare - Wicklow, 1:100,000 scale Bedrock Geology Series, Sheet 16.

Institute of Geologists Ireland (2013): Guidelines for Preparation of Soils, Geology & Hydrogeology Chapters in Environmental Impact Statements.

National Roads Authority (2008): Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes.

FIGURES



Legend

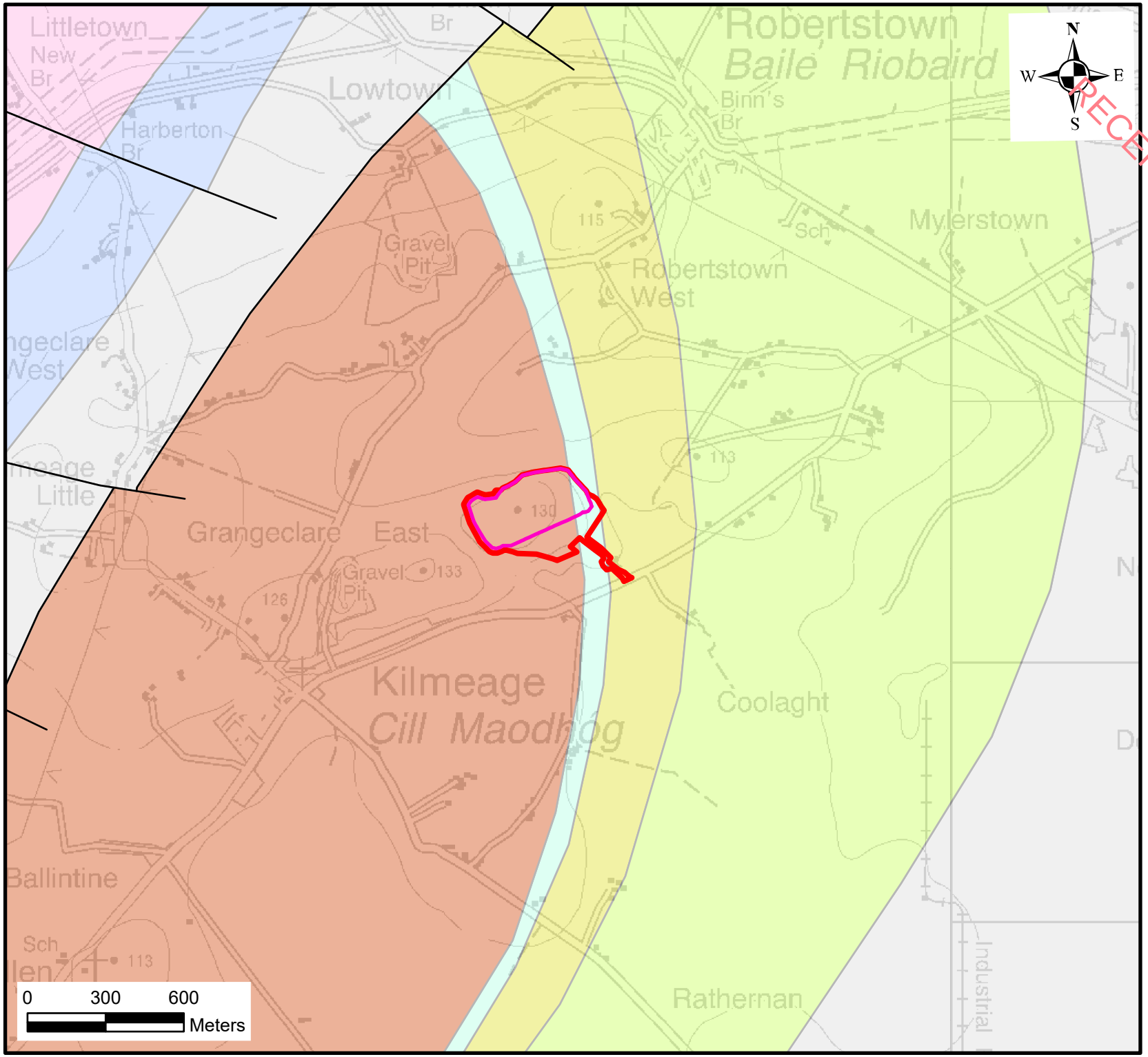
- Application Area
- Extraction - Infill Area
- Borehole locations

Subsoils

- A, Alluvium
- Cut, Cut over raised peat
- GLs, Gravels derived from Limestones
- L, Lacustrine sediments
- TLs, Till derived from limestones

HYDRO ENVIRONMENTAL SERVICES
22 Lower Main St
Dungarvan
Co.Waterford
Ireland
tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Client: Quarry Consulting	
Job: Kilmeague Sand & Gravel Pit, Co. Kildare	
Title: Local Subsoils Map	
Figure No: 7-1	
Drawing No: P1512-0-0224-A4-701-00A	
Sheet Size: A4	Project No: P1512-0
Scale: 1:15,000	Drawn By: GD
Date: 06/02/2024	Checked By: MG



Legend

- Application Area
- Extraction - Infill Area
- Geological Linework

Bedrock

- Allenwood Formation
- Boston Hill Formation
- Clashen Sandstone Formation
- Feighcullen Formation
- Ferbane Mudstone Formation
- Old Red Sandstone (undifferentiated
- Waulsortian Limestones

HYDRO ENVIRONMENTAL SERVICES
22 Lower Main St
Dungarvan
Co.Waterford
Ireland
tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Client: Quarry Consulting

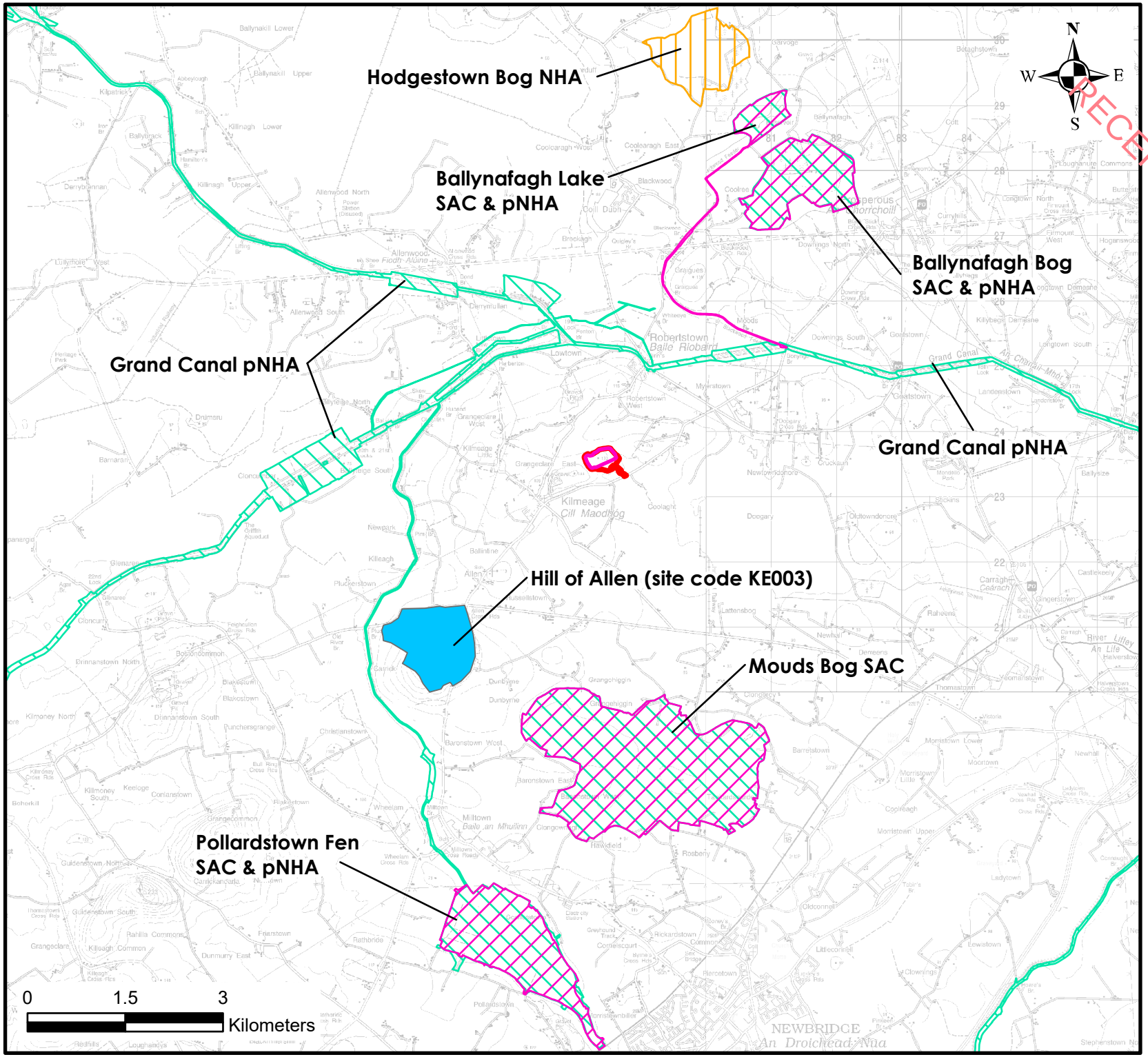
Job: Kilmeague Sand & Gravel Pit, Co. Kildare

Title: GSI Bedrock Map

Figure No: 7-2

Drawing No: P1512-0-0224-A4-702-00A

Sheet Size: A4	Project No: P1512-0
Scale: 1:20,000	Drawn By: GD
Date: 06/02/2024	Checked By: MG



Legend

- Application Area
- Extraction - Infill Area
- SAC
- pNHA
- NHA

Geological Heritage Sites

- Hill of Allen

HYDRO ENVIRONMENTAL SERVICES
22 Lower Main St
Dungarvan
Co.Waterford
Ireland
tel: +353 (0)58 44122
fax: +353 (0)58 44244
email: info@hydroenvironmental.ie
web: www.hydroenvironmental.ie

Client: Quarry Consulting

Job: Kilmeague Sand & Gravel Pit, Co. Kildare

Title: Geological Heritage Sites and Designated Sites Map

Figure No: 7-3

Drawing No: P1512-0-0224-A4-703-00A

Sheet Size: A4 | Project No: P1512-0

Scale: 1:80,000 | Drawn By: GD

Date: 06/02/2024 | Checked By: MG

APPENDICES

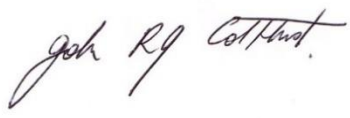
Report on a Sand and Gravel Resource at Grangeclare East,

Kilmeague, County Kildare

Report for: Joseph Logan

7th July 2020

Prepared by:



EurGeol John Colthurst PhD PGeo

Blackhall,

Clane,

County Kildare

Phone 045 868868 or 087 2054842

E-mail: john.colthurst1@gmail.com

Introduction

A deposit of sand and gravel is present in the townland of Grangeclare East, Kilmeague, County Kildare.

The deposit is located between Kilmeague and Robertstown (Figure 1).

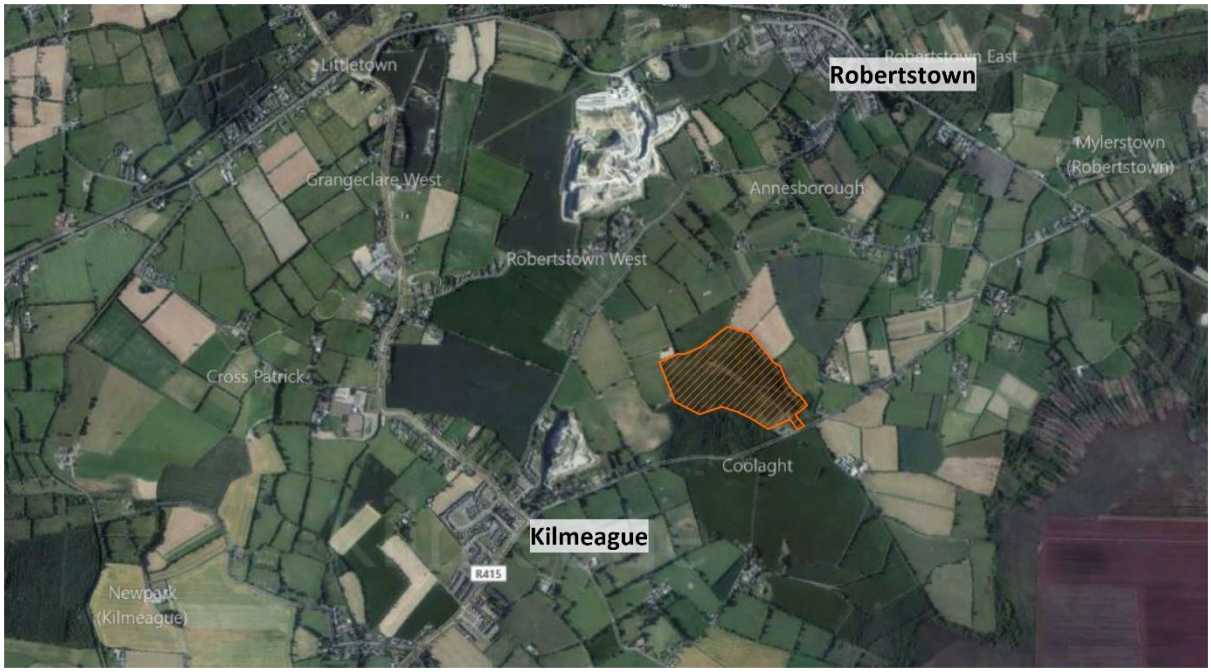


Figure 1. Location of the sand and gravel deposit, outlined in orange and cross-hatched.

The deposit forms a prominent hill, rising to 131m in a generally flat area at an elevation of 100m or less.

The deposit is presently covered with commercial forestry, planted approximately 20 years ago. The forestry is mixed with both deciduous and coniferous species present. Species include ash, sycamore, beech, oak, alder, larch and Sitka spruce.

The site is accessed by an unsurfaced track, starting at the public road and running in a north-westerly direction as far as a communications mast on the summit of the hill.

Geology

Figure 2 and figure 3 are downloaded from the Geological Survey website. The Sand and Gravel site is shown as underlain by Devonian aged Old Red Sandstone rocks. These are shown as overlain to the east by basal Carboniferous Ferbane Mudstone and Cloghan Sandstone. There is little or no bedrock exposure in the area, but the Geological Survey interpretation is remarkably accurate as proved by the well-drilling done on the site.

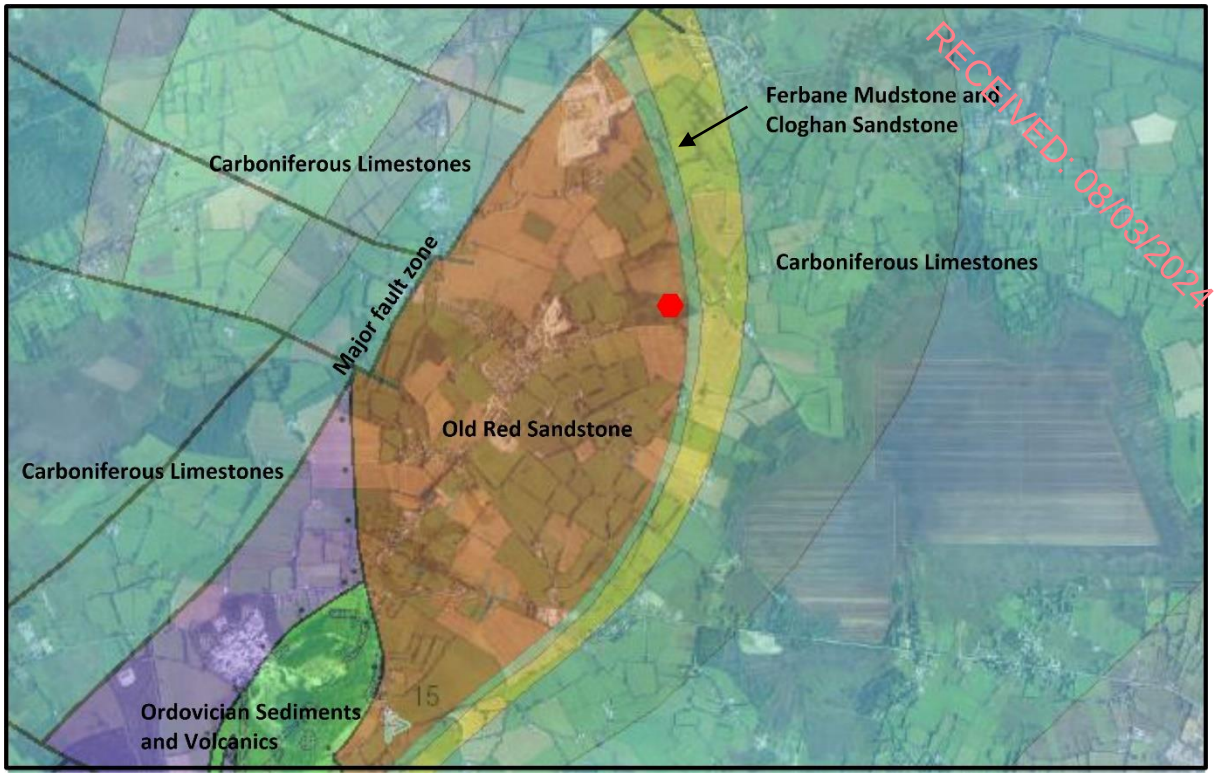


Figure 2. Bedrock Geology of the area around Kilmeague, taken from the Geological Survey of Ireland. The position of the sand and gravel site is indicated by a red octagon.

Figure 3. Quaternary Geology of the area around Kilmeague taken from the Geological Survey of Ireland. Sand and gravel deposits are in green, till in pale blue-green, and peat in brown. Note the large gravel pit (Hanlon Concrete Products) north of the site and the exhausted pit, west of the site.

An initial deskstop study concluded that there could be a gravel resource up to 30m thick on the site. Examination of an adjacent gravel pit revealed good quality limestone gravel and sand with little silt or clay and a decision was taken to carry out the initial investigation of the sand and gravel resource.

Peterson Drilling Services Limited were contracted to drill five boreholes on the site. The method used was Cased Down the Hole Hammer Drilling. This ensured good penetration even through boulders and very dense material. The holes are used as groundwater monitoring wells as well as providing continuous samples through the gravel and into underlying bedrock.

Peterson Drilling Services started drilling on the 12/3/2020 and completed the last of the five boreholes on 23/3/2020. All holes were completed as planned and all five intersected bedrock under thick sand and gravel.

Stephan Peterson provided his drill logs and detail of the Standpipe Installation for all 5 boreholes.

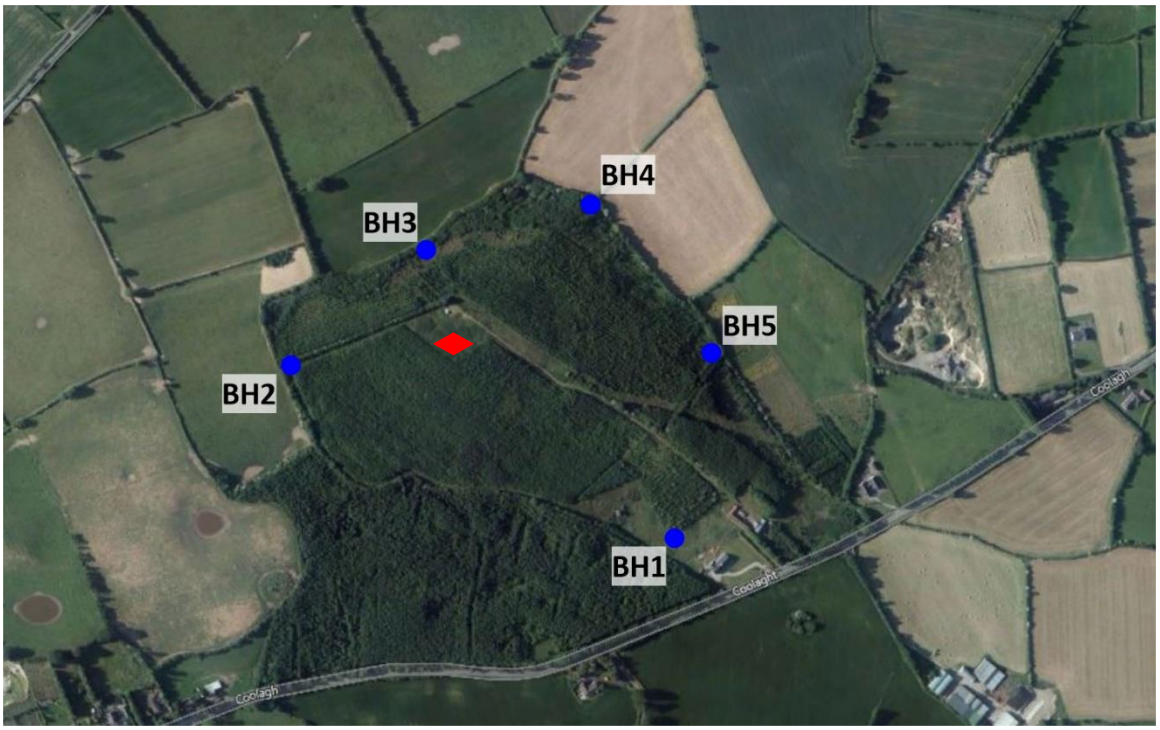


Figure 4 Borehole locations. The red diamond marks the location of the bulk sample pit.

The boreholes can be summarised as follows:

BH1, collar elevation 109.39m

0-0.25m	Topsoil
0.25-3.20m	Silty sand
3.20-20.70m	Sand and gravel
20.70-23m	Red mudstone

BH2, collar elevation 122.43m

0-0.3m	Topsoil
0.3-13.3m	Sand and gravel
13.3-13.5m	Silty horizon
13.5-29.5m	Sand and gravel
29.5-32.8m	Reddish gravelly sand, could be partly bedrock?
32.8-38m	Fine grained weathered red sandstone.

BH3, collar elevation 119.31m

0-0.3m	Topsoil
0.3-0.8m	Silty clay
0.8-31.0m	Sand and gravel
31.0-33.6m	Reddish brown sandy gravel, could be partly bedrock?
33.6-35m	Fine grained red sandstone

BH4, collar elevation 117.71m

0-0.3m	Topsoil
0.3-30.8m	Sand and gravel
30.8-33.2m	Reddish sand and gravel, could be partly bedrock
33.2-35m	Fine grained reddish sandstone

BH5, collar elevation 101.78m

0-0.2m	Topsoil
0.2-11.5m	Sand and gravel
11.5-15.8m	Silty sand and gravel
15.8-20m	Grey shaly calcareous mudstone

Standpipes were installed in all five boreholes. The details of each installation were provided by Peterson Drilling Services and are included in the Appendix.

Figure 5. Drill rig in operation on the site of BH5

In addition to the drilling Ger Birchall dug a pit close to the radio mast and extracted a bulk sample of the sand and gravel on 25th March 2020, site marked by red diamond, figure 4, and this bulk sample was stored with the drilled samples.

Figure 6. Trial pit for bulk sample.

Figure 7. Sand and gravel extracted from the trial pit.

On 26th March John Colthurst examined the drill cuttings and the samples collected from the trial pit and he prepared 3 bulk samples for testing by Testall.

Each bulk sample consists of approximately 120Kgs of material. Two of the bulk samples were made up of material from boreholes BH2 (3m-29m) and BH3 (3m-31m) and the third one was material from the Trial Pit.

John Colthurst examined the drill cuttings from all five boreholes.

Figure 8. Bagged and labelled samples, laid out in sequence, BH2

The logs provided by Peterson Drilling are accurate in every sense.

Additional Comments are as follows:

BH1 There is a minor amount of silt in the first 3m. This may represent a small silty depression on top of the gravels. The remainder of the Borehole is good quality sand and gravel. Bedrock was intersected at 20.7m and it is a fine-grained red mudstone.

BH2 This is good quality sand and gravel, except for a 20cm silty lens at 13.3m. The last 3m from 29.5m is redder in colour than the overlying sand and gravel. This material contains more sandstone and less limestone than the overlying gravels and is probably locally sourced.

Figure 9 Washed Gravel, 9-12m BH2

Figure 10. Washed material from 29.5m in BH2. Note pieces of red sandstone, vein quartz, and Ordovician andesite

Bedrock in BH2 is red sandstone and is coarser grained than the red mudstone in BH1. Both lithologies are typical of the Devonian Old Red Sandstone.

Figure 11. Red Sandstone bedrock in BH2. There is also quite a lot of white vein quartz. A few exotic fragments including the green andesite, behind the €1 coin may have fallen down the hole.

BH3 This is good quality sand and gravel, but immediately above the bedrock from 31m down there is a reddish gravel like the material illustrated in Figure 8. Bedrock is red sandstone.

Figure 10. Red sandstone bedrock in BH3.

BH4 Very similar to BH3. Good quality gravel with reddish gravel above the bedrock. Bedrock is red sandstone.

BH5 Good sand and gravel down to 11.5m. The interval from 11.5-15.8m is described as silty sand and gravel by Stephan Petersen. This material is very silty and contains wet clay. It may not be useable, but in any case, is likely to be below the level of extraction. This borehole finishes in soft grey calcareous mudstone. This mudstone is probably the Ferbane Mudstone Formation which directly overlies the Old Red Sandstone.

Figure 11. Washed sand and gravel, 10m, BH5

Figure 12. Grey calcareous mudstone, BH5

The bulk sample was also washed and examined.

Figure 13. Washed trial pit sample

Table 1 Components in Washed Trial Pit sample	Sample %	Age
Dark grey fine-grained limestone	55%	Carboniferous
Pale grey Waulsortian Reef/ Visean Shelf/ Oolite	28%	Carboniferous
Yellow and Brown Sandstone	8%	Devonian
Andesitic volcanics	3%	Ordovician
Siltstones	3%	Carboniferous?
Calcite, quartz, chert, others	3%	
	100%	

A testing programme was agreed with Testall. Split each sample from BH2, BH3 and the Trial pit into a 0/4mm fraction and 4mm plus fraction. Note that the largest pieces from the boreholes are ≤20mm as the drilling process fragments anything >20mm.

Samples from Boreholes 2 and 3 and the Trial Pit were tested as outlined below:

Test	0/4mm sand unwashed	10/14mm chips (boreholes) or pebble (trial pit)
Total Sulphur	Yes	Yes
Acid Soluble Sulphate	Yes	Yes
Water Soluble Sulphate	Yes	Yes
Los Angeles value	No	Yes
Magnesium Sulphate Soundness	No	Yes
Water Absorption	Yes	Yes
Particle Density	Yes	Yes
Methylene Blue	Yes	No
Calcium Carbonate Content	Yes	No
Drying Shrinkage	Mix with chips	Mix with sand
Chloride Content	Yes	No
Organic Matter	Yes	No

Gradings, bulk samples, 0/4mm raw	Yes	No, disturbed by drilling
Fines content, 0/4mm unwashed	Yes	

Wash the sand from the trial pit sample and do the following:

Test	0/4mm washed sand from trial pit
Total Sulphur	Yes
Acid Soluble Sulphate	Yes
Water Soluble Sulphate	Yes
Los Angeles value	No
Magnesium Sulphate Soundness	No
Water Absorption	Yes
Particle Density	Yes
Methylene Blue	Yes
Calcium Carbonate Content	No
Drying Shrinkage	See above
Chloride Content	Yes
Organic Matter	Yes
Gradings, 0/4mm washed	Yes
Fines content, 0/4mm washed	Yes

Test	Testing Company	Material tested	Date	Result	SR21 Compliance	SR 16 Compliance
Total Sulphur Content	Testall	Unwashed Sand, BH2 Unwashed Sand, BH3 Unwashed Sand, Pit Washed Sand	30/6/2020 30/6/2020 30/6/2020 30/6/2020	0.1% 0.1% <0.1% <0.1%	Yes, must be ≤1%	Yes, must be ≤1%
Acid soluble Sulphate as SO_4	Testall	Unwashed Sand, BH2 Unwashed Sand, BH3 Unwashed Sand, Pit Washed Sand	30/6/2020 30/6/2020 30/6/2020 30/6/2020	<0.1% <0.1% <0.1% <0.1%	Yes, must be ≤0.2%	Yes, must be ≤0.2%
Sulphate Aqueous Extract mg/l SO4	Testall	Unwashed Sand, BH2 Unwashed Sand, BH3 Unwashed Sand, Pit Washed Sand	30/6/2020 30/6/2020 30/6/2020 30/6/2020	<0.01% <0.01% <0.01% <0.01%	Not specified	to be declared
Total Sulphur Content	Testall	Washed 10/14mm, BH2 Washed 10/14mm, BH3 Washed 10/14mm, Pit	24/6/2020 24/6/2020 24/6/2020	<0.1% <0.1% <0.1%	Yes, must be ≤1%	Yes, must be ≤1%
Acid soluble Sulphate	Testall	Washed 10/14mm, BH2 Washed 10/14mm, BH3	24/6/2020 24/6/2020	0.1% <0.1%	Yes, must be ≤0.2%	Yes, must be ≤0.2%

as SO_4		Washed 10/14mm, Pit	24/6/2020	<0.1%		
Sulphate Aqueous Extract mg/l SO4	Testall	Washed 10/14mm, BH2 Washed 10/14mm, BH3 Washed 10/14mm, Pit	24/6/2020 24/6/2020 24/6/2020	<0.01% <0.01% <0.01%	Not specified	To be declared
Los Angeles Coefficient	Testall	Washed 10/14mm, BH2 Washed 10/14mm, BH3 Washed 10/14mm, Pit	29/6/2020 29/6/2020 24/6/2020	20 21 21	Yes, must be ≤30	Must be ≤40 For high strength ≤25
Water Absorption, Coarse aggregate	Testall	Washed 10/14mm, BH2 Washed 10/14mm, BH3 Washed 10/14mm, Pit	3/6/2020 3/6/2020 5/6/2020	2.2% 1.8% 3.8%	Must be ≤2%	To be declared
Water Absorption Fine aggregate 0.063 to 4mm	Testall	Unwashed Sand, BH2 Unwashed Sand, BH3 Unwashed Sand, Pit Washed Sand	3/6/2020 3/6/2020 9/6/2020 9/6/2020	1.3% 1.0% 2.2% 2.2%	Must be ≤2%	To be declared
Particle Density, Coarse aggregate	Testall	Washed 10/14mm, BH2 Washed 10/14mm, BH3 Washed 10/14mm, Pit	3/6/2020 3/6/2020 5/6/2020	2.70 2.70 2.53	Not Specified	To be declared
Particle Density, Fine aggregate 0.063 to 4mm	Testall	Unwashed Sand, BH2 Unwashed Sand, BH3 Unwashed Sand, Pit Washed Sand	3/6/2020 3/6/2020 9/6/2020 9/6/2020	2.67 2.66 2.55	Not Specified	To be declared
Fines content, fine aggregate, Amount finer than 0.063 from grading	Testall	Unwashed Sand, BH2 Unwashed Sand, BH3 Unwashed Sand, Pit Washed Sand	8/6/2020 3/6/2020 8/6/2020 17/6/2020	14.1% 16.7% 7.8% 0.9%	N/A	Must be determined If >3% passing 0.063 assess
Magnesium Sulphate soundness, 10-14mm	Testall	Washed 10/14mm, BH2 Washed 10/14mm, BH3 Washed 10/14mm, Pit	2/7/2020 2/7/2020 2/7/2020	5% 5% 5%	Yes, must be ≤25%	Must be determined, various thresholds.
Geological Examination	Geologist			5	Satisfactory	Satisfactory
Water Soluble Chlorides	Testall	Unwashed Sand, BH2 Unwashed Sand, BH3 Unwashed Sand, Pit Washed Sand	30/6/2020 30/6/2020 30/6/2020 30/6/2020	0.001% 0.002% 0.002% 0.002%	Not Specified	To be declared, Mainly important for dredged marine aggregates
Drying Shrinkage, coarse aggregate	Testall	Not yet available				Must be ≤0.075%
Drying Shrinkage, fine aggregate	Testall	Not yet available				Must be ≤0.075%
Calcium Carbonate	Testall	Unwashed Sand, BH2 Unwashed Sand, BH3 Unwashed Sand, Pit	30/6/2020 30/6/2020 30/6/2020	19.4% 22.2% 14%	Not specified	To be declared, ≤25% in brushed macro-textured surface course
Organic Content	Testall	Unwashed Sand, BH2 Unwashed Sand, BH3 Unwashed Sand, Pit Washed sand	30/6/2020 30/6/2020 30/6/2020 30/6/2020	0.1% 0.2% <0.1% <0.1%	Not specified	
Methylene Blue	Testall	Unwashed Sand, BH2 Unwashed Sand, BH3 Unwashed Sand, Pit Washed sand	9/6/2020 9/6/2020 9/6/2020 9/6/2020	0.7g/Kg 0.5g/Kg 0.5g/Kg 0.2g/Kg	See below	See below

Petrography	Prof Geol				Not required if TS <1%	Done by Geologist on visit
Grading	Testall	Unwashed Sand, BH2 Unwashed Sand, BH3 Unwashed Sand, Pit Washed sand	8/6/2020 3/6/2020 8/6/2020 17/6/2020		Full record	Full Record

S.R.21 Testing

S.R.21:2014 & A1:2016 deals with Guidance on the use of I.S.13242:2002 & A1:2007 – Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction. Gravel pits normally produce S.R.21 material by crushing the oversize fraction.

S.R 21:2014 & A1:2016 requires suitable material to contain less than 10% sedimentary mudrock. Based on the Professional Geologist's examination of the quarry and pit there is a small amount of siltstone, much less than 10% and estimated at 3%, in the aggregate.

S.R.21 states that material with a Total Sulphur value ≤0.1% is always acceptable and material with a value of >1% is not acceptable. Material which falls between these two values may be acceptable but additional work, including petrography, must be completed to determine the nature of the pyrite or other sulphur bearing minerals.

The chemical tests, Total Sulphur and Acid Soluble Sulphate, must be done on all the products unless the Professional Geologist advises that the tests carried out on one specific product are applicable to the others. The tests have been done on washed and unwashed sand and on 10/14mm material. The results are extremely low in both the sand and the 10/14mm aggregate.

S.R.21 compliant Aggregates must have a Los Angeles value of ≤30 and a Magnesium Soundness value of ≤25%. The 10/14mm material on which these test are normally done is fully compliant.

S.R.21 material must have a Water Absorption of ≤2%. Some of the water Absorption Values for the 10/14mm aggregate are >2% but S.R.21 products are graded materials, most commonly 0-31.5mm and therefore the Water Absorption can only be determined accurately after the graded product is produced.

S.R.16 Testing

S.R.16:2016 deals with Guidance on the use of I.S. EN 12620:2002 & A1:2008- Aggregates for concrete.

S.R.16:2016 requires that certain properties of an aggregate must be declared. These properties include Water Absorption, Particle Density, Carbonate Content, and Water Soluble Chloride value.

Specific values are set for Sulphur Content, Flakiness Index and Drying Shrinkage. Total Sulphur and Acid Soluble Sulphate (Total Sulphate) results are all satisfactory. The Flakiness Index can only be determined once the aggregates are produced but they will almost certainly be compliant. The Drying Shrinkage results are not yet available.

Magnesium Sulphate Soundness and Los Angeles Co-efficient are also set values but different thresholds apply for different categories of concrete and S.R.16 needs to be checked regarding products such as high strength concrete. The values obtained for the 10/14mm aggregate indicate that it is suitable for all purposes.

The Professional Geologist is required to assess whether there are any deleterious materials present and these include mica, schist, phyllite, chalk, conglomerate, marl, calcareous mudstone, shale, porous basalt, flint, chalcedonic quartz, sulphides, coal, organic materials and expansive minerals. The Professional Geologist is satisfied that none of these, other than a small amount (circa 3%) of siltstone, are present.

If the fines content in a fine aggregate is greater than 3% the Professional Geologist is required to assess these fines. The fines content of the 0/4mm fraction in the drillholes is high, 14.1% and 16.7% but some of this fine material is the product of the drilling process. The fines content of the 0/4mm unwashed sand in the trial Pit is 7.8% and this is a reasonable value for the <0.063mm material in the unwashed sand. The washed sand has an extremely low value of 0.9%. The Geologist has examined the sand under a binocular microscope and is satisfied that it does not contain any deleterious materials. The Methylene Blue test is used as an indicator of the amount of clay in the sand. The low methylene Blue values of 0.2g/Kg in washed sand and 0.5g/Kg in unwashed sand are consistent with an extremely low clay content.

Alkali Silica Reaction

S.R.16:2016 requires that aggregates for concrete be assessed for Alkali-Silica reactivity by the Competent Person (Professional Geologist).

Some Irish aggregates including Carboniferous limestones, and gravels derived from Carboniferous limestone contain chert (SiO_2). Chert content is variable and may be as much as 10% in Limestone aggregate and can be considerably higher in some gravels. In general, very few quarries extract limestones with more than 10% chert because the material is hard on crushers and general plant.

The Institution of Engineers of Ireland and The Irish Concrete Society jointly produced a report on Alkali-Silica Reaction in Concrete in 2003, referenced as Item 36 in the Bibliography attached to SR16:2016.

This states that the degree of crystallinity in the chert is important. This is affected by the degree of low-grade metamorphism and deformation to which the aggregate has been subjected. Temperatures in excess of 200º Celsius stabilise the crystalline structure of the chert, making it unreactive.

The IEI/ICS report also confirms that there were no recorded issues of ASR in Irish aggregates when they carried out surveys in 1989 or in 2003.

The report also states in Table 1 that if the chert, chalcedony, flint content is ≤ 5% the aggregate may be classified as unlikely to be deleteriously alkali reactive. Regarding aggregate from Kilmeague, the chert, chalcedony, flint content of the gravel is <5%.

The Professional Geologist is satisfied that Kilmeague aggregate poses no significant risk of Alkali-Silica reaction.

Appendices:

Drill logs provided by Petersen Drilling Services Ltd

Summaries of Standpipe Installations provided by Petersen Drilling Services Ltd

Test results from Testall

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12570

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Testall

Certificate of Analysis of a Sample for Methylene Blue Value to BS EN 933- Part 9 : 2009

Sample No	SA12570	
Material Description	Unwashed Sand (Sieved Passing 4mm)	
Supplier	Insitu	
Source	Borehole	
Location / Chainage	Grangeclare Stud, Co. Kildare	
Offset / Level	BH 2	OGL -18m
Method of Sampling	Not stated	
Sample Cert. / Sampled By	No	Client
Site Ref. / Client Ref.	BH 2	
Date Sampled	20 May 2020	
Date Received	20 May 2020	
Date Test Completed	08 June 2020	

Result:

Methylene Blue Value **0.7 g/kg**
(grams blue dye/kg of 0 -2mm fraction)

Remarks

Notes

Results relate only to the sample tested and apply to sample as received.

Sample information stated above has been provided by the client.

Signed : D. Jordan Date : 09 June 2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

UKAS TESTING
8995

Testall

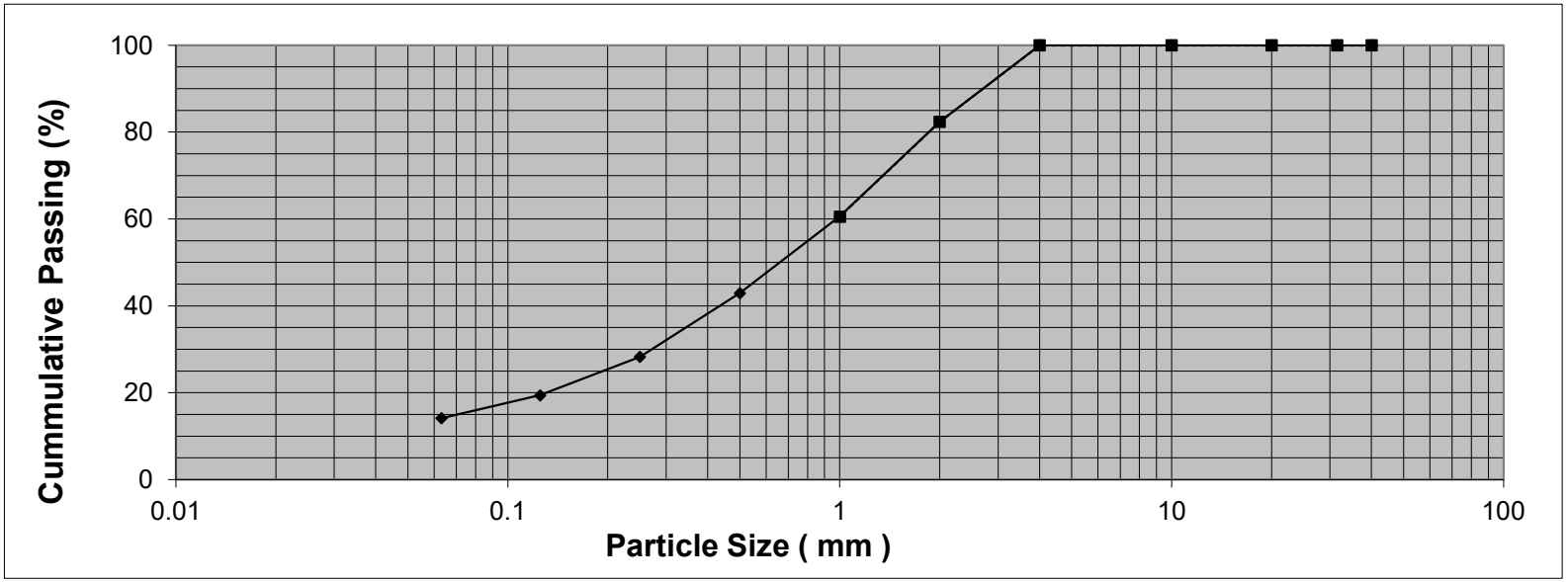
Client: Joseph Logan
Contract: Grangeclare Stud, Co. Kildare
Job No: J00955

Testall Ltd
295a Moorlough Rd,
Drumclay, Newtownbutler
Co. Fermanagh, BT92 8BJ

AGGREGATES - PARTICLE SIZE DISTRIBUTION

BS EN 933 : Part 1 : 1997 - (7.1/7.2 Washing and Sieving method)

Client	Joseph Logan		Contract	Grangeclare Stud, Co. Kildare
Material	Unwashed Sand (Sieved Passing 4mm)		Sample No./Site Ref:	SA12570
Supplier/Source	Insitu	Borehole	Date Sampled	20/05/2020
Deposition/Chainage	Grangeclare Stud, Co. Kildare		Date Received	20/05/2020
Offset/Level	BH 2	OGL -18m	Date Tested	28/05/2020
Moisture Content %	5.9		Sample Cert/Sampled by	No Client (sample as received)



BS Sieve Size	% Passing	Spec
40 mm	100	
31.5 mm	100	
20.0 mm	100	
14 mm	100	
10 mm	100	
6.3 mm	100	
4 mm	100	
2.0 mm	82	
1 mm	61	
500 µm	43	
250 µm	28	
125 µm	19	
63 µm	14.1	

Remarks :

Authorised signatories

- [x] D. Jordan - Technical Director
- [ ] B. McGovern - Laboratory Manager

Signed: D. Jordan
for Testall Ltd.

Date: 08/06/2020

UKAS TESTING
8995

Testall Ltd
295a Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

Testall

Determination of Particle Density and Water Absorption to BS EN

Job No J00955 **1097 - Pt 6 : 2013** ***Report No SA12570***

Client	:	Joseph Logan
Contract	:	Grangeclare Stud, Co. Kildare
Material Description	:	Unwashed Sand (Sieved Passing 4mm)
Supplier	:	Insitu
Source	:	Borehole
Location / Chainage	:	Grangeclare Stud, Co. Kildare
Offset / Level	:	BH 2 OGL -18m
Method of Sampling	:	~~BS EN 932-1:1997~~ / Not Stated
Sample Cert. / Sampled By	:	No Client
Sample No.	:	SA12570
Site Ref. / Client Ref.	:	BH 2
Date Sampled	:	20 May 2020
Date Received	:	20 May 2020
Date Test Completed	:	02 June 2020

Apparent Particle Density	:	**2.67**	**Mg/m³**
Particle Density Oven Dried	:	**2.58**	**Mg/m³**
Particle Density S.S.D.	:	**2.61**	**Mg/m³**
Water Absorption	:	**1.3**	**%**

Remarks :

Signed : D. Jordan **Date :** 03 June 2020

for Testall Ltd

UKAS TESTING 8995

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12570

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF SULFATES TO BS EN 1744-1 : 2009 + A1 : 2012 Clause 11 & 12

Sample No	:	SA12570	
Supplier	:	Insitu	
Source	:	Borehole	
Sample Deposition	:	Grangeclare Stud, Co. Kildare	
Chainage	:		
Offset / Level	:	BH 2	OGL -18m
Sample Description	:	Unwashed Sand (Sieved Passing 4mm)	
Site Ref. / Client Ref.	:		BH 2
Sampling Cert. / Sampled By	:	No	Client
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Tests Completed	:	18 June 2020	
Sampling Method	:	Not stated	

Results

Test	Test Determined		Result	Unit
1	Acid Soluble Sulfate (SO_3)	ASS	<0.1	%
2	Acid Soluble Sulfate (SO_4)	ASS	<0.1	%
3	Total Sulfur (S)	TS	0.1	%
4	Water Soluble Sulfate (SO_3)	WSS	<0.01	%
5	Water Soluble Sulfate (SO_3)	WSS	<50	(mg/l)
6	Water Soluble Sulfate (SO_4)	WSS	<0.01	%
7	Water Soluble Sulfate (SO_4)	WSS	<60	(mg/l)

Comments
This test was subcontracted to a UKAS accredited laboratory.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12570

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Testall

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF
CALCIUM CARBONATE CONTENT IN ACCORDANCE WITH IN HOUSE METHOD (based on BS6463-102:2001)

Sample No	:	SA12570
Supplier	:	Insitu
Source	:	Borehole
Sample Deposition	:	Grangeclare Stud, Co. Kildare
Chainage	:	
Offset / Level	:	BH 2 OGL -18m
Sample Description	:	Unwashed Sand (Sieved Passing 4mm)
Site Ref. / Client Ref.	:	
Sampling Cert. / Sampled By	:	No Client (sample as received)
Date Received	:	20 May 2020
Date Tests Completed	:	18 June 2020
Sampling Method	:	Not stated

Results

Calcium Carbonate Equivalent (CaO)	**(%)**	:	**19.4**

Comments
Testing performed by subcontracted laboratory.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12570

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF
Water Soluble Chloride content TO BS EN 1744-1 : 2009 + A1 : 2012 : Clause 7

Sample No	:	SA12570	
Supplier	:	Insitu	
Source	:	Borehole	
Sample Deposition	:	Grangeclare Stud, Co. Kildare	
Chainage	:		
Offset / Level	:	BH 2	OGL -18m
Sample Description	:	Unwashed Sand (Sieved Passing 4mm)	
Site Ref. / Client Ref.	:	BH 2	
Sampling Cert. / Sampled By	:	No Client	
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Tests Completed	:	18 June 2020	
Sampling Method	:	Not stated	

Results

Chloride Content of Aggregate (C) (%) : **0.001**

Comments

This test was subcontracted to a UKAS accredited laboratory.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12570

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF ORGANIC CONTENT
BS 1377: Part 3: 1990 Clause 3

Sample No	:	SA12570	
Supplier	:	Insitu	
Source	:	Borehole	
Sample Deposition	:	Grangeclare Stud, Co. Kildare	
Chainage	:		
Offset / Level	:	BH 2	OGL -18m
Sample Description	:	Unwashed Sand (Sieved Passing 4mm)	
Site Ref. / Client Ref.	:	BH 2	
Sampling Cert. / Sampled By	:	No	Client (sample as received)
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Tests Completed	:	18 June 2020	
Sampling Method	:	Not stated	

Results:

Organic Content (%)	:	**0.1**

Comments

This test was subcontracted to a UKAS accredited laboratory.
The reported % organic content is the average organic matter content present in the soil fraction passing the 2mm test sieve to the nearest 0.1% of the original oven dry mass of soil.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12571

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Testall

Certificate of Analysis of a Sample for Methylene Blue Value to BS EN 933- Part 9 : 2009

Sample No	SA12571	
Material Description	Unwashed Sand (Sieved Passing 4mm)	
Supplier	Insitu	
Source	Borehole	
Location / Chainage	Grangeclare Stud, Co. Kildare	
Offset / Level	BH 3	OGL -18m
Method of Sampling	Not stated	
Sample Cert. / Sampled By	No	Client
Site Ref. / Client Ref.	BH 3	
Date Sampled	20 May 2020	
Date Received	20 May 2020	
Date Test Completed	08 June 2020	

Result:

Methylene Blue Value **0.5 g/kg**
(grams blue dye/kg of 0 -2mm fraction)

Remarks

Notes

Results relate only to the sample tested and apply to sample as received.

Sample information stated above has been provided by the client.

Signed : D. Jordan Date : 09 June 2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

UKAS TESTING
8995

Testall

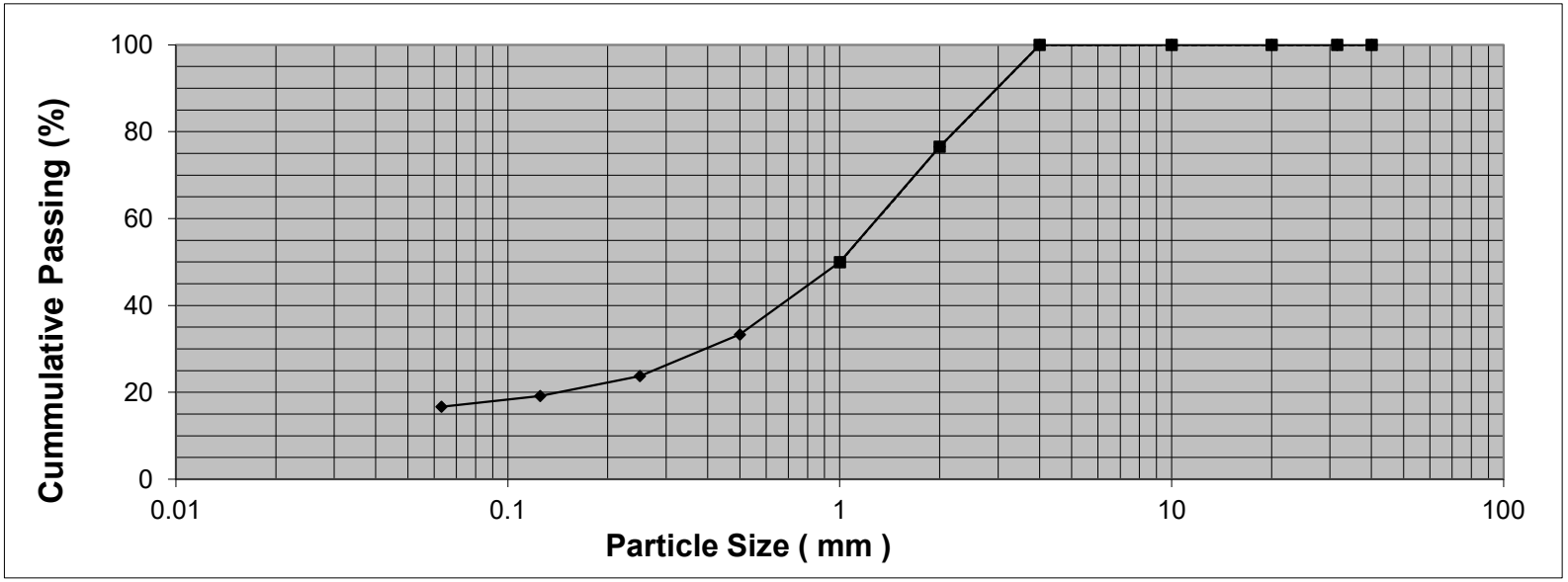
Client: Joseph Logan
Contract: Grangeclare Stud, Co. Kildare
Job No: J00955

Testall Ltd
295a Moorlough Rd,
Drumclay, Newtownbutler
Co. Fermanagh. BT92 8BJ

AGGREGATES - PARTICLE SIZE DISTRIBUTION

BS EN 933 : Part 1 : 1997 - (7.1/7.2 Washing and Sieving method)

Client	Joseph Logan		Contract	Grangeclare Stud, Co. Kildare
Material	Unwashed Sand (Sieved Passing 4mm)		Sample No./Site Ref:	SA12571
Supplier/Source	Insitu	Borehole	Date Sampled	20/05/2020
Deposition/Chainage	Grangeclare Stud, Co. Kildare		Date Received	20/05/2020
Offset/Level	BH 3	OGL -18m	Date Tested	29/05/2020
Moisture Content %	4.5		Sample Cert/Sampled by	No Client (sample as received)



BS Sieve Size	% Passing	Spec
40 mm	100	
31.5 mm	100	
20.0 mm	100	
14 mm	100	
10 mm	100	
6.3 mm	100	
4 mm	100	
2.0 mm	77	
1 mm	50	
500 µm	33	
250 µm	24	
125 µm	19	
63 µm	16.7	

Remarks :

Authorised signatories

- [x] D. Jordan - Laboratory Manager
- [ ] G.McHugh - Quality Manager

Signed: D. Jordan

for Testall Ltd.

Date: 03/06/2020

UKAS TESTING
8995

Testall Ltd
295a Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

Testall

Determination of Particle Density and Water Absorption to BS EN

Job No J00955 **1097 - Pt 6 : 2013** ***Report No SA12571***

Client	:	Joseph Logan
Contract	:	Grangeclare Stud, Co. Kildare
Material Description	:	Unwashed Sand (Sieved Passing 4mm)
Supplier	:	Insitu
Source	:	Borehole
Location / Chainage	:	Grangeclare Stud, Co. Kildare
Offset / Level	:	BH 3 OGL -18m
Method of Sampling	:	BS EN 932-1:1997 ~~/ Not Stated~~
Sample Cert. / Sampled By	:	No Client
Sample No.	:	SA12571
Site Ref. / Client Ref.	:	BH 3
Date Sampled	:	20 May 2020
Date Received	:	20 May 2020
Date Test Completed	:	28 May 2020

Apparent Particle Density	:	**2.66**	**Mg/m³**
Particle Density Oven Dried	:	**2.59**	**Mg/m³**
Particle Density S.S.D.	:	**2.62**	**Mg/m³**
Water Absorption	:	**1.0**	**%**

Remarks :

Signed : D. Jordan **Date :** 03 June 2020

for Testall Ltd

UKAS TESTING 8995

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12571

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF SULFATES TO BS EN 1744-1 : 2009 + A1 : 2012 Clause 11 & 12

Sample No	:	SA12571	
Supplier	:	Insitu	
Source	:	Borehole	
Sample Deposition	:	Grangeclare Stud, Co. Kildare	
Chainage	:		
Offset / Level	:	BH 3	OGL -18m
Sample Description	:	Unwashed Sand (Sieved Passing 4mm)	
Site Ref. / Client Ref.	:		BH 3
Sampling Cert. / Sampled By	:	No	Client
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Tests Completed	:	18 June 2020	
Sampling Method	:	Not stated	

Results

Test	Test Determined		Result	Unit
1	Acid Soluble Sulfate (SO_3)	ASS	<0.1	%
2	Acid Soluble Sulfate (SO_4)	ASS	<0.1	%
3	Total Sulfur (S)	TS	0.1	%
4	Water Soluble Sulfate (SO_3)	WSS	<0.01	%
5	Water Soluble Sulfate (SO_3)	WSS	<50	(mg/l)
6	Water Soluble Sulfate (SO_4)	WSS	<0.01	%
7	Water Soluble Sulfate (SO_4)	WSS	<60	(mg/l)

Comments
This test was subcontracted to a UKAS accredited laboratory.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12571

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Testall

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF
CALCIUM CARBONATE CONTENT IN ACCORDANCE WITH IN HOUSE METHOD (based on BS6463-102:2001)

Sample No	:	SA12571
Supplier	:	Insitu
Source	:	Borehole
Sample Deposition	:	Grangeclare Stud, Co. Kildare
Chainage	:	
Offset / Level	:	BH 3 OGL -18m
Sample Description	:	Unwashed Sand (Sieved Passing 4mm)
Site Ref. / Client Ref.	:	
Sampling Cert. / Sampled By	:	No Client (sample as received)
Date Received	:	20 May 2020
Date Tests Completed	:	18 June 2020
Sampling Method	:	Not stated

Results

Calcium Carbonate Equivalent (CaO)	**(%)**	:	**22.2**

Comments
Testing performed by subcontracted laboratory.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12571

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF
Water Soluble Chloride content TO BS EN 1744-1 : 2009 + A1 : 2012 : Clause 7

Sample No	:	SA12571	
Supplier	:	Insitu	
Source	:	Borehole	
Sample Deposition	:	Grangeclare Stud, Co. Kildare	
Chainage	:		
Offset / Level	:	BH 3	OGL -18m
Sample Description	:	Unwashed Sand (Sieved Passing 4mm)	
Site Ref. / Client Ref.	:	BH 3	
Sampling Cert. / Sampled By	:	No Client	
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Tests Completed	:	18 June 2020	
Sampling Method	:	Not stated	

Results

Chloride Content of Aggregate (C) (%) : **0.002**

Comments

This test was subcontracted to a UKAS accredited laboratory.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12571

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF ORGANIC CONTENT
BS 1377: Part 3: 1990 Clause 3

Sample No	:	SA12571	
Supplier	:	Insitu	
Source	:	Borehole	
Sample Deposition	:	Grangeclare Stud, Co. Kildare	
Chainage	:		
Offset / Level	:	BH 3	OGL -18m
Sample Description	:	Unwashed Sand (Sieved Passing 4mm)	
Site Ref. / Client Ref.	:	BH 3	
Sampling Cert. / Sampled By	:	No	Client (sample as received)
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Tests Completed	:	18 June 2020	
Sampling Method	:	Not stated	

Results:

Organic Content (%)	:	**0.2**

Comments

This test was subcontracted to a UKAS accredited laboratory.
The reported % organic content is the average organic matter content present in the soil fraction passing the 2mm test sieve to the nearest 0.1% of the original oven dry mass of soil.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12572

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Testall

Certificate of Analysis of a Sample for Methylene Blue Value to BS EN 933- Part 9 : 2009

Sample No	SA12572	
Material Description	Unwashed Sand (Sieved Passing 4mm)	
Supplier	Insitu	
Source	Trial Pit	
Location / Chainage	Grangeclare Stud, Co. Kildare	
Offset / Level	Trial Pit	OGL -6m
Method of Sampling	Not stated	
Sample Cert. / Sampled By	No	Client
Site Ref. / Client Ref.	TP 1	
Date Sampled	20 May 2020	
Date Received	20 May 2020	
Date Test Completed	08 June 2020	

Result:

Methylene Blue Value **0.5 g/kg**
(grams blue dye/kg of 0 -2mm fraction)

Remarks

Notes

Results relate only to the sample tested and apply to sample as received.
Sample information stated above has been provided by the client.

Signed : D. Jordan Date : 09 June 2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

UKAS TESTING
8995

Testall

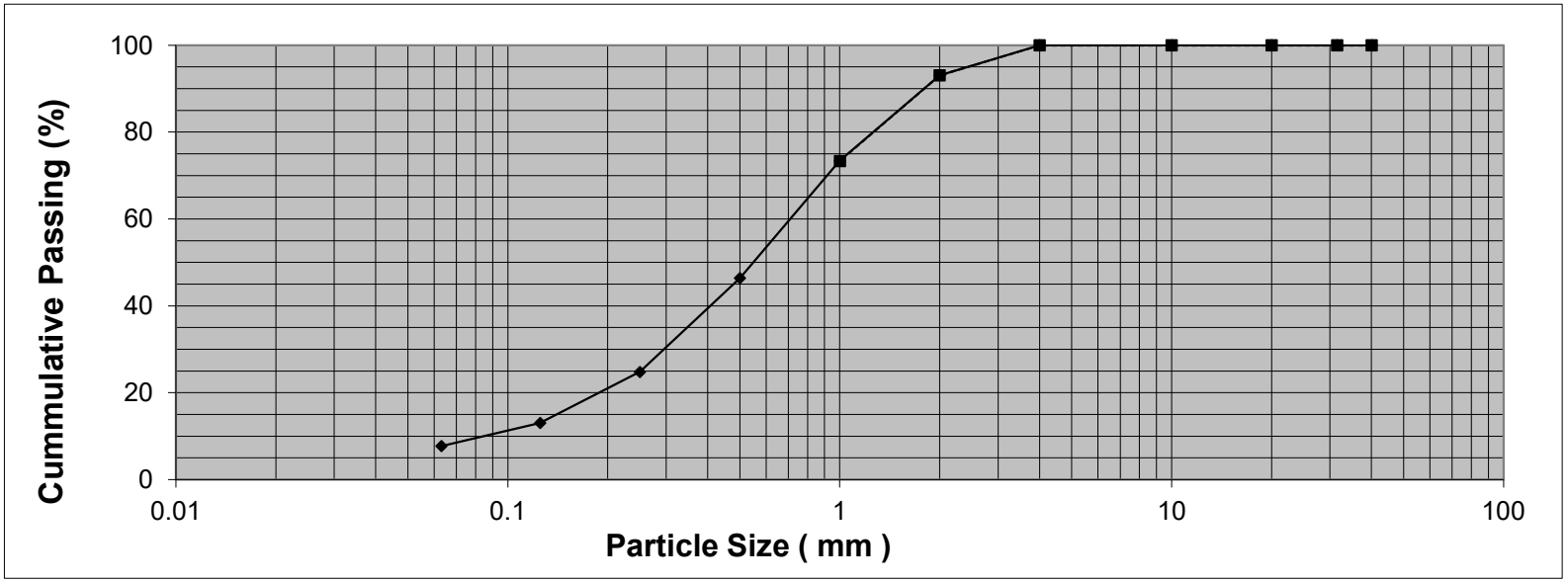
Client: Joseph Logan
Contract: Grangeclare Stud, Co. Kildare
Job No: J00955

Testall Ltd
295a Moorlough Rd,
Drumclay, Newtownbutler
Co. Fermanagh, BT92 8BJ

AGGREGATES - PARTICLE SIZE DISTRIBUTION

BS EN 933 : Part 1 : 1997 - (7.1/7.2 Washing and Sieving method)

Client	Joseph Logan		Contract	Grangeclare Stud, Co. Kildare
Material	Unwashed Sand (Sieved Passing 4mm)		Sample No./Site Ref:	SA12572
Supplier/Source	Insitu	Trial Pit	Date Sampled	20/05/2020
Deposition/Chainage	Grangeclare Stud, Co. Kildare		Date Received	20/05/2020
Offset/Level	Trial Pit	OGL -6m	Date Tested	28/05/2020
Moisture Content %	10.4		Sample Cert/Sampled by	No Client (sample as received)



BS Sieve Size	% Passing	Spec
40 mm	100	
31.5 mm	100	
20.0 mm	100	
14 mm	100	
10 mm	100	
6.3 mm	100	
4 mm	100	
2.0 mm	93	
1 mm	73	
500 µm	46	
250 µm	25	
125 µm	13	
63 µm	7.8	

Remarks :

Authorised signatories

- [x] D. Jordan - Technical Director
- [ ] B. McGovern - Laboratory Manager

Signed: D. Jordan

for Testall Ltd.

Date: 08/06/2020

UKAS TESTING
8995

Testall Ltd
295a Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

Determination of Particle Density and Water Absorption to BS EN 1097

Job No J00955 **- Pt 6 : 2013** ***Report No SA12572***

Client	:	Joseph Logan
Contract	:	Grangeclare Stud, Co. Kildare
Material Description	:	Unwashed Sand (Sieved Passing 4mm)
Supplier	:	Insitu
Source	:	Trial Pit
Location / Chainage	:	Grangeclare Stud, Co. Kildare
Offset / Level	:	Trial Pit OGL -6m
Method of Sampling	:	~~BS EN 932-1:1997~~ / Not Stated
Sample Cert. / Sampled By	:	No Client
Sample No.	:	SA12572
Site Ref. / Client Ref.	:	TP 1
Date Sampled	:	20 May 2020
Date Received	:	20 May 2020
Date Test Completed	:	09 June 2020

Apparent Particle Density	:	**2.55**	**Mg/m³**
Particle Density Oven Dried	:	**2.41**	**Mg/m³**
Particle Density S.S.D.	:	**2.47**	**Mg/m³**
Water Absorption	:	**2.2**	**%**

Remarks :

Signed : D. Jordan **Date :** 09 June 2020

for Testall Ltd

UKAS TESTING 8995

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12572

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF SULFATES TO BS EN 1744-1 : 2009 + A1 : 2012 Clause 11 & 12

Sample No	:	SA12572	
Supplier	:	Insitu	
Source	:	Trial Pit	
Sample Deposition	:	Grangeclare Stud, Co. Kildare	
Chainage	:		
Offset / Level	:	Trial Pit	OGL -6m
Sample Description	:	Unwashed Sand (Sieved Passing 4mm)	
Site Ref. / Client Ref.	:		TP 1
Sampling Cert. / Sampled By	:	No	Client
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Tests Completed	:	18 June 2020	
Sampling Method	:	Not stated	

Results

Test	Test Determined		Result	Unit
1	Acid Soluble Sulfate (SO_3)	ASS	<0.1	%
2	Acid Soluble Sulfate (SO_4)	ASS	<0.1	%
3	Total Sulfur (S)	TS	<0.1	%
4	Water Soluble Sulfate (SO_3)	WSS	<0.01	%
5	Water Soluble Sulfate (SO_3)	WSS	<50	(mg/l)
6	Water Soluble Sulfate (SO_4)	WSS	<0.01	%
7	Water Soluble Sulfate (SO_4)	WSS	<60	(mg/l)

Comments
This test was subcontracted to a UKAS accredited laboratory.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12572

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Testall

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF
CALCIUM CARBONATE CONTENT IN ACCORDANCE WITH IN HOUSE METHOD (based on BS6463-102:2001)

Sample No	:	SA12572
Supplier	:	Insitu
Source	:	Trial Pit
Sample Deposition	:	Grangeclare Stud, Co. Kildare
Chainage	:	
Offset / Level	:	Trial Pit OGL -6m
Sample Description	:	Unwashed Sand (Sieved Passing 4mm)
Site Ref. / Client Ref.	:	
Sampling Cert. / Sampled By	:	No Client (sample as received)
Date Received	:	20 May 2020
Date Tests Completed	:	18 June 2020
Sampling Method	:	Not stated

Results

Calcium Carbonate Equivalent (CaO)	**(%)**	:	**14.0**

Comments
Testing performed by subcontracted laboratory.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12572

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF
Water Soluble Chloride content TO BS EN 1744-1 : 2009 + A1 : 2012 : Clause 7

Sample No	:	SA12572
Supplier	:	Insitu
Source	:	Trial Pit
Sample Deposition	:	Grangeclare Stud, Co. Kildare
Chainage	:	
Offset / Level	:	Trial Pit OGL -6m
Sample Description	:	Unwashed Sand (Sieved Passing 4mm)
Site Ref. / Client Ref.	:	TP 1
Sampling Cert. / Sampled By	:	No Client
Date Sampled	:	20 May 2020
Date Received	:	20 May 2020
Date Tests Completed	:	18 June 2020
Sampling Method	:	Not stated

Results

Chloride Content of Aggregate (C) (%) : **0.002**

Comments

This test was subcontracted to a UKAS accredited laboratory.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12572

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF ORGANIC CONTENT
BS 1377: Part 3: 1990 Clause 3

Sample No	:	SA12572
Supplier	:	Insitu
Source	:	Trial Pit
Sample Deposition	:	Grangeclare Stud, Co. Kildare
Chainage	:	
Offset / Level	:	Trial Pit OGL -6m
Sample Description	:	Unwashed Sand (Sieved Passing 4mm)
Site Ref. / Client Ref.	:	TP 1
Sampling Cert. / Sampled By	:	No Client (sample as received)
Date Sampled	:	20 May 2020
Date Received	:	20 May 2020
Date Tests Completed	:	18 June 2020
Sampling Method	:	Not stated

Results:

Organic Content (%)	:	**<0.1**

Comments

This test was subcontracted to a UKAS accredited laboratory.
The reported % organic content is the average organic matter content present in the soil fraction passing the 2mm test sieve to the nearest 0.1% of the original oven dry mass of soil.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12573

Testall Ltd
295a Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Determination of Thermal and Weathering Properties of Aggregates (Magnesium Sulfate Test) BS EN 1367 - 2 : 2009

Sample No.	:	SA12573	
Material Description	:	Washed 10/14mm chips (Sieved passing 14mm & retained on 10mm)	
Supplier	:	Insitu	
Source	:	Borehole	
Location / Chainage	:	Grangeclare Stud, Co. Kildare	
Offset / Level	:	BH 2	OGL -18m
Method of Sampling	:	Not stated	
Date Test Completed	:	01 July 2020	
Sample Cert. / Sampled By	:	No	Client
Site Ref. / Client Ref.	:	BH 2	BH 2
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Size Fraction Tested	:	14/10mm	

Results :

Sample A (%)	:	4.7
Sample B (%)	:	4.7
Magnesium Sulfate Value	:	**5**

Remarks :

Notes: This test report shall not be reproduced except in full, without the prior written approval of the laboratory.
Results relate only to the sample tested and apply to sample as received.
Sample information supplied above has been provided by the client.

Signed : D. Jordan **Date :** 02/07/2020

for Testall Ltd

Authorised signatories :

☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

UKAS TESTING 8995

Testall Ltd
295a Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

Testall

Determination of Particle Density and Water Absorption to BS EN

Job No J00955 **1097 - Pt 6 : 2013** ***Report No SA12573***

Client	:	Joseph Logan
Contract	:	Grangeclare Stud, Co. Kildare
Material Description	:	Washed 10/14mm chips (Sieved passing 14mm & retained on 10mm)
Supplier	:	Insitu
Source	:	Borehole
Location / Chainage	:	Grangeclare Stud, Co. Kildare
Offset / Level	:	BH 2 OGL -18m
Method of Sampling	:	~~BS EN 932-1:1997~~ / Not Stated
Sample Cert. / Sampled By	:	No Client
Sample No.	:	SA12573
Site Ref. / Client Ref.	:	BH 2
Date Sampled	:	20 May 2020
Date Received	:	20 May 2020
Date Test Completed	:	02 June 2020

Apparent Particle Density	:	**2.70**	**Mg/m³**
Particle Density Oven Dried	:	**2.54**	**Mg/m³**
Particle Density S.S.D.	:	**2.60**	**Mg/m³**
Water Absorption	:	**2.2**	**%**

Remarks :

Signed : D. Jordan **Date :** 03 June 2020

for Testall Ltd

UKAS TESTING 8995

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12573

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF SULFATES TO BS EN 1744-1 : 2009 + A1 : 2012 Clause 11 & 12

Sample No	:	SA12573	
Supplier	:	Insitu	
Source	:	Borehole	
Sample Deposition	:	Grangeclare Stud, Co. Kildare	
Chainage	:		
Offset / Level	:	BH 2	OGL -18m
Sample Description	:	Washed 10/14mm chips (Sieved passing 14mm & retained on 10mm)	
Site Ref. / Client Ref.	:		BH 2
Sampling Cert. / Sampled By	:	No	Client
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Tests Completed	:	22 June 2020	
Sampling Method	:	Not stated	

Results

Test	Test Determined		Result	Unit
1	Acid Soluble Sulfate (SO_3)	ASS	0.1	%
2	Acid Soluble Sulfate (SO_4)	ASS	0.1	%
3	Total Sulfur (S)	TS	<0.1	%
4	Water Soluble Sulfate (SO_3)	WSS	<0.01	%
5	Water Soluble Sulfate (SO_3)	WSS	<50	(mg/l)
6	Water Soluble Sulfate (SO_4)	WSS	<0.01	%
7	Water Soluble Sulfate (SO_4)	WSS	<60	(mg/l)

Comments
This test was subcontracted to a UKAS accredited laboratory.

Signed : D. Jordan

Date : 24/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grandeclare Stud

Job No: J00955

Report No: SA12573

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Testall

Determination of Resistance to Fragmentation of Aggregates (Los Angeles Method)

to BS EN 1097 - 2 : 2010

Sample No	:	SA12573	
Material Description	:	Washed 10/14mm chips (Sieved passing 14mm & retained on 10mm)	
Supplier	:	Insitu	
Source	:	Borehole	
Location / Chainage	:	Grandeclare Stud, Co. Kildare	
Offset / Level	:	BH 2	OGL -18m
Test Portion Fraction Size	:	10/12.5/14	
Sample Cert. / Sampled By	:	No	Client
Method of Sampling	:	Not stated	
Site ref. / Client Ref.	:		BH 2
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Test Completed	:	25 June 2020	

Los Angeles Coefficient (LA)	:	20

Remarks :

Notes: This test report shall not be reproduced except in full, without the prior written approval of the laboratory.
Results relate only to the sample tested and apply to sample as received.
Sample information stated above has been provided by the client.

Signed : D. Jordan **Date :** 29 June 2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

UKAS TESTING
8995

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12574

Testall Ltd
295a Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Determination of Thermal and Weathering Properties of Aggregates (Magnesium Sulfate Test) BS EN 1367 - 2 : 2009

Sample No.	:	SA12574	
Material Description	:	Washed 10/14mm chips (Sieved passing 14mm & retained on 10mm)	
Supplier	:	Insitu	
Source	:	Borehole	
Location / Chainage	:	Grangeclare Stud, Co. Kildare	
Offset / Level	:	BH 3	OGL -18m
Method of Sampling	:	Not stated	
Date Test Completed	:	01 July 2020	
Sample Cert. / Sampled By	:	No	Client
Site Ref. / Client Ref.	:	BH 3	BH 3
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Size Fraction Tested	:	14/10mm	

Results :

Sample A (%)	:	5.1
Sample B (%)	:	4.9
Magnesium Sulfate Value	:	**5**

Remarks :

Notes: This test report shall not be reproduced except in full, without the prior written approval of the laboratory.
Results relate only to the sample tested and apply to sample as received.
Sample information supplied above has been provided by the client.

Signed : D. Jordan **Date :** 02/07/2020

for Testall Ltd

Authorised signatories :

☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

UKAS TESTING 8995

Testall Ltd
295a Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

Testall

Determination of Particle Density and Water Absorption to BS EN

Job No J00955 **1097 - Pt 6 : 2013** ***Report No SA12574***

Client	:	Joseph Logan
Contract	:	Grangeclare Stud, Co. Kildare
Material Description	:	Washed 10/14mm chips (Sieved passing 14mm & retained on 10mm)
Supplier	:	Insitu
Source	:	Borehole
Location / Chainage	:	Grangeclare Stud, Co. Kildare
Offset / Level	:	BH 3 OGL -18m
Method of Sampling	:	~~BS EN 932-1:1997~~ / Not Stated
Sample Cert. / Sampled By	:	No Client
Sample No.	:	SA12574
Site Ref. / Client Ref.	:	BH 3
Date Sampled	:	20 May 2020
Date Received	:	20 May 2020
Date Test Completed	:	02 June 2020

Apparent Particle Density	:	**2.70**	**Mg/m³**
Particle Density Oven Dried	:	**2.58**	**Mg/m³**
Particle Density S.S.D.	:	**2.62**	**Mg/m³**
Water Absorption	:	**1.8**	**%**

Remarks :

Signed : D. Jordan **Date :** 03 June 2020

for Testall Ltd

UKAS TESTING 8995

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12574

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF SULFATES TO BS EN 1744-1 : 2009 + A1 : 2012 Clause 11 & 12

Sample No	:	SA12574	
Supplier	:	Insitu	
Source	:	Borehole	
Sample Deposition	:	Grangeclare Stud, Co. Kildare	
Chainage	:		
Offset / Level	:	BH 3	OGL -18m
Sample Description	:	Washed 10/14mm chips (Sieved passing 14mm & retained on 10mm)	
Site Ref. / Client Ref.	:		BH 3
Sampling Cert. / Sampled By	:	No	Client
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Tests Completed	:	22 June 2020	
Sampling Method	:	Not stated	

Results

Test	Test Determined		Result	Unit
1	Acid Soluble Sulfate (SO_3)	ASS	<0.1	%
2	Acid Soluble Sulfate (SO_4)	ASS	<0.1	%
3	Total Sulfur (S)	TS	<0.1	%
4	Water Soluble Sulfate (SO_3)	WSS	<0.01	%
5	Water Soluble Sulfate (SO_3)	WSS	<50	(mg/l)
6	Water Soluble Sulfate (SO_4)	WSS	<0.01	%
7	Water Soluble Sulfate (SO_4)	WSS	<60	(mg/l)

Comments
This test was subcontracted to a UKAS accredited laboratory.

Signed : D. Jordan

Date : 24/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grandeclare Stud

Job No: J00955

Report No: SA12574

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Testall

Determination of Resistance to Fragmentation of Aggregates (Los Angeles Method)

to BS EN 1097 - 2 : 2010

Sample No	:	SA12574	
Material Description	:	Washed 10/14mm chips (Sieved passing 14mm & retained on 10mm)	
Supplier	:	Insitu	
Source	:	Borehole	
Location / Chainage	:	Grandeclare Stud, Co. Kildare	
Offset / Level	:	BH 3	OGL -18m
Test Portion Fraction Size	:	10/12.5/14	
Sample Cert. / Sampled By	:	No	Client
Method of Sampling	:	Not stated	
Site ref. / Client Ref.	:		BH 3
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Test Completed	:	24 June 2020	

Los Angeles Coefficient (LA)	:	21

Remarks :

Notes: This test report shall not be reproduced except in full, without the prior written approval of the laboratory.
Results relate only to the sample tested and apply to sample as received.
Sample information stated above has been provided by the client.

Signed : D. Jordan **Date :** 29 June 2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

UKAS TESTING
8995

Client:	**Joseph Logan** Grandeclare, Kilmeague, Co. Kildare	**Testall Ltd** 295a Moorlough Rd, Drumclay, Newtownbutler, Co. Fermanagh, BT92 8BJ Tel : +44 (0)28 67737805 Email : contact@testallltd.com	
Contract:	Grangeclare Stud, Co. Kildare		
Job No:	J00955		
Report No:	SA12575		

Testall

Determination of Resistance to Fragmentation of Aggregates (Los Angeles Method)

to BS EN 1097 - 2 : 2010

Sample No	:	SA12575	
Material Description	:	Washed 10/14mm chips (Sieved passing 14mm & retained on 10mm)	
Supplier	:	Insitu	
Source	:	Trial Pit	
Location / Chainage	:	Grangeclare Stud, Co. Kildare	
Offset / Level	:	TP	OGL -6m
Test Portion Fraction Size	:	10/12.5/14	
Sample Cert. / Sampled By	:	No	Client
Method of Sampling	:	Not stated	
Site ref. / Client Ref.	:		TP 1
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Test Completed	:	19 June 2020	
Los Angeles Coefficient (LA)	:	21	

Remarks :

Notes: This test report shall not be reproduced except in full, without the prior written approval of the laboratory.
Results relate only to the sample tested and apply to sample as received.
Sample information stated above has been provided by the client.

Signed : D. Jordan **Date :** 24 June 2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

UKAS TESTING
8995

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12575

Testall Ltd
295a Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Determination of Thermal and Weathering Properties of Aggregates (Magnesium Sulfate Test) BS EN 1367 - 2 : 2009

Sample No.	:	SA12575	
Material Description	:	Washed 10/14mm chips (Sieved passing 14mm & retained on 10mm)	
Supplier	:	Insitu	
Source	:	Trial Pit	
Location / Chainage	:	Grangeclare Stud, Co. Kildare	
Offset / Level	:	TP	OGL -6m
Method of Sampling	:	Not stated	
Date Test Completed	:	01 July 2020	
Sample Cert. / Sampled By	:	No	Client
Site Ref. / Client Ref.	:	TP 1	TP 1
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Size Fraction Tested	:	14/10mm	

Results :

Sample A (%)	:	8.3
Sample B (%)	:	7.0
Magnesium Sulfate Value	:	**8**

Remarks :

Notes: This test report shall not be reproduced except in full, without the prior written approval of the laboratory.
Results relate only to the sample tested and apply to sample as received.
Sample information supplied above has been provided by the client.

Signed : D. Jordan **Date :** 02/07/2020

for Testall Ltd

Authorised signatories :

☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

UKAS TESTING 8995

Testall Ltd
295a Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

Testall

Determination of Particle Density and Water Absorption to BS EN

Job No J00955 **1097 - Pt 6 : 2013** ***Report No SA12575***

Client	:	Joseph Logan
Contract	:	Grangeclare Stud, Co. Kildare
Material Description	:	Washed 10/14mm chips (Sieved passing 14mm & retained on 10mm)
Supplier	:	Insitu
Source	:	Trial Pit
Location / Chainage	:	Grangeclare Stud, Co. Kildare
Offset / Level	:	TP OGL -6m
Method of Sampling	:	~~BS EN 932-1:1997~~ / Not Stated
Sample Cert. / Sampled By	:	No Client
Sample No.	:	SA12575
Site Ref. / Client Ref.	:	TP 1
Date Sampled	:	20 May 2020
Date Received	:	20 May 2020
Date Test Completed	:	04 June 2020

Apparent Particle Density	:	**2.53**	**Mg/m³**
Particle Density Oven Dried	:	**2.31**	**Mg/m³**
Particle Density S.S.D.	:	**2.40**	**Mg/m³**
Water Absorption	:	**3.8**	**%**

Remarks :

Signed : D. Jordan **Date :** 05 June 2020

for Testall Ltd

UKAS TESTING 8995

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12575

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF SULFATES TO BS EN 1744-1 : 2009 + A1 : 2012 Clause 11 & 12

Sample No	:	SA12575
Supplier	:	Insitu
Source	:	Trial Pit
Sample Deposition	:	Grangeclare Stud, Co. Kildare
Chainage	:	
Offset / Level	:	TP OGL -6m
Sample Description	:	Washed 10/14mm chips (Sieved passing 14mm & retained on 10mm)
Site Ref. / Client Ref.	:	TP 1
Sampling Cert. / Sampled By	:	No Client
Date Sampled	:	20 May 2020
Date Received	:	20 May 2020
Date Tests Completed	:	22 June 2020
Sampling Method	:	Not stated

Results

Test	Test Determined		Result	Unit
1	Acid Soluble Sulfate (SO_3)	ASS	<0.1	%
2	Acid Soluble Sulfate (SO_4)	ASS	<0.1	%
3	Total Sulfur (S)	TS	<0.1	%
4	Water Soluble Sulfate (SO_3)	WSS	<0.01	%
5	Water Soluble Sulfate (SO_3)	WSS	<50	(mg/l)
6	Water Soluble Sulfate (SO_4)	WSS	<0.01	%
7	Water Soluble Sulfate (SO_4)	WSS	<60	(mg/l)

Comments
This test was subcontracted to a UKAS accredited laboratory.

Signed : 

Date : 24/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12576

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Testall

Certificate of Analysis of a Sample for Methylene Blue Value to BS EN 933- Part 9 : 2009

Sample No	SA12576	
Material Description	Washed Sand (Sieved Passing 4mm)	
Supplier	Insitu	
Source	Trial Pit	
Location / Chainage	Grangeclare Stud, Co. Kildare	
Offset / Level	TP	OGL -6m
Method of Sampling	Not stated	
Sample Cert. / Sampled By	No	Client
Site Ref. / Client Ref.	TP 1	
Date Sampled	20 May 2020	
Date Received	20 May 2020	
Date Test Completed	08 June 2020	

Result:

Methylene Blue Value **0.2 g/kg**
(grams blue dye/kg of 0 -2mm fraction)

Remarks

Notes

Results relate only to the sample tested and apply to sample as received.
Sample information stated above has been provided by the client.

Signed : D. Jordan Date : 09 June 2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

UKAS TESTING
8995

Testall

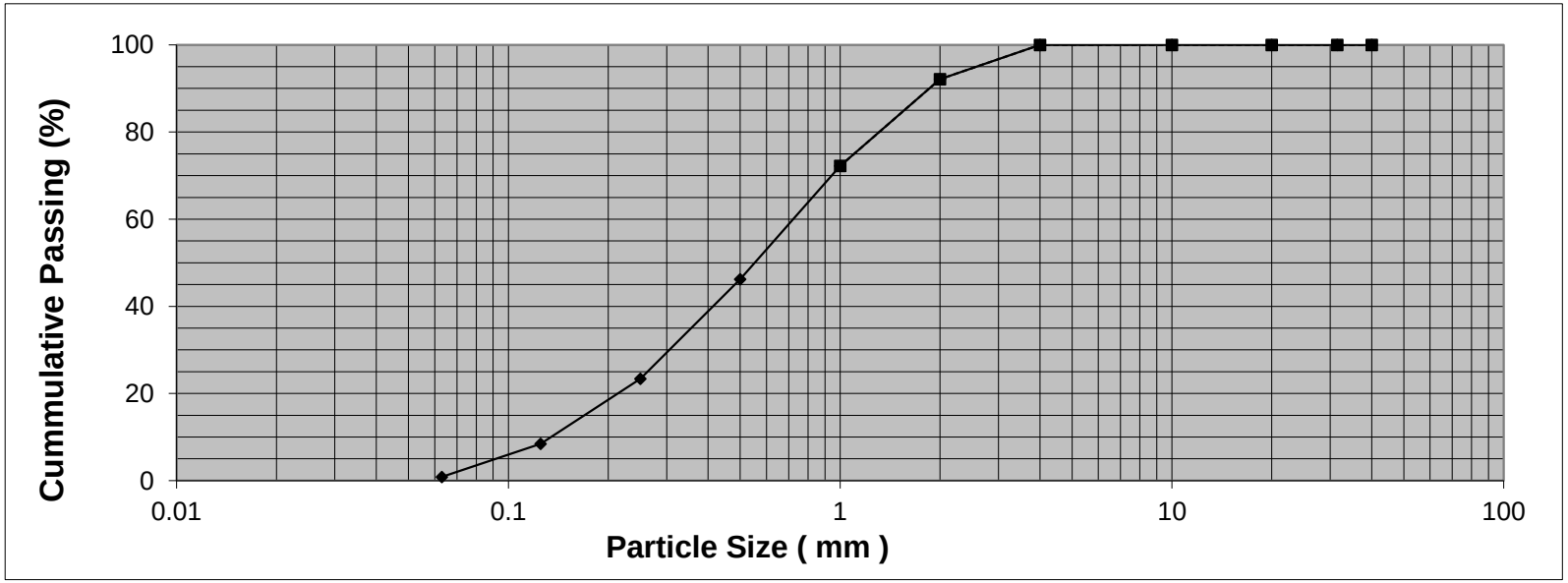
Client: Joseph Logan
Contract: Grangeclare Stud, Co. Kildare
Job No: J00955

Testall Ltd
295a Moorlough Rd,
Drumclay, Newtownbutler
Co. Fermanagh, BT92 8BJ

AGGREGATES - PARTICLE SIZE DISTRIBUTION

BS EN 933 : Part 1 : 1997 - (7.1/7.2 Washing and Sieving method)

Client	Joseph Logan		Contract	Grangeclare Stud, Co. Kildare
Material	Washed Sand (Sieved Passing 4mm)		Sample No./Site Ref:	SA12576
Supplier/Source	Insitu	Trial Pit	Date Sampled	20/05/2020
Deposition/Chainage	Grangeclare Stud, Co. Kildare		Date Received	20/05/2020
Offset/Level	TP	OGL -6m	Date Tested	04/06/2020
Moisture Content %	0.0		Sample Cert/Sampled by	No Client (sample as received)



BS Sieve Size	% Passing	Spec
40 mm	100	
31.5 mm	100	
20.0 mm	100	
14 mm	100	
10 mm	100	
6.3 mm	100	
4 mm	100	
2.0 mm	92	
1 mm	72	
500 µm	46	
250 µm	23	
125 µm	8	
63 µm	0.9	

Remarks :

Authorised signatories

- [x] D. Jordan - Technical Director
- [ ] B. McGovern - Laboratory Manager

Signed: D. Jordan

for Testall Ltd.

Date: 17/06/2020

UKAS TESTING
8995

Testall Ltd
295a Moorlough Rd
Drumclay
Newtownbutler
Co. Fermanagh
BT92 8BJ

Determination of Particle Density and Water Absorption to BS EN 1097

Job No J00955 **- Pt 6 : 2013** ***Report No SA12576***

Client	:	Joseph Logan
Contract	:	Grangeclare Stud, Co. Kildare
Material Description	:	Washed Sand (Sieved Passing 4mm)
Supplier	:	Insitu
Source	:	Trial Pit
Location / Chainage	:	Grangeclare Stud, Co. Kildare
Offset / Level	:	TP OGL -6m
Method of Sampling	:	~~BS EN 932-1:1997~~ / Not Stated
Sample Cert. / Sampled By	:	No Client
Sample No.	:	SA12576
Site Ref. / Client Ref.	:	TP 1
Date Sampled	:	20 May 2020
Date Received	:	20 May 2020
Date Test Completed	:	09 June 2020

Apparent Particle Density	:	**2.55**	**Mg/m³**
Particle Density Oven Dried	:	**2.41**	**Mg/m³**
Particle Density S.S.D.	:	**2.47**	**Mg/m³**
Water Absorption	:	**2.2**	**%**

Remarks :

Signed : D. Jordan **Date :** 09 June 2020

for Testall Ltd

UKAS TESTING 8995

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12576

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF SULFATES TO BS EN 1744-1 : 2009 + A1 : 2012 Clause 11 & 12

Sample No	:	SA12576	
Supplier	:	Insitu	
Source	:	Trial Pit	
Sample Deposition	:	Grangeclare Stud, Co. Kildare	
Chainage	:		
Offset / Level	:	TP	OGL -6m
Sample Description	:	Washed Sand (Sieved Passing 4mm)	
Site Ref. / Client Ref.	:		TP 1
Sampling Cert. / Sampled By	:	No	Client
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Tests Completed	:	29 June 2020	
Sampling Method	:	Not stated	

Results

Test	Test Determined		Result	Unit
1	Acid Soluble Sulfate (SO_3)	ASS	<0.1	%
2	Acid Soluble Sulfate (SO_4)	ASS	<0.1	%
3	Total Sulfur (S)	TS	<0.1	%
4	Water Soluble Sulfate (SO_3)	WSS	<0.01	%
5	Water Soluble Sulfate (SO_3)	WSS	<50	(mg/l)
6	Water Soluble Sulfate (SO_4)	WSS	<0.01	%
7	Water Soluble Sulfate (SO_4)	WSS	<60	(mg/l)

Comments
This test was subcontracted to a UKAS accredited laboratory.

Signed : 

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12576

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF
Water Soluble Chloride content TO BS EN 1744-1 : 2009 + A1 : 2012 : Clause 7

Sample No	:	SA12576
Supplier	:	Insitu
Source	:	Trial Pit
Sample Deposition	:	Grangeclare Stud, Co. Kildare
Chainage	:	
Offset / Level	:	TP OGL -6m
Sample Description	:	Washed Sand (Sieved Passing 4mm)
Site Ref. / Client Ref.	:	TP 1
Sampling Cert. / Sampled By	:	No Client
Date Sampled	:	20 May 2020
Date Received	:	20 May 2020
Date Tests Completed	:	29 June 2020
Sampling Method	:	Not stated

Results

Chloride Content of Aggregate (C) (%)	:	**0.002**

Comments

This test was subcontracted to a UKAS accredited laboratory.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

Client: **Joseph Logan**
Grandeclare,
Kilmeague,
Co. Kildare

Testall Ltd
295a Moorlough Rd,
Drumclay,
Newtownbutler,
Co. Fermanagh,
BT92 8BJ
Tel : +44 (0)28 67737805
Email : contact@testallltd.com

Contract: Grangeclare Stud, Co. Kildare

Job No: J00955

Report No: SA12576

CERTIFICATE OF ANALYSIS FOR DETERMINATION OF ORGANIC CONTENT
BS 1377: Part 3: 1990 Clause 3

Sample No	:	SA12576	
Supplier	:	Insitu	
Source	:	Trial Pit	
Sample Deposition	:	Grangeclare Stud, Co. Kildare	
Chainage	:		
Offset / Level	:	TP	OGL -6m
Sample Description	:	Washed Sand (Sieved Passing 4mm)	
Site Ref. / Client Ref.	:	TP 1	
Sampling Cert. / Sampled By	:	No	Client (sample as received)
Date Sampled	:	20 May 2020	
Date Received	:	20 May 2020	
Date Tests Completed	:	29 June 2020	
Sampling Method	:	Not stated	

Results:

Organic Content (%)	:	**<0.1**

Comments

This test was subcontracted to a UKAS accredited laboratory.
The reported % organic content is the average organic matter content present in the soil fraction passing the 2mm test sieve to the nearest 0.1% of the original oven dry mass of soil.

Signed : D. Jordan

Date : 30/06/2020

for Testall Ltd

Authorised signatories : ☑ D. Jordan - Technical Director ☐ B. McGovern - Laboratory Manager

AGP22196_02

Report on the Geophysical Investigation At Kilmeague, Co. Kildare For Quarry Consulting.

16TH October 2023

APEX Geophysics Limited
Unit 6, Knockmullen Business Park
Gorey
Co. Wexford

T: 0402 21842
E: info@apexgeophysics.ie
W: www.apexgeophysics.com

PRIVATE AND CONFIDENTIAL

THE FINDINGS OF THIS REPORT ARE THE RESULT OF A GEOPHYSICAL SURVEY USING NON-INVASIVE SURVEY TECHNIQUES CARRIED OUT AT THE GROUND SURFACE. INTERPRETATIONS CONTAINED IN THIS REPORT ARE DERIVED FROM A KNOWLEDGE OF THE GROUND CONDITIONS, THE GEOPHYSICAL RESPONSES OF GROUND MATERIALS AND THE EXPERIENCE OF THE AUTHOR. APEX GEOPHYSICS LTD. HAS PREPARED THIS REPORT IN LINE WITH BEST CURRENT PRACTICE AND WITH ALL REASONABLE SKILL, CARE AND DILIGENCE IN CONSIDERATION OF THE LIMITS IMPOSED BY THE SURVEY TECHNIQUES USED AND THE RESOURCES DEVOTED TO IT BY AGREEMENT WITH THE CLIENT. THE INTERPRETATIVE BASIS OF THE CONCLUSIONS CONTAINED IN THIS REPORT SHOULD BE TAKEN INTO ACCOUNT IN ANY FUTURE USE OF THIS REPORT.

PROJECT NUMBER	AGP22196		
AUTHOR	**CHECKED**	**REPORT STATUS**	**DATE**
EURGEOL YVONNE O'CONNELL P.GEO., M.SC. PH.D. (GEOPHYSICS)	EURGEOL PETER O'CONNOR P.GEO. M.SC. (GEOPHYSICS) DIP. EIA MGT.	V.01	12TH JANUARY 2023
EURGEOL YVONNE O'CONNELL P.GEO., M.SC. PH.D. (GEOPHYSICS)	TONY LOMBARD M.SC. (GEOPHYSICS)	V.02	16TH OCTOBER 2023

CONTENTS

1. EXECUTIVE SUMMARY

APEX Geophysics Limited was requested by Quarry Consulting to carry out a geophysical investigation at a site located near Kilmeague, Co. Kildare. The site has potential for sand and gravel deposits. The objective of the investigation was to provide information on sand and gravel thickness and volume of the available resource.

The site is approximately 9.5 km southwest of Clane, Co. Kildare covering a survey area of approximately 19.5 ha of forested area crosscut by several forest tracks with small areas of open land in the southeast of the site. Site topography slopes significantly across the site from 94 m OD in the southeast to 129m OD in the centre, falling away to 117 mOD the northeast.

The Geological Survey of Ireland (GSI) Quaternary Sediments map for the area indicates that the site is predominantly in an area of gravels derived from limestone, with till derived from limestones in the north and southeast of the site. The GSI 1:100k Bedrock Geology map for the area indicates that the site is underlain by red conglomerate, sandstone and mudstone of Old Red Sandstone, shale and sandstone of the Ferbane Mudstone Formation and thick-bedded grey sandstone of the Cloghan Sandstone Formation.

Five boreholes were drilled around the perimeter of the site in 2020 and indicated 15.8 to 33.2 m of sand/gravel deposits (with < 10 % fines) down to the top of rock at 93.43 mOD in the northwest and 81 mOD in the south.

The geophysical survey was carried out on the 15th December 2022 involving the collection of 7 Electrical resistivity Tomography (ERT) profiles and 1 seismic refraction profile. Due to the thick forestation, survey profiles were only recorded in accessible locations in the east and southeast of the site.

The geophysical and borehole data indicates soils comprising of **'clean' SAND/GRAVEL**, **silty SAND/GRAVEL** in the centre of the site with clayey SAND/GRAVEL and sandy gravelly CLAY across the southeast of the site.

Mudstone bedrock has been interpreted in the southeast and sandstone in the centre/west. Bedrock has been interpreted at elevations of approx. 77-93.43 mOD.

The geophysical and borehole data has outlined a zone of **'clean' SAND/GRAVEL** and **silty SAND/GRAVEL** across an area of 16.55 ha. Topsoil/sandy gravelly clay overburden is estimated to be 1 m thick. The **'clean' SAND/GRAVEL** and **silty SAND/GRAVEL** is estimated to have an average thickness of 24.5 m.

The geophysical results have outlined a potential resource of c.6.93 million tonnes of **'clean' SAND/GRAVEL** and **silty SAND/GRAVEL**. This classification is dependent on confirmatory pitting and drilling, and satisfactory laboratory testing results.

Tracks should be cleared across the west and northwest of the site in order to carry out additional geophysics.

Two boreholes and six trial pits have been recommended to confirm the findings of the geophysical survey. Samples should be sent for Particle Size Distribution (PSD) analysis and for chemical, physical, and mechanical laboratory tests if any further development is planned.

The volume and tonnage estimates are based on interpreted geophysical data in conjunction with the available borehole information and average heights from the topographic data acquired as part of the geophysical investigation. This should be refined after any topographic survey, direct investigation or detailed design.

The geophysical report should be reviewed after any further direct investigation.

2. INTRODUCTION

APEX Geophysics Limited was requested by Quarry Consulting to carry out a geophysical investigation at Kilmeague, Co. Kildare. The site has potential for sand and gravel deposits.

2.1 Survey Objectives

The objective of the investigation was to provide information on the following:

- sand and gravel thickness,
- overburden thickness
- volume of available resource,
- depth to and type of bedrock.

2.2 Site Background

The site is located near Kilmeague, Co. Kildare, approximately 9.5 km southwest of Clane, Co. Kildare (Fig. 2.1). The site covers an area of approximately 19.5 ha and comprises of forested area crosscut by several forest tracks with small areas of open land in the southeast of the site. Site topography slopes significantly across the site from 94 m OD in the southeast to 129m OD in the centre, falling away to 117 mOD the northeast. Due to the thick forestation, survey profiles were only recorded in accessible locations in the east and southeast of the site (see Fig. 2.1).

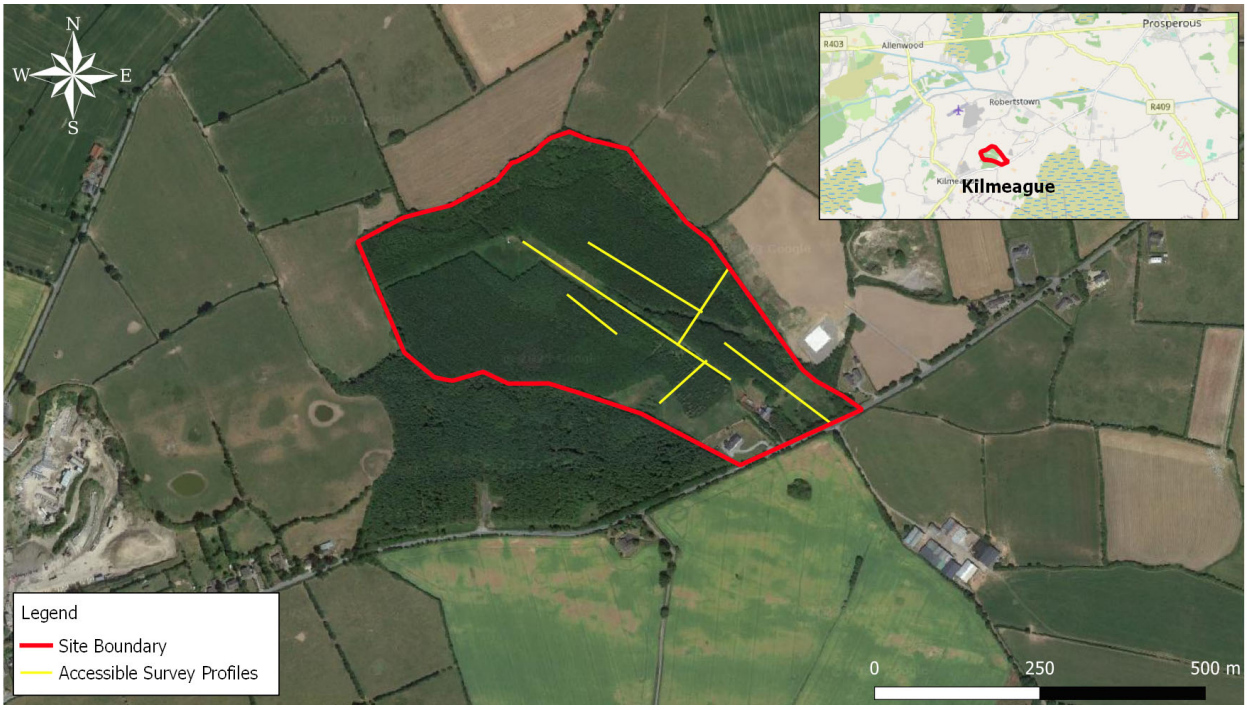


Fig 2.1: Site location.

2.2.1 Geology

The Geological Survey of Ireland (GSI) 1:100k Bedrock Geology map for the area (GSIa, 2019) indicates that the site is underlain by rocks of three geological formations: conglomerate, sandstone and mudstone of Old Red

Sandstone in the west and centre, with shale and sandstone of the Ferbane Mudstone Formation and thick-bedded grey sandstone of the Cloghan Sandstone Formation in the east/southeast (Fig. 2.2).

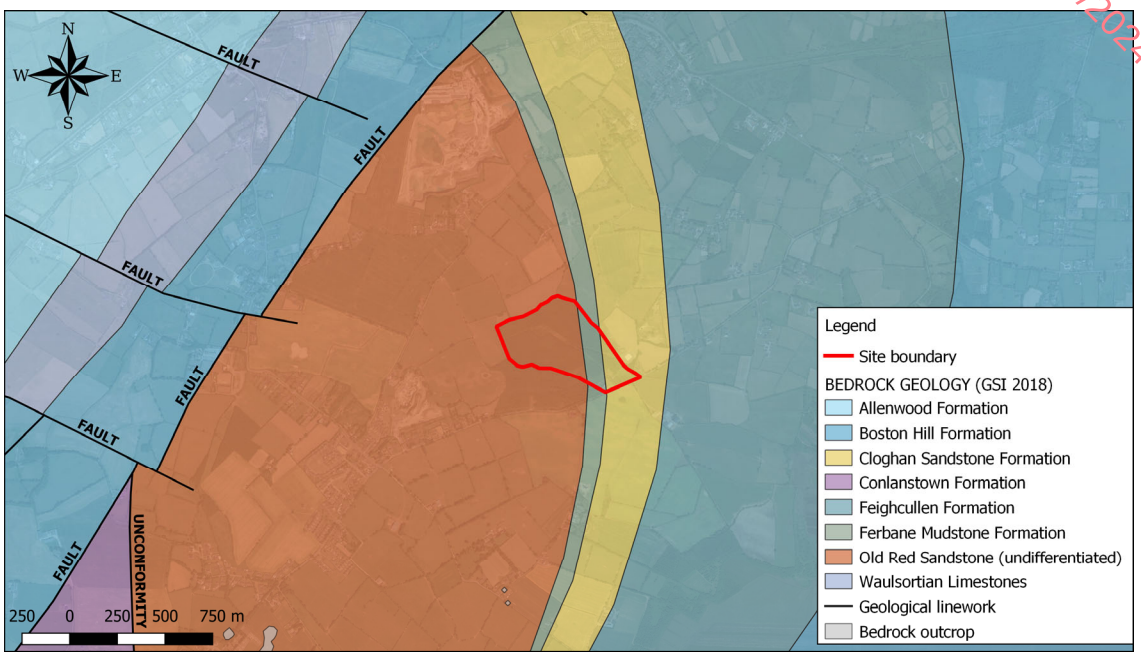


Fig 2.2: Bedrock geology.

2.2.2 Soils

The GSI Quaternary Sediments map for the area (GSIc, 2019) indicates that the site is predominantly in an area of gravels derived from limestones with till derived from limestones in the north and southeast of the site (Fig. 2.3).

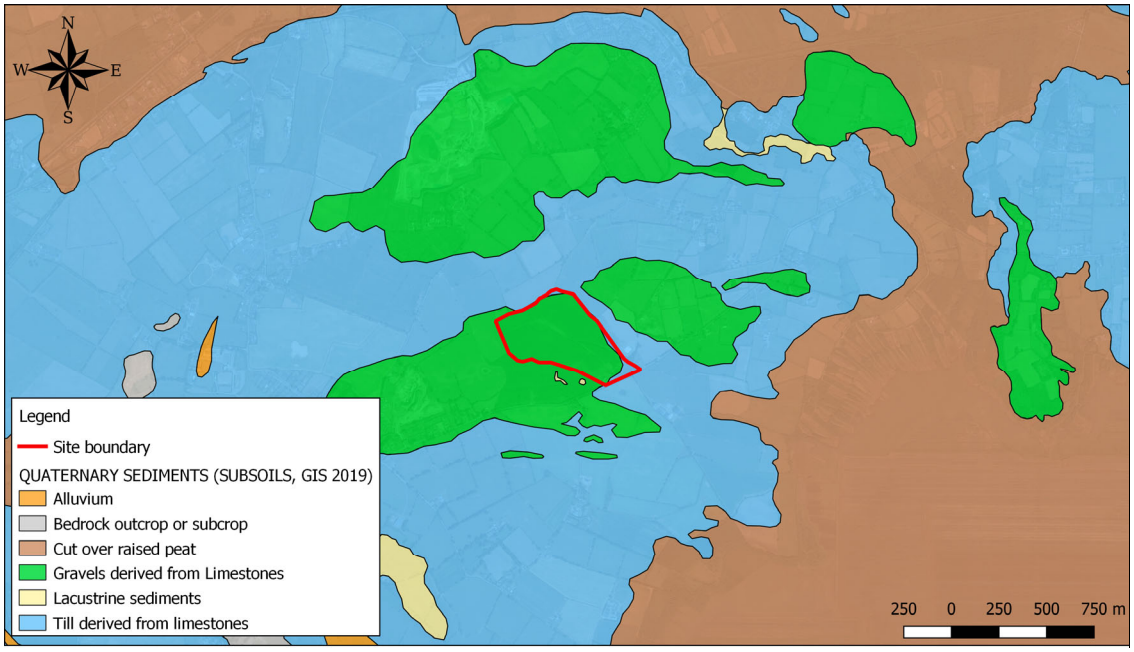


Fig 2.3: Quaternary sediments.

2.2.3 Vulnerability

The groundwater vulnerability rating for the site (GSIb, 2019) is predominantly 'high' and is 'moderate' in areas mapped as till areas in the north of the site (Fig. 2.4).

Fig 2.4: Groundwater vulnerability.

2.2.4 Aquifer Classification

The Old Red Sandstone is classified (GSI, 2019) as a 'locally important aquifer – bedrock which is moderately productive only in local zones, the Ferbane Formation as a 'poor aquifer – bedrock which is generally unproductive except for local zones' and the Cloghan Formation as a 'locally important aquifer – bedrock which is moderately productive' (Fig. 2.5). The sand/gravel deposits are not classified as an aquifer.

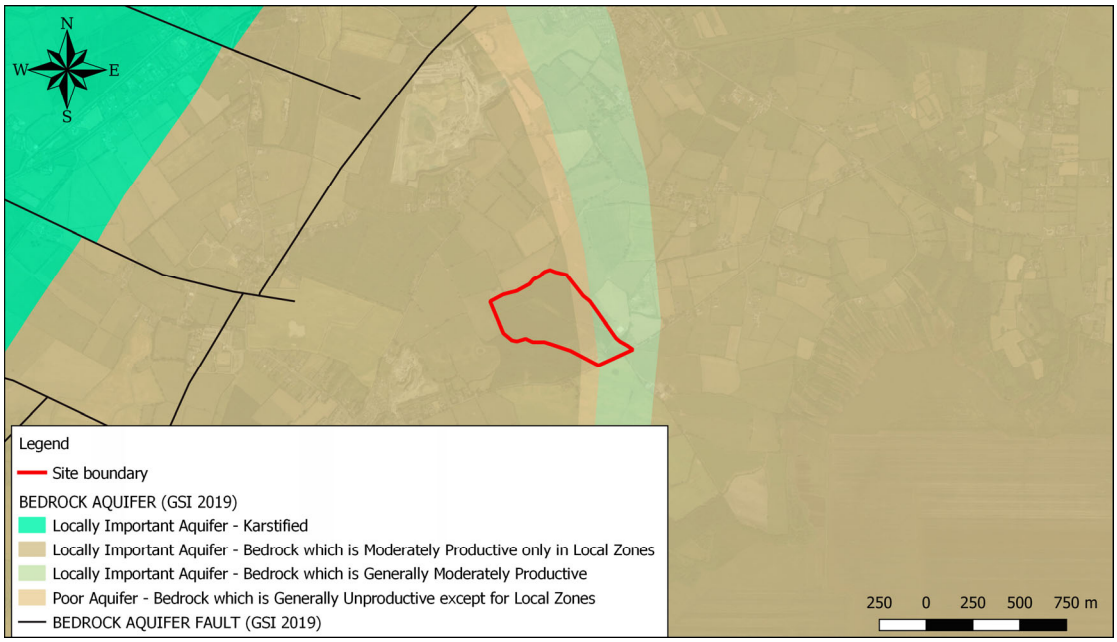


Fig 2.5: Bedrock aquifer.

2.2.5 Historical Data

The historical 6-inch sheet (Fig. 2.6) notes 'mounds of limestone gravel' across the site.

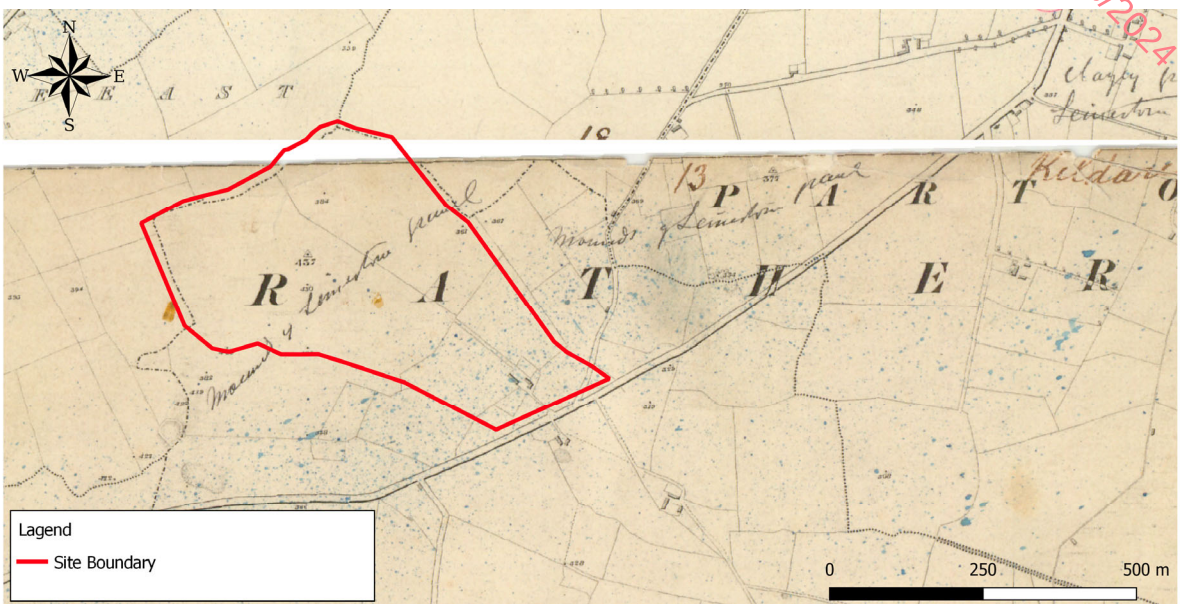


Fig 2.6: The historical 6-inch map.

2.2.6 Airborne Electromagnetic Data

Airborne electromagnetic (AEM) data was acquired in the survey area as part of the Tellus project (GSId, 2019). The data was acquired using 4 frequencies (24, kHz, 12 kHz, 9 kHz and 3 kHz) indicating bulk apparent resistivities for varying depths – with the 24 kHz (Fig. 2.7) examining the shallowest depths estimated to be <20 m below ground level.

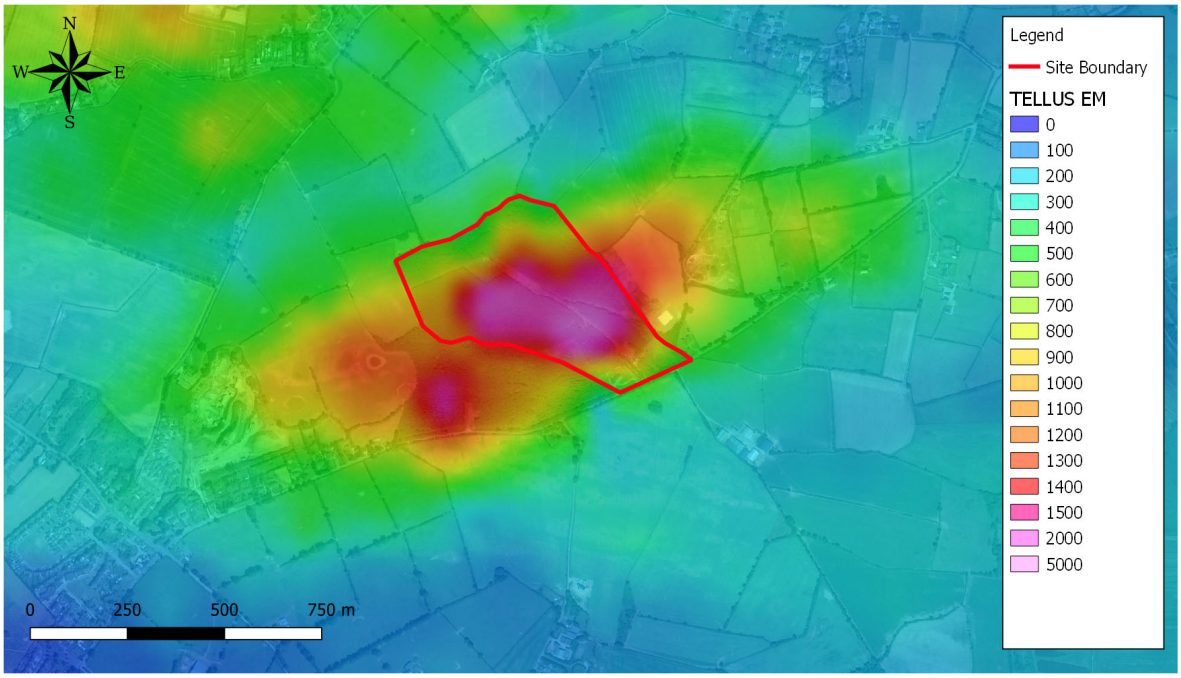


Fig 2.7: Tellus AEM 25 kHz apparent resistivity contours.

The AEM data indicate high resistivities (> 1000 Ohm-m) across the centre of the site. The variations in resistivities appear to be more indicative of the soils (see Fig. 2.3) than the underlying bedrock (see Fig. 2.2).

2.2.7 Direct Investigation

A geological report was prepared in 2020 (ESP, 2020). Five boreholes were drilled around the perimeter of the site. The boreholes indicated sand/gravel deposits (with < 10 % fines) down to the top of rock. Rock was encountered at 93.43 mOD in the northwest and 81 mOD in the south. The water table was encountered between 90.53 mOD in the north of the site and 88.1 mOD to the south of the site.

2.3 Survey Rationale

The investigation consisted of 2D Electrical resistivity Tomography (ERT) and Seismic Refraction profiling. EM31 was not carried out due to large parts of the site being inaccessible apart from the locations where the ERT was recorded.

ERT images the electrical resistivity of the materials in the subsurface along a profile to produce a cross-section showing the variation in resistivity with depth. Each cross-section will be interpreted to determine the material type along the profile based on typical resistivities returned for Irish ground materials.

Seismic Refraction profiling measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities. Readings are taken using geophones connected via multi-core cable to a seismograph.

As with all geophysical methods the results are based on indirect readings of the subsurface properties. The effectiveness of the proposed approach will be affected by variations in the ground properties. By combining a number of techniques it is possible to provide a higher quality interpretation and reduce any ambiguities which may otherwise exist. Further information on the detailed methodology of each geophysical method employed in this investigation is given in **APPENDIX A: DETAILED GEOPHYSICAL METHODOLOGY**.

3. RESULTS

The survey was carried out on the 15th December 2022 involving the collection of 7 ERT profiles and 1 seismic refraction profile. The geophysical survey locations are indicated on Drawing AGP22196_01 (Appendix C).

3.1 ERT

Seven ERT Profiles (R1-R7) have been acquired across the site. ERT profile R2 was acquired as a repeat of the first 200 m of R1 to investigate interference along the profile. Both profiles are significantly affected by the presence of wire fencing buried in the undergrowth and/or other underground services. The data for R1 and R2 are not presented in this report. The resistivity values have been interpreted on the following basis:

Resistivity (Ohm-m)	Interpretation
50-250	Topsoil and Sandy gravelly CLAY
250-500	Clayey SAND/GRAVEL
500-1000	**Silty SAND/GRAVEL**
1000-3000	**'Clean' SAND/GRAVEL**
100-300	MUDSTONE
400-1000	SANDSTONE

3.2 Seismic refraction profiling

One seismic refraction spread (S1) was recorded along R6 (Appendix C). The seismic velocities indicated 4 seismic velocity layers that have been interpreted in conjunction with the ERT data on the following basis:

Average Seismic Velocity (m/s)	Interpretation	Estimated Stiffness/ Rock Quality
300	Sandy gravelly CLAY / Topsoil	Soft/Loose
608	SAND/GRAVEL, silty or clayey SAND/GRAVEL	Medium Dense
1597	SAND/GRAVEL, silty or clayey SAND/GRAVEL (saturated)	Dense
3038	Slightly Weathered to Fresh BEDROCK	Good

3.3 Integrated interpretation

The geophysical results and interpretation are presented on Drawings AGP22196_R3 to AGP22196_R7, Appendix C and summarised on Drawing AGP22196_02.

The geophysical data in conjunction with the borehole information have been interpreted as follows:

- Topsoil/sandy gravelly clay thickness is generally estimated at approx. 1 m thick apart from occasional local pockets of thicker material (e.g. in the northwest on R7, Drawing AGP22196_R7).

- The seismic velocities of the layer of dense SAND/GRAVEL, silty or clayey SAND/GRAVEL coupled with a decrease in resistivities suggest the SAND/GRAVEL, silty or clayey SAND/GRAVEL are saturated at depth.

- Bedrock has been interpreted from the geophysical and borehole data at elevations varying from approx. 77.0 - 93.43 mOD. In the centre and to the west of the site, the electrical resistivity of the rock (400 – 1000 Ohm-m) and seismic velocities (3038 m/s) are typical of a slightly weathered to fresh dark sandstone. Mudstone bedrock, with low resistivities 100-300 Ohm-m) has been interpreted in the southeast of the site (see AGP22196_R3).

4. RESOURCE

Electrical resistivity values for Irish sand and gravel deposits are generally within the following ranges:

Material	*Fines Content %	Resistivity (Ohm-m)	Economic Potential
'Clean' SAND/GRAVEL	< 5	> 1000	Yes
Silty SAND/GRAVEL	5 - 15	500-1000	may have, subject to screening/washing.
Clayey SAND/GRAVEL	> 15%	250-500	unlikely, due to fines content

**Fines refer to the clay and silt content of the sand/gravel material. The higher the fines content the poorer the material and use is restricted and screening/or washing required. These estimates should be confirmed by subsequent sampling and testing.*

The ERT data in conjunction with the borehole data has been used to outline a 16.55 ha zone of **'clean' SAND/GRAVEL** and **silty SAND/GRAVEL** (Drawing AGP22196_02). This classification is dependent on satisfactory laboratory testing results. The **silty SAND/GRAVEL** material may have economic potential but the fines content, which, based on previous experience, is likely to be between 5% and 15% and may be a limiting factor. The boreholes on the perimeter of the site indicate <10 % fines in the material.

Given that the borehole data indicates sand/gravel deposits down to the top of rock, the interpreted thickness of the **'clean' SAND/GRAVEL** and the **silty SAND/GRAVEL** has been interpreted as ranging from approx. 16 m (ERT R3) to 33 m (BH4).

An estimated average thickness of 24.5 m has been used to calculate the potential resource. The estimated volumes are shown in Table 4.1 below:

Material	Extent	Interpreted Thickness (Average)	Computed Overburden Volume	Computed Sand/Gravel Volume	Sand/Gravel Resource Tonnes *
	(ha)	(m)	(cu.m)	(cu.m)	(@1.8 t/cu.m. - 5% fines)
Overburden	16.55	1	165,521		
SAND/GRAVEL and silty SAND/GRAVEL	16.55	24.5		4,055,265	6,934,502

** A conversion density of 1.8 tonnes/cu.m. for SAND/GRAVEL has been used. An allowance of -5% has been made for waste.*

The geophysical results have outlined a potential resource of c.6.93 million tonnes of **'clean' SAND/GRAVEL** and **silty SAND/GRAVEL**. This classification is dependent on confirmatory drilling and pitting, and satisfactory laboratory testing results.

This is a gross estimate based on interpreted geophysical data in conjunction with the available borehole information.

5. RECOMMENDATIONS

Tracks should be cleared across the west and northwest of the site in order to carry out further confirmatory geophysics.

Boreholes and trial pits to confirm the findings of the geophysical survey are recommended at the following locations:

No.	Easting (ITM)	Northing (ITM)	Comment
PBH1	678501.8	723585.4	Confirm thickness of 'clean' SAND/GRAVEL
PBH2	678635.4	723474.2	Confirm thickness of 'clean' SAND/GRAVEL
PTP1	678463.9	723609.6	Confirm silty SAND/GRAVEL & 'clean' SAND/GRAVEL
PTP2	678369.8	723563.9	Confirm sandy gravelly CLAY
PTP3	678536.7	723516.0	Confirm 'clean' SAND/GRAVEL
PTP4	678550.6	723459.5	Confirm 'clean' SAND/GRAVEL
PTP5	678505.2	723419.1	Confirm sandy gravelly CLAY
PTP6	678696.1	723425.0	Confirm sandy gravelly CLAY

PBH1 and PBH2 should be drilled until the sand/gravel is bottomed out or regional watertable encountered. Samples should be taken from the trial pits and boreholes for Particle Size Distribution (PSD) analysis and for chemical, physical, mechanical and laboratory tests to assess suitability for use. If the pits show good quality material down to 4 - 5 m then two pits should be deepened as macro pits with the sides battered back to a safe angle to allow digging in of the excavator.

The volume and tonnage estimates are based on interpreted geophysical data in conjunction with the available borehole information and average heights from the topographic data acquired as part of the geophysical investigation. This should be refined after any topographic survey, direct investigation or detailed design.

The geophysical report should be reviewed after any further direct investigation.

REFERENCES

Bell F.G., 1993;
'Engineering Geology', Blackwell Scientific Press.

ESP, 2020;
Sand deposits at Coolaght, Kilmeague, Co. Kildare, Earth Science Partnership Ltd., Co. Mayo

Geotomo Software, 2006;
'RES2DINV Users Manual', Malaysia.

GSI, 2019;
Bedrock Aquifer Shapefile. http://www.gsi.ie/Mapping.htm

GSIa, 2018;
Bedrock Geology 1:100,000 Shapefile. http://www.gsi.ie/Mapping.htm

GSIb, 2019;
Groundwater Vulnerability Shapefile. http://www.gsi.ie/Mapping.htm

GSIc, 2019;
Quaternary Subsoils Shapefile. http://www.gsi.ie/Mapping.htm

GSId, 2019;
TELLUS_RES25_4F_MERGE_2019B_Coast_Clipped. GSI, 2019

Redpath, B.B., 1973;
'Seismic refraction exploration for engineering site investigations', NTIS, U.S. Dept. of Commerce

Sheriff, R.E., and Geldart, L.P., 1982;
Exploration seismology, volume 1: Cambridge University Press, 253 pp.

SeisImager, 2009;
'SeisImager / 2D Manual version 3.3'. OYO Corporation.

APPENDIX A: DETAILED GEOPHYSICAL METHODOLOGY

A combination of geophysical techniques was used to provide a high-quality interpretation and reduce any ambiguities, which may otherwise exist.

Electrical Resistivity Tomography (ERT)

Electrical Resistivity Tomography was carried out to provide information on lateral variations in the overburden material as well as on the underlying overburden and bedrock.

Principles

This surveying technique makes use of the Wenner resistivity array. The 2D-resistivity profiling method records a large number of resistivity readings in order to map lateral and vertical changes in material types. This method involves the use of electrodes connected to a resistivity meter, using computer software to control the process of data collection and storage.

Data Collection

Profiles were recorded using an ABEM LS4 resistivity meter, imaging software, four 21 takeout multicore cables and up to 80 stainless steel electrodes. Saline solution was used at the electrode/ground interface in order to gain a good electrical contact required for the technique to work effectively. The recorded data were processed and viewed immediately after surveying.

Data Processing

The field readings were stored in computer files and inverted using the RES2DINV package (Geotomo Software, 2006) with up to 5 iterations of the measured data carried out for each profile to obtain a 2D-depth model of the resistivities.

The inverted 2D resistivity models and corresponding interpreted geology are displayed on the accompanying drawings alongside the processed seismic sections. Profiles have been contoured using the same contour intervals and colour codes. Distance is indicated along the horizontal axis of the profiles.

Seismic Refraction Profiling

Principles

This method measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities.

Seismic profiling measures the p-wave velocity (Vp) of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher Vp velocities while soft, loose or fractured materials have lower Vp velocities. Readings are taken using geophones connected via multi-core cable to a seismograph.

Data Collection

A Geode high resolution 24 channel digital seismograph, 24 10HZ vertical geophones and a 10 kg hammer were used to provide first break information, with a 24 take-out cable. Equipment was carried and operated by a two-person crew.

Readings are taken using geophones connected via multi-core cable to a seismograph. The depth of resolution of soil/bedrock boundaries is determined by the length of the seismic spread, typically the depth of resolution is about one third the length of the profile. (eg. 69m profile ~23m depth, 33m profile ~ 11m depth).

Data Processing

First break picking in digital format was carried out using the SeisImager/2D PICKWIN software program from Geometrics to construct p-wave (Vp) traveltime plots for each spread. The processing and interpretation uses the ray-tracing and tomographic inversion methods, to acquire depths to boundaries and the P-wave velocities of these layers, using the SeisImager/2D PLOTREFA program.

SeisImager/2D interprets seismic refraction data as a laterally varying layered earth structure. The program includes three methods for data analysis, time-term inversion, the reciprocal method, and tomography. The tomography method creates an initial velocity model, then traces rays through the model, comparing the calculated and measured traveltimes. The model is then modified, and the process repeated to minimise the difference between the calculated and measured times. The data was processed using this method and was then converted to a layer model for display and interpretation.

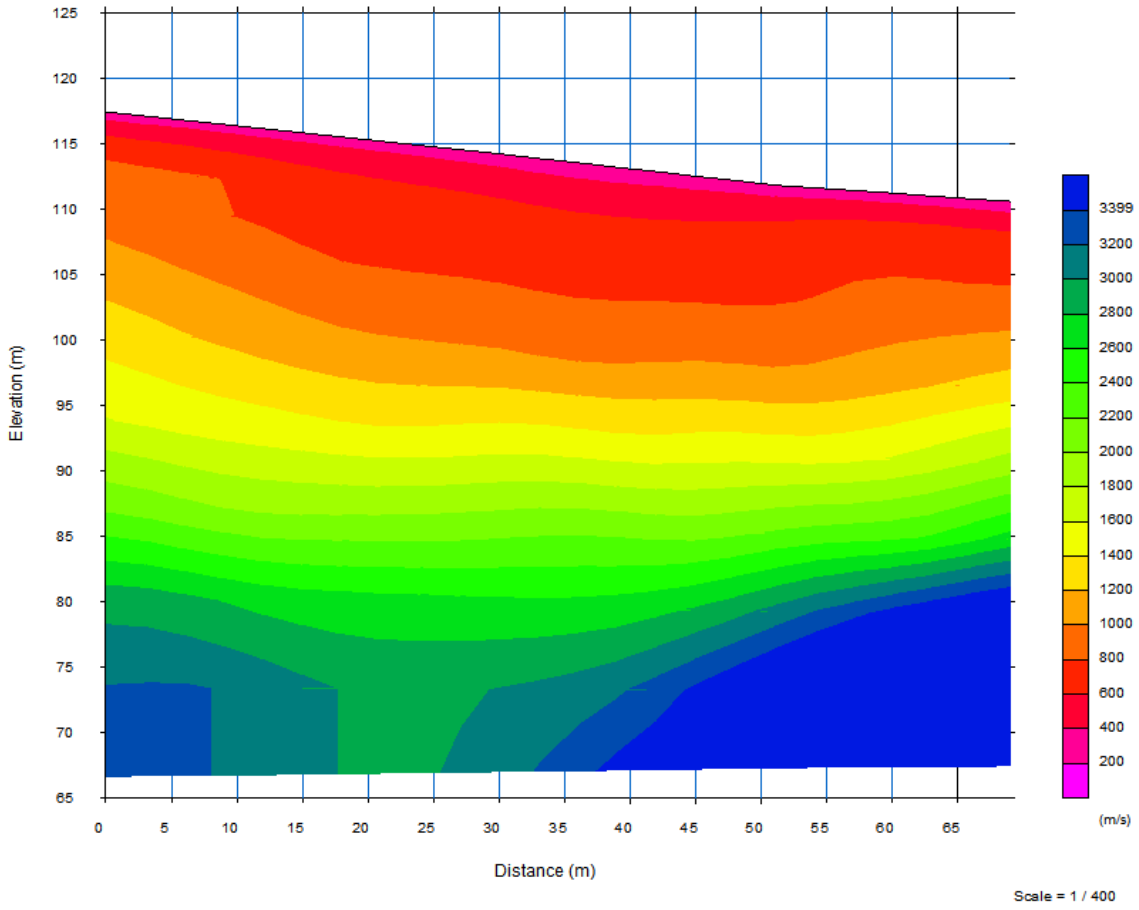
Approximate errors for Vp velocities are estimated to be +/- 10%. Errors for the calculated layer thicknesses are of the order of +/-20%. Possible errors due to the "hidden layer" and "velocity inversion" effects may also occur (Soske, 1959).

Spatial Relocation

All ERT and Seismic Refraction locations were acquired using a Trimble Geo 7X high-accuracy GNSS handheld system using the settings listed below. This system allows collection of GPS data with c.20mm accuracy.

Projection:	Irish Transverse Mercator
Datum:	Ordnance
Coordinate units:	Metres
Altitude units:	Metres
Survey altitude reference:	MSL
Geoid model:	Republic of Ireland

APPENDIX B: SEISMIC DATA



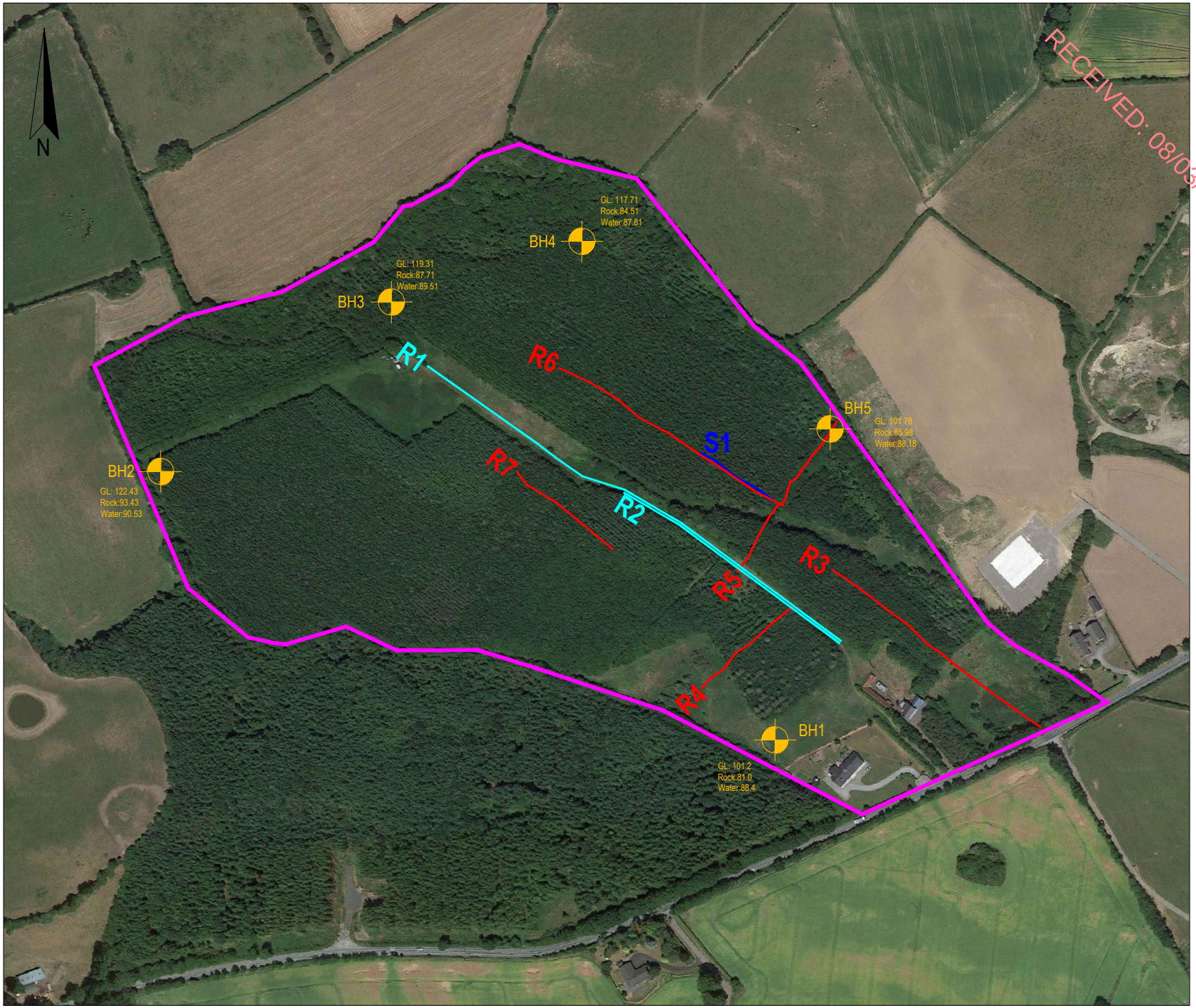
APPENDIX C: DRAWINGS

The information derived from the geophysical investigation presented in the following drawings:

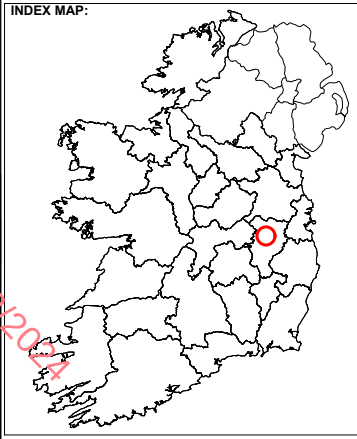
AGP22196_01 Geophysical Locations	1:4000	@ A4
AGP22196_02 Summary Interpretation Map	1:4000	@ A4
AGP22196_R3 Results & Interpretation – ERT R3	1:1000	@ A4
AGP22196_R4 Results & Interpretation – ERT R4	1:1000	@ A4
AGP22196_R5 Results & Interpretation – ERT R5	1:1000	@ A4
AGP22196_R6 Results & Interpretation – ERT R6 & Seismic spread S1	1:1000	@ A4
AGP22196_R7 Results & Interpretation – ERT R7	1:1000	@ A4

GEOPHYSICAL LOCATIONS

SCALE 1:4000



INDEX MAP:



LEGEND:

- Site
- R3 — 2D ERT profile
- R1 — 2D ERT profile affected by interference
- S1 — Seismic refraction profile
- BH1 — 2020 Borehole

The information displayed here is to be used in conjunction with AGP22196_02 Report on the Geophysical Investigation at Kilmeague, Co. Kildare for Quarry Consulting, APEX Geophysics Ltd.,16th October 2023

apex geophysics

6 Knockmullen Business Park
Gorey
Co. Wexford
Ireland

T +353 (0)402-21842
E info@apexgeophysics.ie
www.apexgeophysics.ie

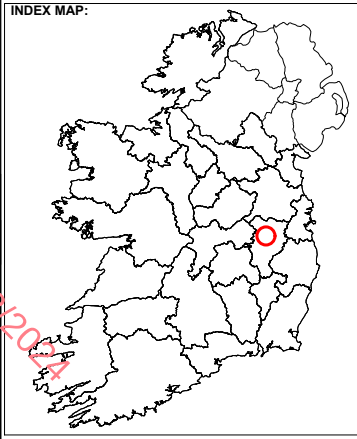
PROJECT:	KILMEAGUE LANDS GEOPHYSICAL SURVEY
CLIENT.:	QUARRY CONSULTING
DRAWING NO:	AGP22196_01
SCALE:	AS INDICATED @ A4
DATE:	16-10-2023

Version:	Date:	Drawn By:	Checked:
01	12-01-2023	YOC	POC
02	16-10-2023	YOC	TL

SUMMARY INTERPRETATION MAP

SCALE 1:4000

INDEX MAP:



LEGEND:

- Site
- 'Clean' SAND/GRAVEL & Silty SAND/GRAVEL
- Clayey SAND/GRAVEL & sandy gravelly CLAY
- PBH1 Proposed borehole
- PTP1 Proposed trial pit

The information displayed here is to be used in conjunction with AGP22196_02 Report on the Geophysical Investigation at Kilmeague, Co. Kildare for Quarry Consulting, APEX Geophysics Ltd.,16th October 2023

apex geophysics

6 Knockmullen Business Park
Gorey
Co. Wexford
Ireland

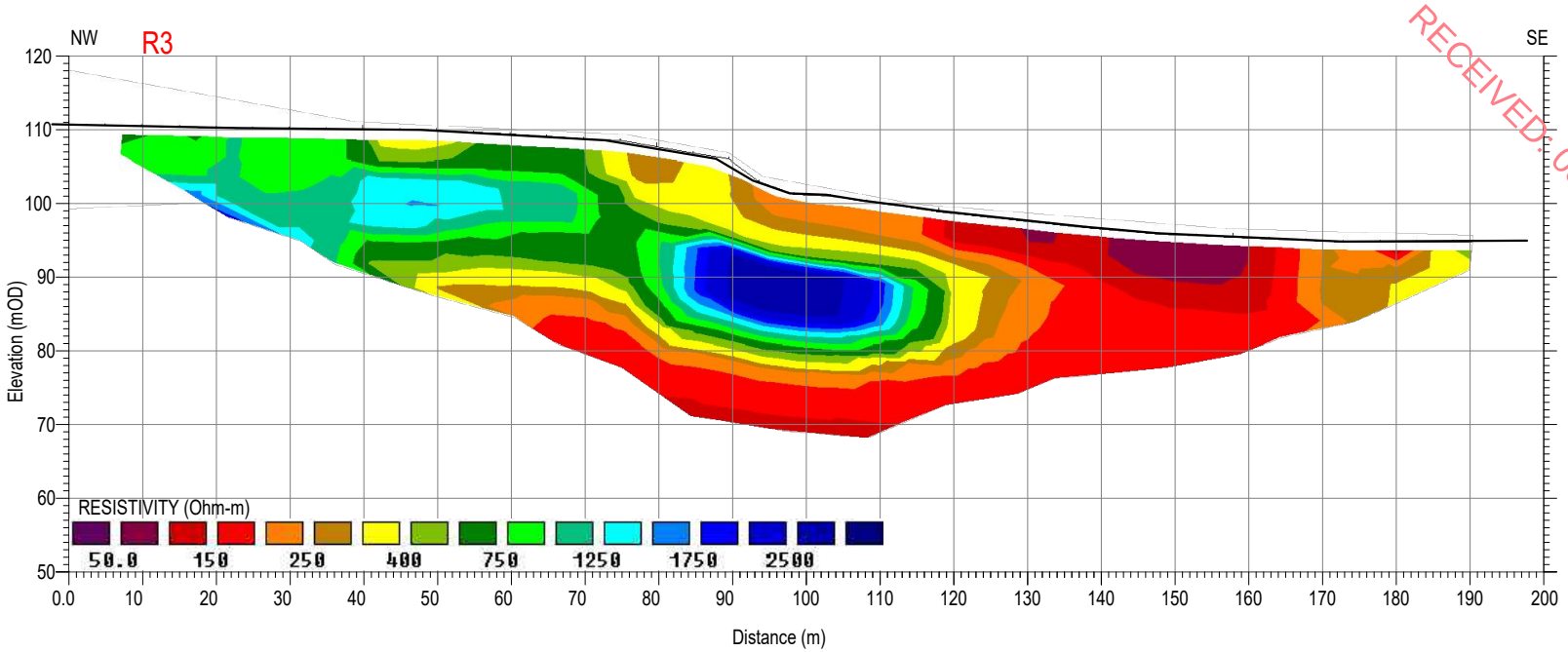
T +353 (0)402-21842
E info@apexgeophysics.ie
www.apexgeophysics.ie

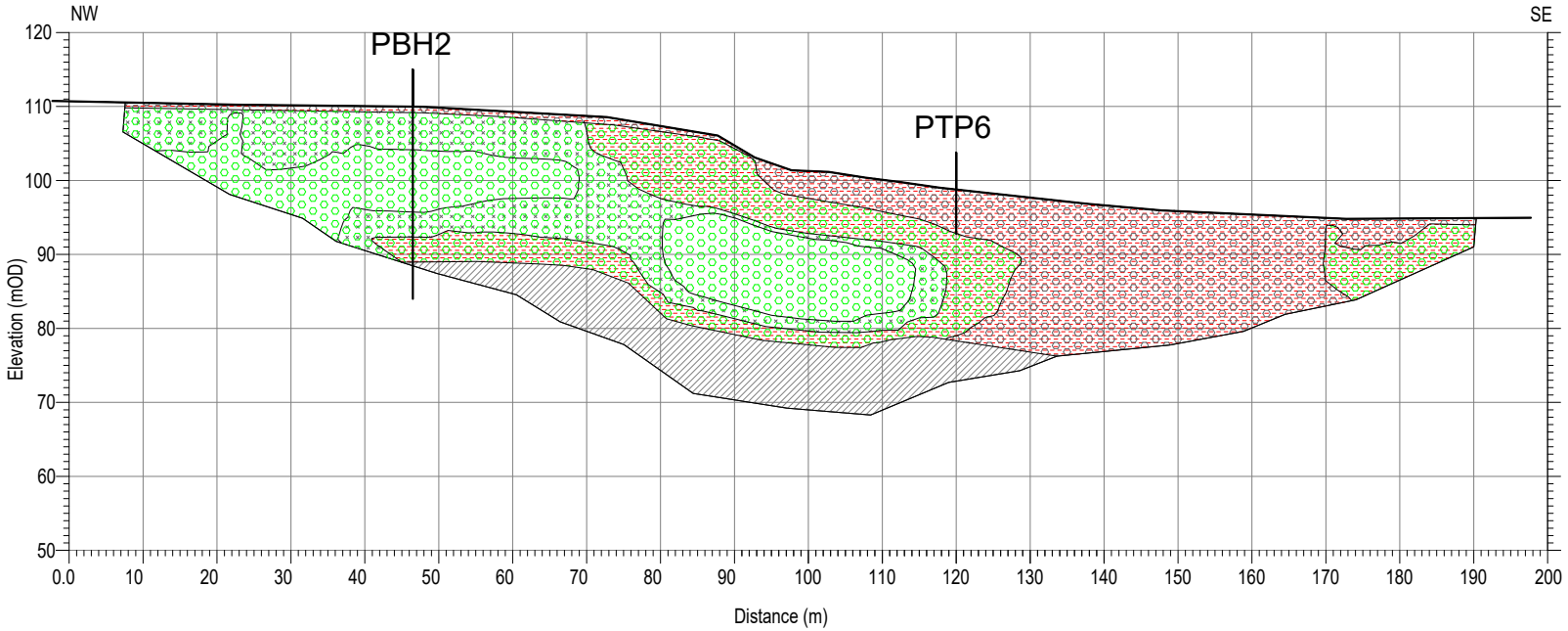
PROJECT:	KILMEAGUE LANDS GEOPHYSICAL SURVEY
CLIENT.:	QUARRY CONSULTING
DRAWING NO:	AGP22196_02
SCALE:	AS INDICATED @ A4
DATE:	16-10-2023

Version:	Date:	Drawn By:	Checked:
01	12-01-2023	YOC	POC
02	16-10-2023	YOC	TL

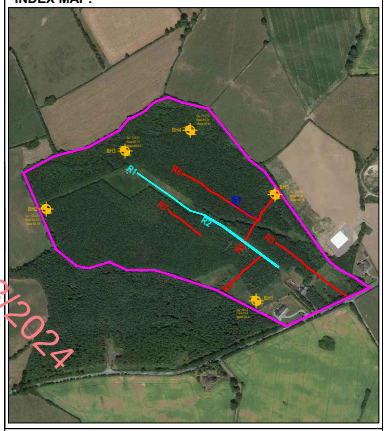
RESULTS & INTERPRETATION - ERT R3

SCALE 1:1000





INDEX MAP:



LEGEND:

- TOPSOIL & sandy gravelly CLAY
- Clayey SAND/GRAVEL
- Silty SAND/GRAVEL
- 'Clean' SAND/GRAVEL
- MUDSTONE
- SANDSTONE
- Seismic refraction layer with interpreted P-wave velocity (1254-1288 m/s)

The information displayed here is to be used in conjunction with AGP22196_02 Report on the Geophysical Investigation at Kilmeague, Co. Kildare for Quarry Consulting, APEX Geophysics Ltd.,16th October 2023

apex geophysics

6 Knockmullen Business Park
Gorey
Co. Wexford
Ireland

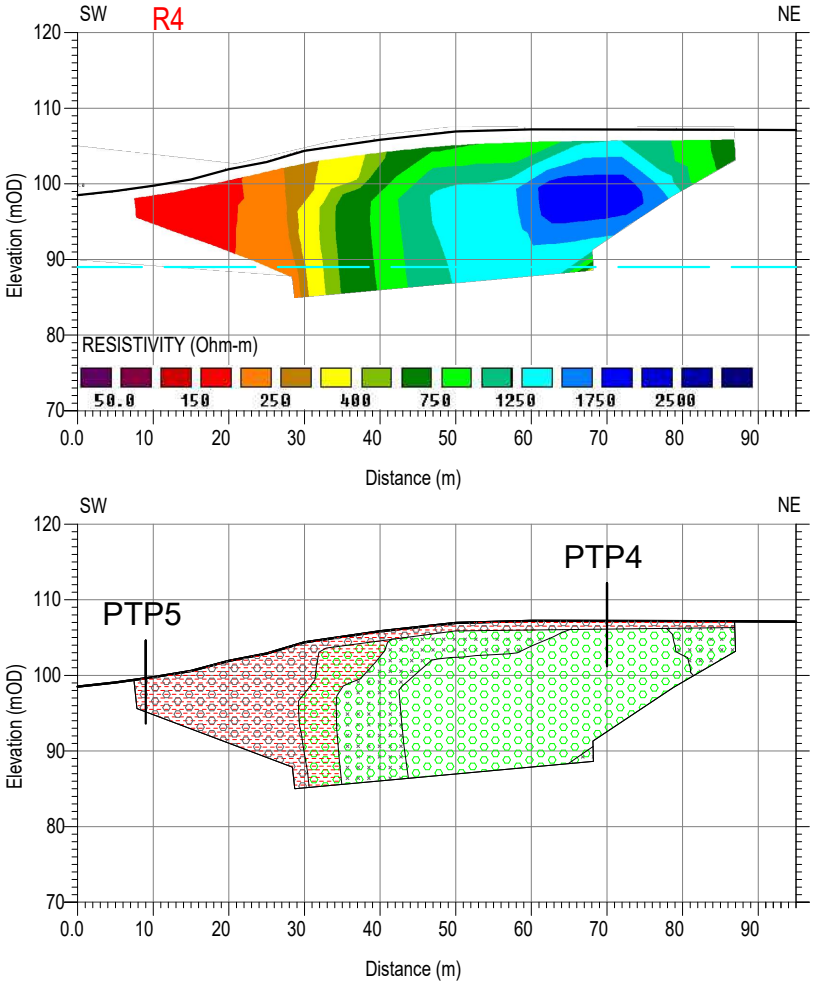
T +353 (0)402-21842
E info@apexgeophysics.ie
www.apexgeophysics.ie

PROJECT:	KILMEAGUE LANDS GEOPHYSICAL SURVEY
CLIENT.:	QUARRY CONSULTING
DRAWING NO:	AGP22196_R3
SCALE:	AS INDICATED @ A4
DATE:	16-10-2023

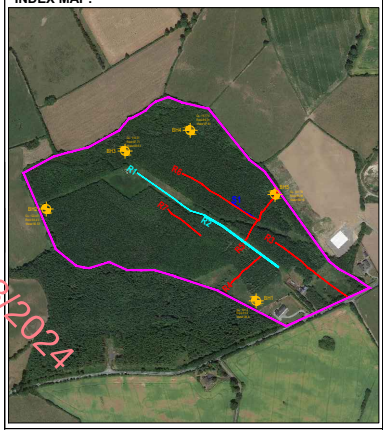
Version:	Date:	Drawn By:	Checked:
01	12-01-2023	YOC	POC
02	16-10-2023	YOC	TL

RESULTS & INTERPRETATION - ERT R4

SCALE 1:1000



INDEX MAP:



LEGEND:

- TOPSOIL & sandy gravelly CLAY
- Clayey SAND/GRAVEL
- Silty SAND/GRAVEL
- 'Clean' SAND/GRAVEL
- MUDSTONE
- SANDSTONE
- Seismic refraction layer with interpreted P-wave velocity (1254-1288 m/s)

The information displayed here is to be used in conjunction with AGP22196_02 Report on the Geophysical Investigation at Kilmeague, Co. Kildare for Quarry Consulting, APEX Geophysics Ltd.,16th October 2023

apex geophysics

6 Knockmullen Business Park
Gorey
Co. Wexford
Ireland

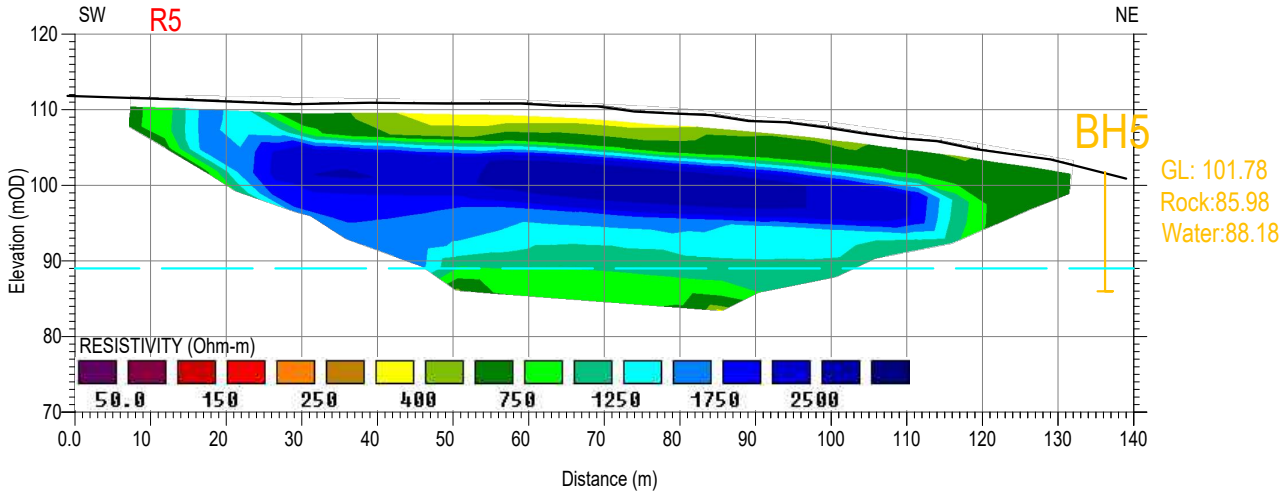
T +353 (0)402-21842
E info@apexgeophysics.ie
www.apexgeophysics.ie

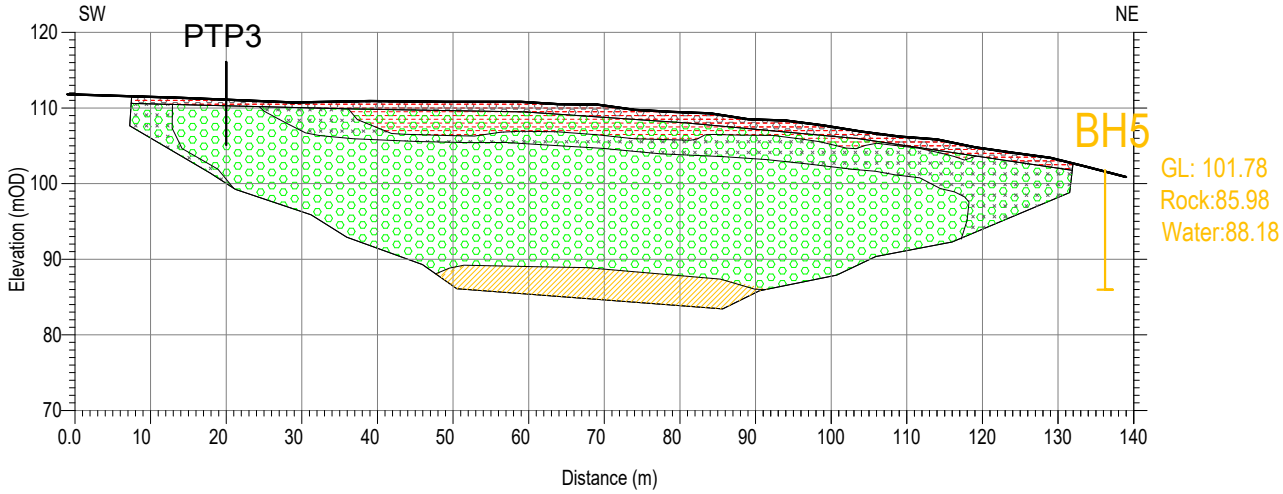
PROJECT:	KILMEAGUE LANDS GEOPHYSICAL SURVEY
CLIENT.:	QUARRY CONSULTING
DRAWING NO:	AGP22196_R4
SCALE:	AS INDICATED @ A4
DATE:	16-10-2023

Version:	Date:	Drawn By:	Checked:
01	12-01-2023	YOC	POC
02	16-10-2023	YOC	TL

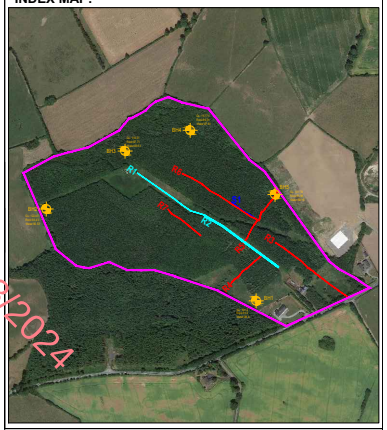
RESULTS & INTERPRETATION - ERT R5

SCALE 1:1000





INDEX MAP:



LEGEND:

- TOPSOIL & sandy gravelly CLAY
- Clayey SAND/GRAVEL
- Silty SAND/GRAVEL
- 'Clean' SAND/GRAVEL
- MUDSTONE
- SANDSTONE
- Seismic refraction layer with interpreted P-wave velocity (1254-1288 m/s)

The information displayed here is to be used in conjunction with AGP22196_02 Report on the Geophysical Investigation at Kilmeague, Co. Kildare for Quarry Consulting, APEX Geophysics Ltd.,16th October 2023

apex geophysics

6 Knockmullen Business Park
Gorey
Co. Wexford
Ireland

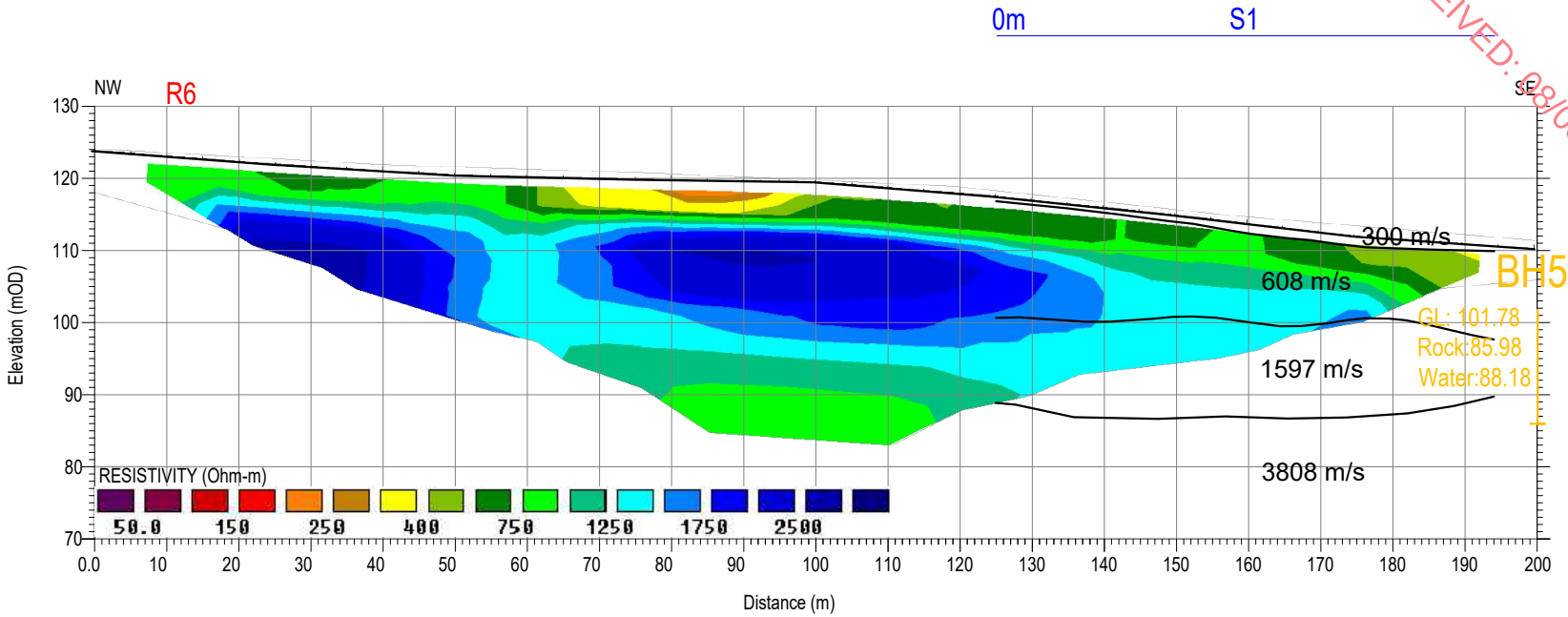
T +353 (0)402-21842
E info@apexgeophysics.ie
www.apexgeophysics.ie

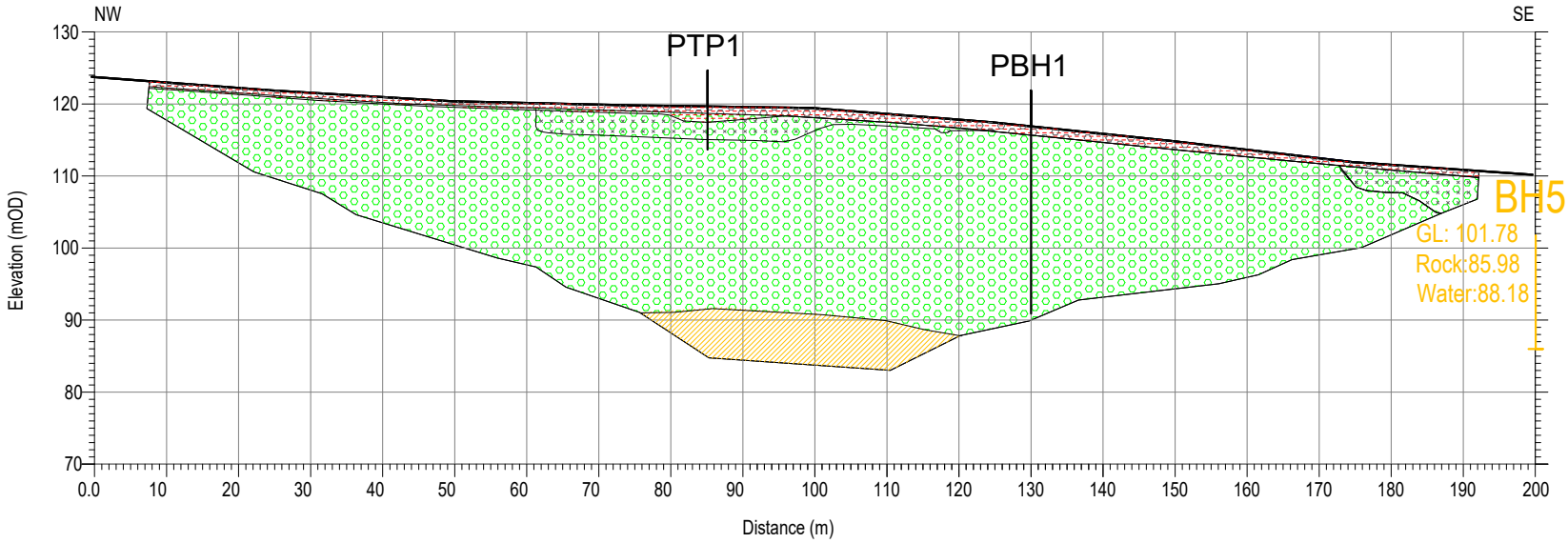
PROJECT:	KILMEAGUE LANDS GEOPHYSICAL SURVEY
CLIENT.:	QUARRY CONSULTING
DRAWING NO:	AGP22196_R5
SCALE:	AS INDICATED @ A4
DATE:	16-10-2023

Version:	Date:	Drawn By:	Checked:
01	12-01-2023	YOC	POC
02	16-10-2023	YOC	TL

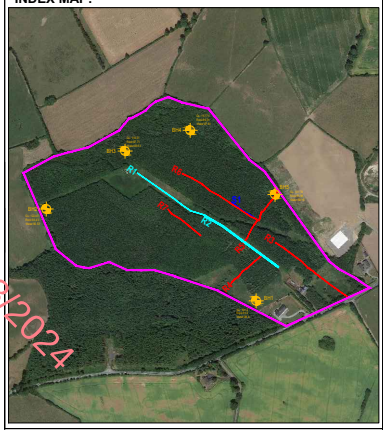
RESULTS & INTERPRETATION - ERT R6 & SEISMIC SPREAD S1

SCALE 1:1000





INDEX MAP:



LEGEND:

- TOPSOIL & sandy gravelly CLAY
- Clayey SAND/GRAVEL
- Silty SAND/GRAVEL
- 'Clean' SAND/GRAVEL
- MUDSTONE
- SANDSTONE
- Seismic refraction layer with interpreted P-wave velocity (1254-1288 m/s)

The information displayed here is to be used in conjunction with AGP22196_02 Report on the Geophysical Investigation at Kilmeague, Co. Kildare for Quarry Consulting, APEX Geophysics Ltd.,16th October 2023

apex geophysics

6 Knockmullen Business Park
Gorey
Co. Wexford
Ireland

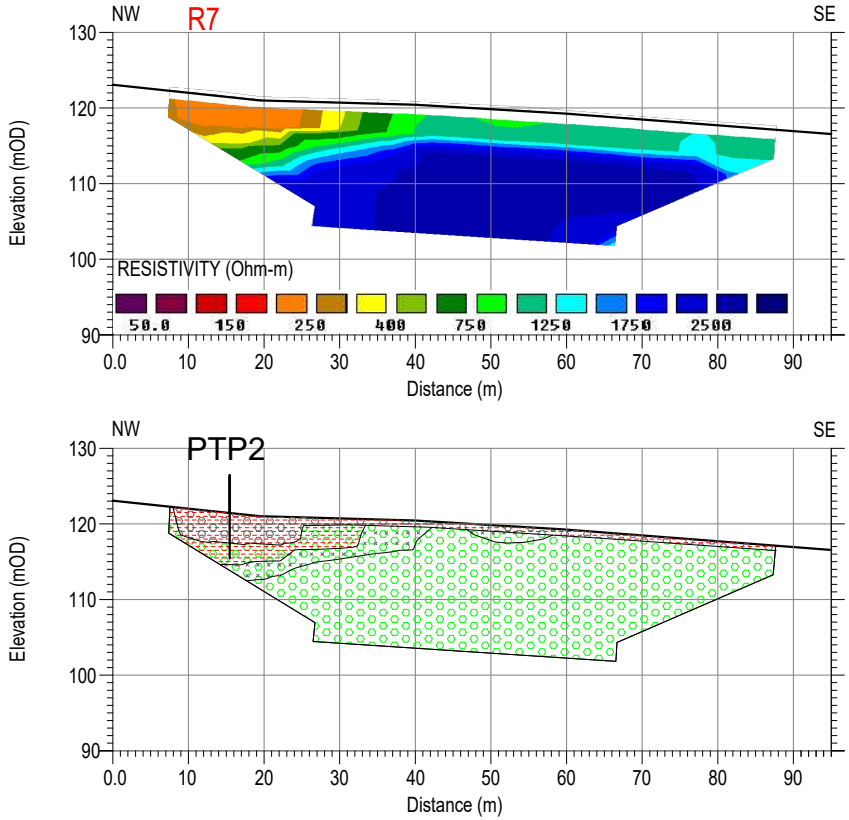
T +353 (0)402-21842
E info@apexgeophysics.ie
www.apexgeophysics.ie

PROJECT:	KILMEAGUE LANDS GEOPHYSICAL SURVEY
CLIENT:	QUARRY CONSULTING
DRAWING NO:	AGP22196_R6
SCALE:	AS INDICATED @ A4
DATE:	16-10-2023

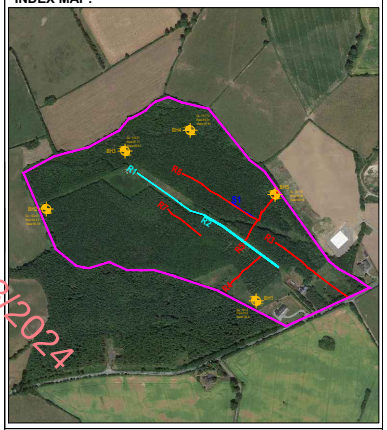
Version:	Date:	Drawn By:	Checked:
01	12-01-2023	YOC	POC
02	16-10-2023	YOC	TL

RESULTS & INTERPRETATION - ERT R7

SCALE 1:1000



INDEX MAP:



LEGEND:

- TOPSOIL & sandy gravelly CLAY
- Clayey SAND/GRAVEL
- Silty SAND/GRAVEL
- 'Clean' SAND/GRAVEL
- MUDSTONE
- SANDSTONE
- 1254-1288 m/s Seismic refraction layer with interpreted P-wave velocity

The information displayed here is to be used in conjunction with AGP22196_02 Report on the Geophysical Investigation at Kilmeague, Co. Kildare for Quarry Consulting, APEX Geophysics Ltd.,16th October 2023

apex geophysics

6 Knockmullen Business Park
Gorey
Co. Wexford
Ireland

T +353 (0)402-21842
E info@apexgeophysics.ie
www.apexgeophysics.ie

PROJECT:	KILMEAGUE LANDS GEOPHYSICAL SURVEY
CLIENT.:	QUARRY CONSULTING
DRAWING NO:	AGP22196_R7
SCALE:	AS INDICATED @ A4
DATE:	16-10-2023

Version:	Date:	Drawn By:	Checked:
01	12-01-2023	YOC	POC
02	16-10-2023	YOC	TL

petersen drilling services ltd. on behalf of **Earth Science** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
0.00	Firm sandy TOPSOIL		RO		0.00	23.00	0000		100	brown												12.00
0.25	Medium dense brown very silty slightly gravelly SAND																					
3.20	Medium dense brown slightly gravelly SAND																					
6.10	Medium dense brown gravelly SAND																					
10.50	Dense brown subrounded SAND & GRAVEL with frequent cobbles and boulders																					
20.70	Medium strong reddish MUDSTONE																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0755			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1920	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer
C	140.00	0.00	23.00							
RO	154.00	0.00	23.00				DTH	115	Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
1010	14.00	14.00	Slow	0.00	0.00	0.00	0.00	N/S

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks
1320	0020	Dayworks: Airlift developing of well

SPT I.D. Number	pd1	Calibration Date	18/09/2017
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details			CSCS No
Support Operative	john whyte		
Lead Driller	stephan petersen		
Site category	Green		
Project Engineer			
Lead Driller's signature			

Project Title

Kilmeague

Weather	Variable	Project No	20-Oct
Date	23/03/2020	Day	Monday
Rig type	knebel hy79	Borehole Number	
Inclination		Orientation	BH 1
Sheet	1 of 1	Completed	Y

AGS

Produced by KeyLogbook

petersen drilling services ltd. on behalf of **Earth Science** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
0.00	Soft to firm clayey TOPSOIL		RO		0.00	45.50	0000		100	brown												Dry
0.30	Dense brown subrounded SAND & GRAVEL with frequent cobbles and boulders																					
9.00	Dense brown gravelly SAND with occasional cobbles and boulders																					
13.30	Firm brown sandy SILT																					
13.50	Dense to very dense brown subrounded SAND & GRAVEL with frequent cobbles and boulders																					
29.50	Dense red brownish gravelly SAND with occasional cobbles and boulders																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0935			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1725	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer
C	140.00	0.00	38.00							
RO	154.00	0.00	38.00				DTH	115	Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks
		General; mobilisation to site
		General; small amount of water in borehole after changing DTH hammer, borehole dried up quickly during open hole drilling

SPT I.D. Number	pd1	Calibration Date	18/09/2017
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details			CSCS No
Support Operative	john whyte		
Lead Driller	stephan petersen		
Site category	Green		
Project Engineer			
Lead Driller's signature			

Project Title

Kilmeague

Weather	Variable	Project No	20-Oct
Date	12/03/2020	Day	Thursday
Rig type	knebel hy79	Borehole Number	
Inclination		Orientation	BH 2
Sheet	1 of 3	Completed	Y

AGS

petersen drilling services ltd. on behalf of **Earth Science** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
32.80	Weak light red fine grained SANDSTONE weathered layers																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0935			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1725	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer
RO	120.00	38.00	45.50				DTH		Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
1300	38.00	38.00	Very Slow	37.80	0.00	0.00	0.00	38.50

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks

SPT I.D. Number	pd1	Calibration Date	18/09/2017
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details			CSCS No
Support Operative	john whyte		
Lead Driller	stephan petersen		
Site category	Green		
Project Engineer			
Lead Driller's signature			

Project Title

Kilmeague

Weather	Variable	Project No	20-Oct
Date	12/03/2020	Day	Thursday
Rig type	knebel hy79	Borehole Number	
Inclination		Orientation	BH 2
Sheet	2 of 3	Completed	Y

petersen drilling services ltd. on behalf of **Earth Science** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test											
		No	Type	Insitu test	From (m)	To (m)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
1015	0.00		
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1230	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks
1130	0020	Dayworks: Airlift developing of well

SPT I.D. Number	pd1	Calibration Date	18/09/2017
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details			CSCS No
Support Operative	john whyte		
Lead Driller	stephan petersen		
Site category	Green		
Project Engineer			
Lead Driller's signature			

Project Title

Kilmeague

Weather	Variable	Project No	20-Oct
Date	16/03/2020	Day	Monday
Rig type	knebel hy79	Borehole Number	
Inclination		Orientation	BH 2
Sheet	3 of 3	Completed	Y

petersen drilling services ltd. on behalf of **Earth Science** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
0.00	Firm clayey TOPSOIL		RO		0.00	35.00	0000		100	brown												29.00
0.30	Firm to stiff brown silty slightly sandy CLAY																					
0.80	Dense brown subrounded SAND & GRAVEL with frequent cobbles and boulders																					
19.50	Dense to very dense brown subrounded SAND & GRAVEL with abundant cobbles and limestone boulders																					
31.00	Medium dense brown reddish rounded sandy GRAVEL with cobbles and boulders																					
33.60	Weak red fine grained SANDSTONE weathered																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0805			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1605	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer
C	140.00	0.00	35.00							
RO	154.00	0.00	35.00				DTH	115	Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
1205	29.00	29.00	Slow	0.00	0.00	0.00	0.00	N/S

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks
1425	0020	Dayworks: Airlift developing of well

SPT I.D. Number	pd1	Calibration Date	18/09/2017
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details			CSCS No
Support Operative	john whyte		
Lead Driller	stephan petersen		
Site category	Green		
Project Engineer			
Lead Driller's signature			

Project Title

Kilmeague

Weather	Fine	Project No	20-Oct
Date	19/03/2020	Day	Thursday
Rig type	knebel hy79	Borehole Number	
Inclination		Orientation	BH 3
Sheet	1 of 2	Completed	Y

AGS

Produced by KeyLogbook

petersen drilling services ltd. on behalf of **Earth Science** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details					Drilling Details				Standard Penetration Test											
		No	Type	Insitu test	From (m)	To (m)	Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
34.30	Strong red fine grained SANDSTONE																					

Shift details				Drilling Equipment Details										Ground Water Record									Backfill (m)		
Start time (hhmm)	Hole (m)	Water (m)	Casing (m)	Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer	Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)	Type	From (m)	To (m)
0805															1150	34.00	34.00	Medium	28.70	0.00	0.00	0.00	N/S			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)																							
1605	0.00																									

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks

SPT I.D. Number	pd1	Calibration Date	18/09/2017
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details			CSCS No
Support Operative	john whyte		
Lead Driller	stephan petersen		
Site category	Green		
Project Engineer			
Lead Driller's signature			

Project Title

Kilmeague

Weather	Fine	Project No	20-Oct
Date	19/03/2020	Day	Thursday
Rig type	knebel hy79	Borehole Number	
Inclination		Orientation	BH 3
Sheet	2 of 2	Completed	Y

petersen drilling services ltd. on behalf of **Earth Science** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
0.00	Firm clayey TOPSOIL		RO		0.00	35.00	0000		100	brown												29.50
0.30	Dense brown subrounded SAND & GRAVEL with frequent cobbles and boulders																					
30.80	Dense brown reddish SAND & GRAVEL with cobbles and boulders																					
33.20	Weak red fine grained SANDSTONE																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
1330			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1355	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer
C	140.00	0.00	35.00							
RO	154.00	0.00	35.00				DTH	115	Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
1250	29.50	29.50	Very Slow	29.00	0.00	0.00	0.00	N/S

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks
1355	0020	Dayworks: Airlift developing of well

SPT I.D. Number	pd1	Calibration Date	18/09/2017
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details			CSCS No
Support Operative	john whyte		
Lead Driller	stephan petersen		
Site category	Green		
Project Engineer			
Lead Driller's signature			

Project Title

Kilmeague

Weather	Variable	Project No	20-Oct
Date	18/03/2020	Day	Wednesday
Rig type	knebel hy79	Borehole Number	
Inclination		Orientation	BH 4
Sheet	1 of 1	Completed	Y

petersen drilling services ltd. on behalf of **Earth Science** Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
0.00	Firm TOPSOIL		RO		0.00	20.00	0000		100	brown												14.00
0.20	Medium dense brown slightly gravelly SAND																					
2.10	Dense brown subrounded SAND & GRAVEL with frequent cobbles and boulders																					
11.50	Dense brown silty SAND & GRAVEL with frequent bands of silt																					
15.80	Weak grey MUDSTONE shaley																					

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0805			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1325	0.00		

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Bit serial No	Flush	Polymer
C	140.00	0.00	17.00							
RO	154.00	0.00	17.00				DTH	154	Air	No
RO	120.00	17.00	20.00				DTH		Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
0925	14.00	14.00	Slow	0.00	0.00	0.00	0.00	N/S
1020	18.50	17.00	Medium	12.40	0.00	0.00	0.00	N/S

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks
1200	0020	Dayworks: Airlift developing of well

SPT I.D. Number	pd1	Calibration Date	18/09/2017
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details			CSCS No
Support Operative	john whyte		
Lead Driller	stephan petersen		
Site category	Green		
Project Engineer			
Lead Driller's signature			

Project Title

Kilmeague

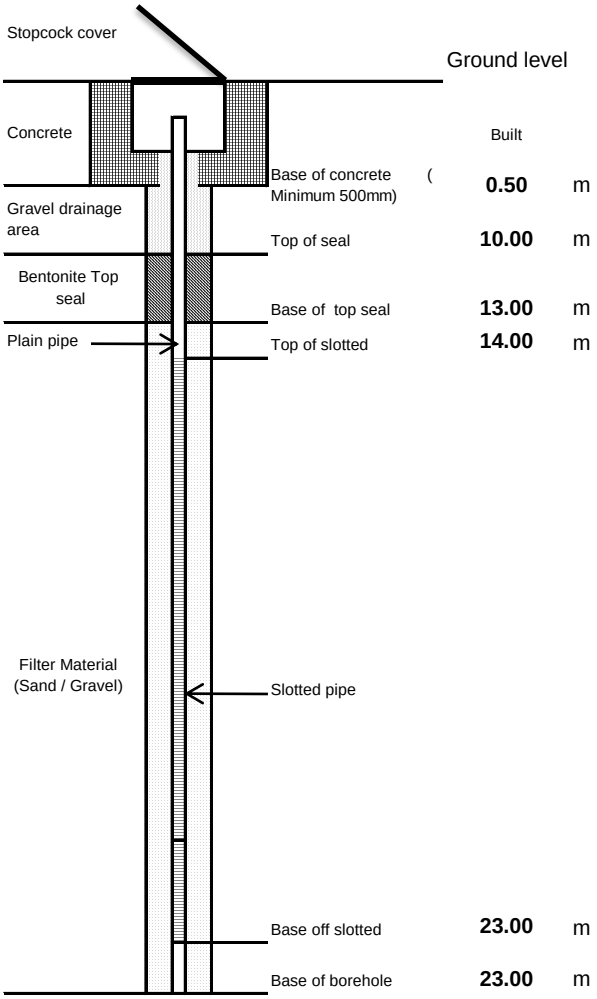
Weather	Fine	Project No	20-Oct
Date	20/03/2020	Day	Friday
Rig type	knebel hy79	Borehole Number	
Inclination		Orientation	BH 5
Sheet	1 of 1	Completed	Y

AGS

petersen drilling services ltd.

Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	154	mm
Slot size	1	mm
Geosock	Yes	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	12.10	m
Time of Initial reading	1520	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	10.00	0.50
Borehole seal top	13.00	10.00
Filter zone	23.00	13.00
Plain pipe	14.00	GL
Slotted zone	23.00	14.00
Base of borehole	23.00	

Remarks

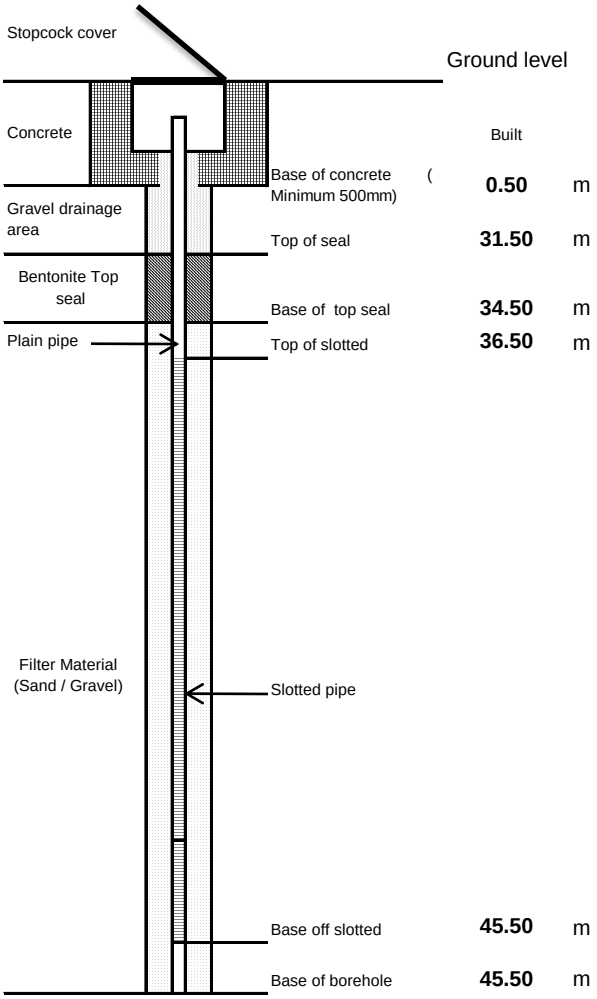
Rig type	knebel hy79	**Project Title**			
Drilling Crew Details		Kilmeague			
Support Operative	john whyte				
Lead Driller	stephan petersen	**Project No**		20-Oct	
Site category	Green	**Day**	Monday	**Date**	March 23, 2020
Engineer				**Borehole Number**	
Lead Driller's signature				**BH 1**	

AGS

petersen drilling services ltd.

Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	120	mm
Slot size	1	mm
Geosock	Yes	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	Dry	m
Time of Initial reading	1710	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	31.50	0.50
Borehole seal top	34.50	31.50
Filter zone	45.50	34.50
Plain pipe	36.50	GL
Slotted zone	45.50	36.50
Base of borehole	45.50	

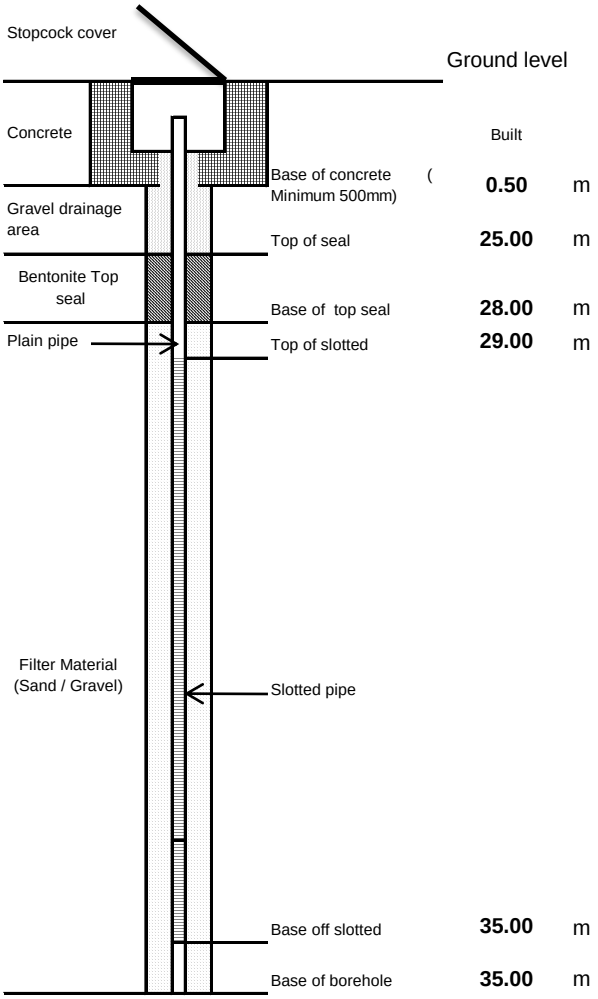
Remarks

Rig type	knebel hy79	**Project Title**			
Drilling Crew Details		Kilmeague			
Support Operative	john whyte				
Lead Driller	stephan petersen	**Project No**		20-Oct	
Site category	Green	**Day**	Thursday	**Date**	March 12, 2020
Engineer				**Borehole Number**	
Lead Driller's signature				**BH 2**	

petersen drilling services ltd.

Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	154	mm
Slot size	1	mm
Geosock	Yes	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	28.60	m
Time of Initial reading	1505	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	25.00	0.50
Borehole seal top	28.00	25.00
Filter zone	35.00	28.00
Plain pipe	29.00	GL
Slotted zone	35.00	29.00
Base of borehole	35.00	

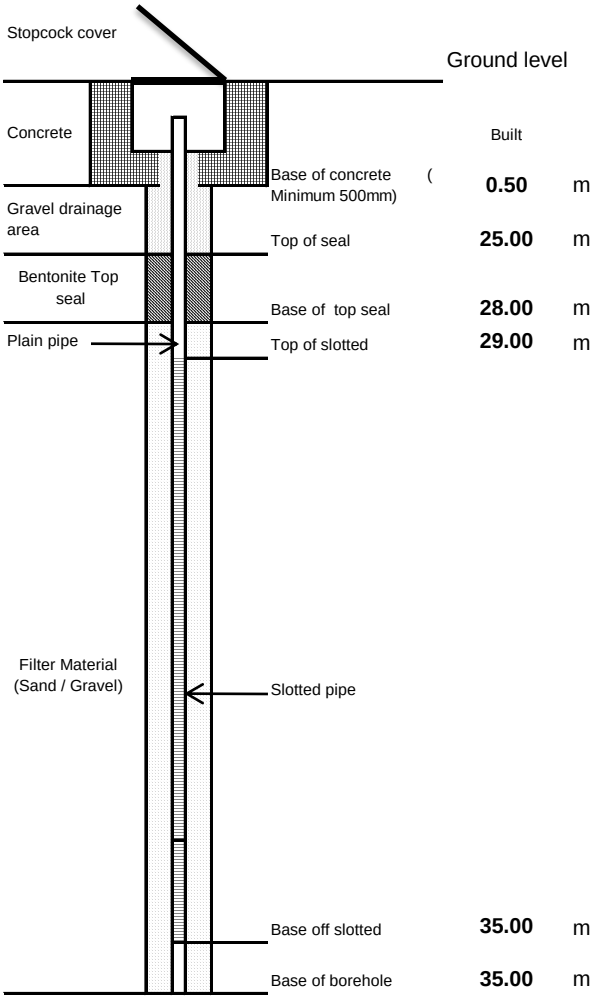
Remarks

Rig type	knebel hy79	**Project Title**			
Drilling Crew Details		Kilmeague			
Support Operative	john whyte				
Lead Driller	stephan petersen	**Project No**		20-Oct	
Site category	Green	**Day**	Thursday	**Date**	March 19, 2020
Engineer				**Borehole Number**	
Lead Driller's signature				**BH 3**	

petersen drilling services ltd.

Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	154	mm
Slot size	1	mm
Geosock	Yes	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	30.40	m
Time of Initial reading	1350	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	25.00	0.50
Borehole seal top	28.00	25.00
Filter zone	35.00	28.00
Plain pipe	29.00	GL
Slotted zone	35.00	29.00
Base of borehole	35.00	

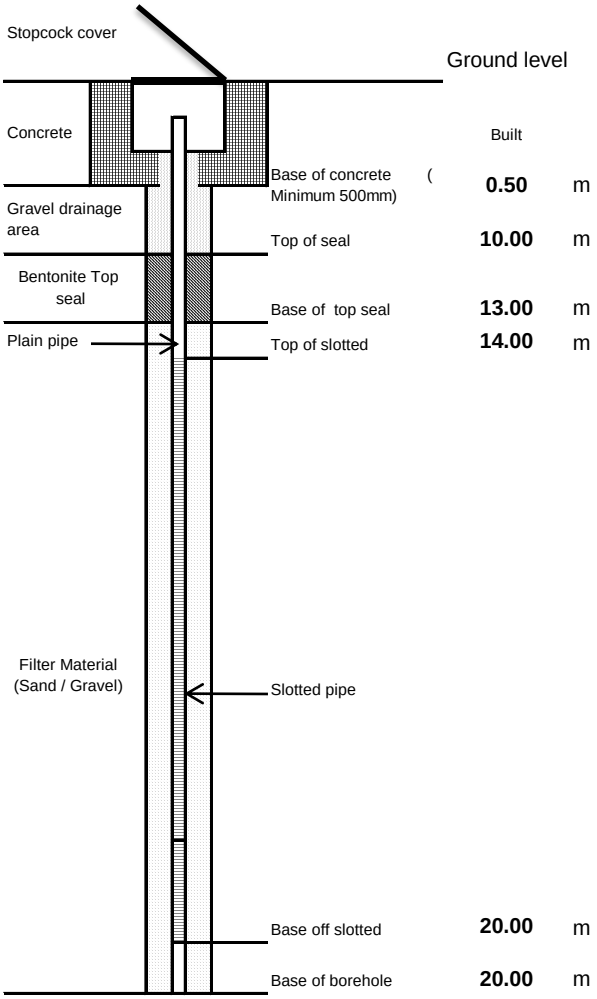
Remarks

Rig type	knebel hy79	**Project Title**			
Drilling Crew Details		Kilmeague			
Support Operative	john whyte				
Lead Driller	stephan petersen	**Project No**		20-Oct	
Site category	Green	**Day**	Wednesday	**Date**	March 18, 2020
Engineer				**Borehole Number**	
Lead Driller's signature				**BH 4**	

petersen drilling services ltd.

Summary of Standpipe Installation

Schematic Diagram (not to scale)



Installation Details

Standpipe diameter (id)	50	mm
Borehole diameter	120	mm
Slot size	1	mm
Geosock	Yes	
Gas tap	None	
Filter type	Gravel	
Type of cover	Upright	
Initial reading	12.30	m
Time of Initial reading	1225	hhmm

	Base (m)	Top (m)
Concrete	0.50	GL
Gravel drainage	10.00	0.50
Borehole seal top	13.00	10.00
Filter zone	20.00	13.00
Plain pipe	14.00	GL
Slotted zone	20.00	14.00
Base of borehole	20.00	

Remarks

Rig type	knebel hy79	**Project Title**			
Drilling Crew Details		Kilmeague			
Support Operative	john whyte				
Lead Driller	stephan petersen	**Project No**		20-Oct	
Site category	Green	**Day**	Friday	**Date**	March 20, 2020
Engineer				**Borehole Number**	
Lead Driller's signature				**BH 5**	

Petersen Drilling Services Ltd. on behalf of Quarry Consulting — Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Liner Dia (mm)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
0.00	Soft to firm brown TOPSOIL		RO		0.00	47.50		0000		100	brown											0.00	0.00
0.30	Loose to Medium dense medium cobble brown slightly gravelly SAND																						
19.00	Medium dense brown gravelly SAND with occasional cobbles and boulders becoming very gravelly																						
27.40	Medium dense medium coarse brown sub-rounded SAND AND GRAVEL with occasional cobbles and boulders																						
30.50	Soft to firm brown sandy SILT																						
31.00	Medium dense medium coarse brown sub-rounded sandy GRAVEL occasional cobbles																						

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0925			
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1710	47.50	40.00	47.50

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer
C	140.00	0.00	47.50					Sim. Casing			
RO	154.00	0.00	47.50				DTH Button Bit		115	Air	No

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks
0925		CAT Scanned: Yes
0925		Permit Completed: Yes

SPT I.D. Number	PD1	Calibration Date	01/02/2021
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details		CSCS No	
Support Operative	John Whyte		
Lead Driller	Stephan Petersen		
Site category	Green		
Project Engineer	D Broderick		
Lead Driller's signature			

Project Title

Kilmeage

Weather	Variable	Project No	44/23
Date	06/11/2023	Day	Monday
Rig type	Knebel HY79	Borehole Number	
Inclination		Orientation	BH 6
Sheet	1 of 3	Completed	Y

Petersen Drilling Services Ltd. on behalf of Quarry Consulting — Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Liner Dia (mm)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)
46.10	Very weak brownish red highly weathered clayey SANDSTONE with frequent limestone fragments																						

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0925			
Finish time (hhmm)	**Hole (m)**	**Water (m)**	**Casing (m)**
1710	47.50	40.00	47.50

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)
1510	41.00	41.00	**Medium**	0.00	0.00	0.00	0.00	N/S

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks

SPT I.D. Number	PD1	**Calibration Date**	01/02/2021
SPT Rod Type	2 3/8 Regular	**SPT Energy Ratio**	0.00
Drilling Crew Details		**CSCS No**	
Support Operative	John Whyte		
Lead Driller	Stephan Petersen		
Site category	Green		
Project Engineer	D Broderick		
Lead Driller's signature			

Project Title

Kilmeage

Weather	Variable	**Project No**	44/23
Date	06/11/2023	**Day**	Monday
Rig type	**Knebel HY79**	**Borehole Number**	
Inclination		**Orientation**	BH 6
Sheet	2 of 3	**Completed**	Y

AGS

Petersen Drilling Services Ltd. on behalf of Quarry Consulting — Rotary Drilling Log

Depth of Stratum Top (m)	Driller's Stratum Description	Sample / Hole / Test Details: No	Type	Insitu test	From (m)	To (m)	Liner Dia (mm)	Drilling Details: Core run time (hhmm)	Total core Recovery (m)	Flush Return %	Flush Colour	Standard Penetration Test: Self Weight Pen (mm)	75 mm	150 mm	Seating Pen (mm)	75 mm	150 mm	225 mm	300 mm	Main Pen (mm)	N value	Casing Depth (m)	Water/ flush level (m)

Shift details

Start time (hhmm)	Hole (m)	Water (m)	Casing (m)
0810	47.50	40.60	47.50
Finish time (hhmm)	Hole (m)	Water (m)	Casing (m)
1230			

Drilling Equipment Details

Casing (C) Open Hole (RO) Coring (RC)	Dia. (mm)	From (m)	To (m)	Barrel	Liner Type	Core Dia (mm)	Bit Type	Casing Type	Bit serial No	Flush	Polymer

Ground Water Record

Time of strike	Depth Struck (m)	Casing (m)	Inflow	5 min	10 min	15 min	20 min	Depth Sealed (m)

Backfill (m)

Type	From (m)	To (m)

Time from	Duration (hhmm)	Remarks or details of any additional testing information, Dayworks
1050	0045	Dayworks: Airlift development of well

SPT I.D. Number	PD1	Calibration Date	01/02/2021
SPT Rod Type	2 3/8 Regular	SPT Energy Ratio	0.00
Drilling Crew Details			CSCS No
Support Operative	John Whyte		
Lead Driller	Stephan Petersen		
Site category	Green		
Project Engineer	D Broderick		
Lead Driller's signature			

Project Title

Kilmeage

Weather	Variable	Project No	44/23
Date	07/11/2023	Day	Tuesday
Rig type	Knebel HY79	Borehole Number	
Inclination		Orientation	BH 6
Sheet	3 of 3	Completed	Y

AGS