Llywodraeth Cymru / Welsh Government

A487 New Dyfi Bridge

Environmental Statement – Volume 3: Appendix 10.2

Ground Investigations Report Volumes 1 and 2

900237-ARP-ZZ-ZZ-RP-CG-00003





Llywodraeth Cymru
Welsh Government

Welsh Government

A487 New Dyfi Bridge

Preliminary Ground Investigation Report – Volume 1

900237-ARP-ZZ-ZZ-RP-CG-00003

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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A487 Dyfi Bridge Phase 1 Works, CC Geotechnical Ltd January 2016 - DRAFT

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1 Executive Summary

A preliminary ground investigation (Key Stage 3) has been carried out along the line of the proposed route of the A487 New Dyfi Bridge. The preliminary investigation comprised five cable percussive boreholes, with one located on the northern side of the Afon Dyfi followed on with rotary coring, and twenty-four machine dug trial pits. The investigation was undertaken to provide preliminary information on the variation in ground conditions along the proposed route, and at the locations where major structures and earthworks are proposed to provide parameters for the Key Stage 3 preliminary design.

This investigation was scoped based on the scheme proposals prior to the changes commissioned by Welsh Government in March 2016. The changes comprise extending the southern end of the viaduct, pushing back the start of the southern embankment further south, and introducing a new layout for the tie-in to the existing A487 in the south. These changes were required as the previous scheme proposals were found to potentially have an adverse effect on flood levels in the area. The new proposals have been incorporated in this report and are not considered to have a significant impact on the previous scope of investigation.

To the south of the Afon Dyfi, the proposed route crosses agricultural land in the bottom of a glacial valley. The proposed scheme comprises an embankment, rising from existing ground level off the existing A487 to around 5m above ground level, and a tie-in to the existing A487. The route then passes onto a viaduct comprising 18 spans, each typically around 34m in length.

At the Afon Dyfi, the route passes over the river via a river bridge approximately 70m in length with a 50m backspan. The ground level on the northern side of the river rises sharply to around 9m above the river bank forming a plateau where the north abutment is founded. The proposed route then enters into an area of rock cutting until the northern end of the scheme.

The ground investigation along the southern embankment and viaduct section revealed topsoil overlying alluvial deposits, which in turn overlay glacial sands and gravels. The alluvial deposits comprised very loose to loose, brown, clayey silt and were greater than 3.0m thick in places. The glacial sands and gravels generally comprised medium dense, becoming dense and then very dense, sand and gravel with depth. Groundwater was encountered in boreholes and trial pits at the top of the sands and gravels and rose into the alluvial deposits. No bedrock was encountered within 30m below existing ground levels in the recent ground investigation.

The ground conditions on the northern side generally comprised glacial deposits, both sands and gravels and head deposits, over bedrock. Made ground, up to 5.0m thick, was present close to the location of the northern abutment. This thinned out in a northerly direction. The bedrock was encountered at 8.8m depth at the approximate position of the northern abutment and comprised strong mudstone with sub-vertical discontinuities.

The Factual Report is presented in Volume 2, along with the Factual Reports for the investigations undertaken in 1999 and 2001.

2 Introduction

2.1 Scope and Objective of the Report

This Ground Investigation Report has been prepared for Welsh Government for the A487 New Dyfi Bridge Improvement Scheme. This report is for Key Stage 3 and shall therefore be referred to as the Preliminary Ground Investigation Report. The ground conditions and material parameters referred to within this report are therefore for the purpose of developing Key Stage 3 preliminary design.

A further site investigation will be carried and Ground Investigation Report prepared at Key Stage 6. This will provide an interpretation of the ground conditions and material parameters for detailed design.

The sources of information which have been included and updated comprise the Preliminary Sources Study Report (PSSR) [Reference 1] and the Factual Site Investigation Report prepared by CC Geotechnical Ltd in January 2016 presented in Volume 2.

2.2 Description of the Project

2.2.1 Site Description

The proposed route lies in the scenic Dyfi Valley in a hilly part of mid-Wales to the east of Cardigan Bay; see Figure 1. From the northern outskirts of Machynlleth, the proposed construction corridor traverses relatively flat to gently undulating ground associated with the floodplain of the Afon Dyfi. Much of this flat ground comprises grass pasture used mainly for grazing of sheep and cattle. Field boundaries are delineated by fences, hedgerows and trees.

In the vicinity of the proposed river crossing, the proposed route crosses the National Cycle Network Route No. 8, a relatively new public footpath, bridleway, cycleway and bridge (see Photograph 9 in Appendix A) that runs for the most part along the south bank of the river. The scheme then crosses Afon Dyfi.

On the north bank of the river, the proposed route traverses a steep wooded slope, approximately 9m high, and continues on higher ground where bedrock out crops in a roadside cutting on the existing A487 carriageway.

The elevation of the floodplain section varies between 5m and 10mAOD, although typically between 8mAOD and 9mAOD, whereas the northern valley side rises steeply to above 200mAOD within 1km from the scheme.

2.2.2 Proposed Scheme

The scheme proposals for the A487 New Dyfi Bridge scheme were changed in March 2016 as the previous proposals were found to potentially have an adverse effect on flood levels in the area.

The changes comprise extending the southern end of the viaduct, pushing back the start of the southern embankment further south, and introducing a new layout for the tie-in to the existing A487 in the south. In addition, the scheme also now includes pumped drainage measures in the area of the railway bridge to deal with localised flooding in this area.

The new proposals (Figure 2) comprise a 1050m long new section of single carriageway road, associated 240m long tie-in to the existing A487 in the south and access to existing fields, including a cattle pass underbridge next to the northern abutment. Flood bunds and associated ramp access is proposed in the southern end of the scheme and along the northern boundary of the existing Eco Park. Provision of field access and turning heads is also planned immediately to the south of the Pont-ar-Ddyfi.

The proposed route is to the south east of the existing route, which includes the Pont-ar-Dyfi Bridge. The proposed scheme includes a 730m long viaduct with approach embankments and a river bridge across the River Dyfi and associated floodplain. The existing A487 will be de-trunked between the two ends of the scheme, and the existing Pont-ar-Dyfi will be restricted to Non-Motorised Units only.

The preliminary design for the viaduct comprises 18 spans, predominantly of 34m length, as well as a 73m span across the main river channel and associated 50m backspan to the southwest; see Figure 2. The piers are proposed to be supported on piles. An approach embankment to the south, less than 5m in height, will be required over significant depths of soft alluvium.

2.3 Geotechnical Category of the Project

The A487 New Dyfi Bridge has been classified as Geotechnical Category 2 as per HD 22/08. This is defined in paragraph 3.2 of that document as:

> *"Projects which include conventional types of geotechnical structures, earthworks and activities, with no exceptional geotechnical risks, unusual or difficult ground conditions or loading conditions. Designs for Category 2 should normally include quantitative geotechnical data and analysis to ensure that the fundamental requirements are satisfied. Routine procedures for field and laboratory testing and for design and execution may be used. The majority of geotechnical activities associated with highways should fall into this category."*

If the scope of the work subsequently changes, the Geotechnical Category Classification may be re-assessed.

Appendix B contains the preliminary Geotechnical Risk Register. The mitigation measures appropriate for each risk will be developed during the preliminary design.

2.4 Other Relevant Information

It is intended that this report is read in conjunction with the following documents:

- Preliminary Sources Study Report (PSSR), compiled by Arup [Reference 1],
- A factual report on the Phase 1 site investigation prepared by CC Geotechnical in January 2016 [Volume 2 of this report],
- A487 Fishguard to Bangor Trunk Road, Pont ar Ddyfi Improvement, Archaeological Watching Brief, CPAT Report No 1387 [Reference 2],

3 Existing Information

3.1 Topographical Maps (Old and Recent)

3.1.1 Topography

From the northern outskirts of Machynlleth, the proposed route traverses relatively flat to gently undulating ground associated with the floodplain of the Afon Dyfi confined within a steep sided glacial valley. The elevation of this section is at around 8.50mOD. However the northern valley side rises steeply to above 200mAOD within 1km from the scheme.

On the north bank of the Afon Dyfi, the proposed route traverses a steep wooded slope, approximately 9m higher than the floodplain, and continues on higher ground where bedrock out crops in a roadside cutting on the existing A487 carriageway.

3.1.2 Historical Mapping

The site history has been reviewed from 1:2,500 and 1:10,000 historical maps purchased as part of the EnviroCheck report for the scheme dated from 1888 to 1995 [Reference 3], and historic aerial photographs viewed at the Welsh Government archives, dated from 1946 to 1997.

The 1:2,500 historical maps have been collected and are provided in Figure 3A to 3E. A summary of the findings of the aerial photographs view is included together with the site walkover findings in Figure 4.

The 1888/89 OS plan shows the study area to comprise predominantly fields; see Figure 3A. To the south west corner of the study area, a road is shown running from Machynlleth in the south to Dovey Bridge in the north along a similar alignment to the A487 today. A drain is shown on the eastern edge of the road. A track is present running in an eastern direction, which joins the main road at around Ch. 0+200m. To the south of the study area, the Machynlleth Railway Station and associated tracks are in place generally orientated in an eastern direction. Review of the Coflein database indicates that the station was constructed in 1863.

From the station, a single rail track runs in a north-easterly direction, crosses the river and is then in cutting until it is under the proposed alignment at around Ch. 1+090m. The Coflein database indicates this is the Corris narrow gauge railway which was constructed in 1889 and was on 500m-long embankment. To the north east of the study area, River Dovey runs in an east to west direction, with a footpath present on the southern bank. Shingle bars are present on the southern edge of the meander (Ch. 0+870m) and also in the centre of the river (Ch. 0+900m). Between Ch. 0+925m and Ch. 1+000m, the proposed alignment crosses fields. At Ch. 1+000m, it ties into the main road with the single track railway line running along the south-eastern side of the road. A county boundary crosses the site at around Ch. 0+480m. Spot levels record a ground level of 23.7ftOD at Ch.

0+200m, and 53ftOD around Ch. 1+000m. Quarries are shown to the south of the railway station and also to the north of Dovey Bridge.

There are no significant changes to the site by 1901; see Figure 3B. Two of the ponds in the south west of the site have been backfilled and a small rectangular water structure has been built to the north of the remaining pond. The shingle bars in the river now from around Ch. 0+880m to Ch. 0+930m have changed position indicating some changes in the river course. The fields at the north of the study area (Ch. 0+950m) are shown to be rough grassland. On the 1:10,000 scale OS plan the branch of the railway heading north east is shown as the Corris Railway.

There were no significant changes to the site between 1902 and 1974, by which time the Corris Railway had been dismantled; see Figure 3C, though there was still some evidence of its alignment on site. The historical plans for 1974 to 1975 show River Dovey to have cut into the northern bank at around Ch. 0+920m, increasing the width of the river. The shingle bars are also no longer shown, though they were visible during the site walkover. A flood bund, approximately 220m long, had been constructed along the southern bank of the river. The main road has been labelled A487. Along this road, spot levels of 7.3mOD and 15.8mOD are indicated in the southern and the northern end of the study area. The northern bank of the river is now shown as being wooded.

There were no significant changes to the site by 1987; see Figure 3D.

By 1995, the railway sidings north of the existing railway lines at the southern end of the site has been removed and the area is occupied by a garden centre and a garage; see Figure 3E. A large pond was also present at the eastern end of the flood bund at approximately Ch. 0+780m to Ch. 0+800m. The shingle bars are on the southern edge of the River Dovey, causing narrowing of the channel at this point (Ch. 0+880). There were no other significant changes to the site.

3.2 Geological Maps and Memoirs

The geology of the site has been reviewed from British Geological Survey (BGS) 1:50,000 Geological Sheet 149 [Reference 4] and associated memoir [Reference 5], 1:10,000 Geological Sheets SH70SW and SH70SE [References 6 & 7], BGS Memoir Sheet 163 [Reference 8], BGS borehole online viewer [Reference 9] and the Regional Geology of Wales [Reference 10].

The bedrock comprises grey turbiditic mudstones and siltstones of the Borth Mudstone Formation of Silurian (Llandovery) age up to about 300m in thickness. The mudstone beds range from 0.2m to 0.6m thick and include a few thin sandstone and siltstone interbeds. It crops out in a roadside cutting on the A487 in the vicinity of the tie-in at the north-eastern end of the scheme; see Photograph 17. The best exposures are visible in nearby quarries, for example at Llwyngwern (NG: SH 759 044). Generally, the bedrock strata strike north-northeast and dip at moderate to steep angles; see Photograph 18.

The 1:10,000 scale published geology map shows an anticlinal (arch shape) axis, trending in a north to south direction, passing through the centre of the tie in with the existing A487 at the northern end of the site. Cleavage / bedding dips to the

east of the axis are recorded as being between 21° and 29° in a north easterly direction. Whilst to the west of the anticlinal axis the bedding is shown dipping at 55° to the west, towards a synclinal (bowl shaped) axis, also trending north to south. On the eastern side of the synclinal axis, the beds are shown dipping very steeply at 81° to the east.

Bedrock is overlain by glacial deposits recorded as glacial till (boulder clay) associated with the last glaciation affecting this area in Devensian time (10,000 years BP). However, within the floodplain of the Afon Dyfi valley there is a poor definition between the glacial deposits and the blanket cover of mixed alluvium associated with the river. In addition, the glacial deposits have frequently been modified by periglacial action and in places have been entirely removed by erosion. The memoirs typically suggest that the glacial deposits comprise heterogeneous grey-brown clays, superficially weathered, to ochreous brown, with poorly sorted and locally derived gravel and boulders.

The 1:10,000 scale geology map shows head deposits at the location of the tie in at the northern end of the route.

Valley-fill and mixed alluvium of the floodplain include coarse to fine-grained gravels with impersistent interbedded sandy clays, clays and silts; see Photograph 11. River terrace deposits up to a few metres thick are recorded elsewhere in the Dyfi valley and consist mainly of gravels; see Photograph 10. The flat tract of the floodplain is criss-crossed by historic river courses (palaeochannels) although these features have been greatly suppressed by successive cultivation.

Unusual deposits of alluvial fan materials and head occur on the north bank of the river and within the route corridor. Alluvial fans develop where a stream undergoes an abrupt change in gradient and, as a result, commonly lie at the confluence of tributary mountain streams with the main valleys. The alluvial fan materials consist mainly of crudely stratified debris, typically subangular to rounded pebbles and boulders with discontinuous lenses of gravelly and silty clay.

Patches of man-made ground are also present nearby. The largest patch of made ground surrounds Machynlleth railway station. However, smaller patches also exist in the vicinity of more recent engineering activities associated with the construction of the National Cycle Network route.

Within the proposed construction corridor there are no known areas of instability or landslides apart from those associated with normal erosion taking place along the river banks (see Photograph 13). No effects on the proposed development are anticipated.

The nearest significant fault is the Pennal Fault which runs east-west through the valley some 500m to the south of the river. It is a sub-vertical normal fault and downthrows some 150-200m to the north. No effects on the proposed development are anticipated.

The BGS database has been reviewed and no further borehole logs were available for the area beyond those described in Section 3.7.

3.3 Aerial Photographs

A study of recent aerial photographs for the proposed development revealed several geomorphological features of interest along the present river channel including gravel bars and eroding banks. In addition, several short curvilinear patterns were noted on the surface of the floodplain that could indicate the presence of buried channels (palaeochannels) beneath the floodplain. One such pattern correlates with a patch of wet ground identified during the walkover at Ch. 0+780m (see Figure 4).

Review of the aerial photographs from the Welsh Government archives further confirms the presence of palaeochannels. In particular, depressions in the ground are visible crossing the proposed alignment between Ch. 0+650m and 0+680m in 1946, 1952 and 1963. An area at lower elevation is also visible between 0+750m and 0+820m understood to correspond to an area flooded on a regular basis since 1953. The possible extents of an historical pond are present approximately 50m east of the Ch. 0+630m in 1946.

3.4 Record of Mines and Mineral Deposits

There are no known records of former mining activity within or in the immediate vicinity of the proposed development. No surface indication of mining operations has been noted during the site walkover survey.

The 1:10,000 scale geology map shows an adit, some 750m to the south of the site, trending in a southerly direction away from the site.

This is further confirmed by the review of the EnviroCheck report which confirms that there are seven BGS recorded mineral sites within 500m of the study area; all of them have ceased operation. The closest is located 180m to the south. Most are recorded as having extracted through opencast methods with two recorded as underground extraction. One is confirmed to have been for the extraction of slate from the Devils Bridge Formation. The two underground mines are located approximately 500m south east of the proposed route and are not deemed to be of risk to the scheme.

The Coal Authority online viewer indicates that the site is not within or close to a coal mining area.

3.5 Land Use and Soil Surveys

The proposed route is largely within agricultural land, which is used for grazing livestock.

The BGS have supplied the following estimated soil chemistry for the site:

- Arsenic 15 to 25mg/kg.
- Cadmium <1.8mg/kg.
- Chromium 60-90mg/kg.
- Lead <150mg/kg.
- Nickel 15-30mg/kg.

3.6 Archaeological and Historical Investigations

A watching brief was undertaken by an archaeologist from CPAT (Clwyd Powys Archaeological Trust), who was present during the excavation of the 25 No. trial pits undertaken in 2015/16 [Reference 2]. CPAT recorded that no features, deposits or finds of archaeological significance were revealed during the course of the watching brief.

3.7 Existing Ground Investigations

3.7.1 A487 Pont-ar-Dyfi Improvement - November 2001

A site investigation was undertaken by CJ Associates in 2001 for the Pont-ar-Dyfi Improvement [Reference 11]. The report is presented in Volume 2 of this report. It comprised fifteen cable percussive boreholes to depths of between 9.50m and 26.10m, five of which were extended by rotary coring to depths of between 18.80m and 29.00m. Six rotary boreholes were drilled to depths of between 1.85m and 15.50m. A total of seventeen trial pits were excavated to depths of between 0.50m and 3.00m. The exploratory holes were not surveyed as part of the investigation work, therefore, accurate positions and levels are not available.

Approximate exploratory hole locations, determined by overlaying plans, are shown on Figures 5 and 6 and the depths summarised in Table 1 below.

Table 1 – Summary of Exploratory Holes

Cable percussive holes	Depth (m)	Rotary coring holes	Depth (m)	Trial Pits	Depth (m)
BH1	15.50			TP1	3.00
BH2	20.05			TP2	3.00
BH3	16.50			TP3	3.00
BH4	15.95			TP4	3.00
BH5	15.95			TP5	2.40
BH6	15.95			TP6	2.40
BH7	15.95			TP7	2.80
BH8	24.15	Extended	27.00	TP8	1.80
BH9	26.10	Extended	29.00	TP9	2.10
		BH10	4.50	TP10	2.70
		BH12	1.85	TP12	3.00
		BH13	4.30	TP13	1.80
BH14	16.45			TP14	2.20
BH15	16.45			TP15	2.60
BH16	20.45			TP16	3.00
BH17	21.95	Extended	25.90	TP17	2.40
BH18	20.50	Extended	22.90	TP18	0.50

Cable percussive holes	Depth (m)	Rotary coring holes	Depth (m)	Trial Pits	Depth (m)
BH19	9.50	Extended	18.80		
		BH20	11.20		
		BH21	15.50		
		BH22	12.00		

Boreholes BH3, BH4, BH5, BH6, BH7 and BH16 are located between Ch. 0+280m and Ch. 0+780m and no bedrock was encountered. Boreholes BH17, BH18 and BH19 are situated between Ch. 0+790m and the southern bank of Afon Dyfi at Ch. 0+880m. These boreholes generally encountered rock at approximately 21m depth, with the exception of BH19, located on the gravel bank, which encountered rock at 15.60m depth indicating that the rockhead is rising to the north. Boreholes BH20, BH21 and BH22 were all located on the northern bank of the Afon Dyfi, between Ch. 0+920m and Ch. 0+980m. These encountered rockhead between 6.5m and 10.5m depth.

3.7.2 Millennium Footbridge - September 1999

A site investigation was undertaken by CJ Associates in 1999 for the construction of the Millennium Footbridge located at the northern end of the proposed scheme [Reference 12]. The available extracts are presented in Volume 2 of this report. The site investigation comprised seven cable percussive boreholes drilled to a maximum depth of 13.70m. Standard penetration tests were undertaken in the boreholes, typically at 1.0m intervals.

Approximate exploratory hole locations, determined by overlaying plans, are shown on Figures 5 and 6.

The boreholes generally revealed 0.10m of topsoil overlying between 0.90m and 2.90m of cohesive alluvial deposits. These generally comprised soft to firm friable, grey brown sandy silty clay with occasional fine to medium gravel, though it was noted that the gravel content generally increased below 1.0m.

The cohesive deposits were underlain by medium dense, fine to medium, rounded and sub-rounded gravel in a grey, coarse sand matrix. The gravel was reported as being occasionally coarse and being dense below 10m depth. In boreholes BH1, BH2 and BH7, located on the southern side of the river, the base of the gravels was not proven. However, in Borehole BH3, BH4, BH5 and BH6, located on the northern side, the base of the gravels was proved at a depth of between 1.50m and 5.90m.

The gravels were underlain by dark grey shale recovered a moderately weak to moderately strong fragments.

3.8 Consultation with Statutory Bodies

Information in relation to land contamination issues and private water supplies has been requested from the Gwynedd Council and Powys County Council. No information has been received at the time of writing.

3.9 Flood Records

Detailed flood modelling is currently being undertaken and will be reported separately.

3.10 Contaminated Land

There are no known records of contaminated land within the proposed development corridor. However, it should be noted that the alignment of the former narrow-gauge Corris Railway follows an approximate line running from The Millennium Bridge in a south-westerly direction towards the Dyfi Eco Park Industrial Estate which lies immediately to the north of Machynlleth railway station. Due to the age of the steam railway, any potential contamination is likely to be ash and clinker.

The EnviroCheck Report [Reference 3] has recorded the following additional information:

- There are two discharge consents within 250m of the site, the closest being 41m to the south-west.
- There is one local authority pollution prevention and control 181m to the south west of the site.
- There has been one pollution incident into controlled waters 123m to the south west of site in October 1994.
- There has been one substantiated pollution incident registered 466m to the south west of site.
- There are two water abstractions within 1km of site, the closest being 771m to the north east.
- There is one historical landfill site within 1km of the site, the closest being 493m to the south west, which also appears to be recorded as a local authority recorded landfill
- There is a licensed waste management facility in the old station yard to the south west.
- There are twenty-three contemporary trade directory entries within 1km of the site, the closest active site being Dovey Auto Craft, garage services to the SW near to the railway station.

3.11 Other Relevant Information

3.11.1 Hydrology & hydrogeology

National Resources Wales (NRW) classifies the Afon Dyfi as a ‘Main River’. It is fast-flowing and meanders within the floodplain limits of approximately 1km in width. It generally flows in a south-westerly direction to the coast where it enters

Cardigan Bay. The EnviroCheck Report records that it has a General Quality Assessment (GQA) Grade: River Quality A.

The superficial deposits are classified as Secondary A aquifers and the bedrock is classified as a Secondary B aquifer. Secondary A aquifers are described as permeable layers supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers. Secondary B aquifers are predominately lower permeability layers which may store and yield limited amount of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

In the vicinity of the existing bridge, previous hydrological studies conducted in 2001, which can be found in the Options and Development Report (2010), indicate that a 1 in 2 year flood event would result in the overtopping of the trunk road [Reference 13]. At the bridge, the typical level of the Afon Dyfi ranges from 0.82mAOD to 2.08mAOD. Blocked drains and blocked drainage ditches combined with a low road vertical alignment have caused a persistent problem with flooding at the A487 Heol-y-Doll Rail Bridge (NG: SH 74418 01290), approximately 50m south of the southern end of the proposed route.

To solve this problem, the scheme shall now include pumped drainage measures in the area of the railway bridge.Assessments carried out to date have not definitively concluded whether the flood water originates from surface water drainage pipes or groundwater flows, although it is considered more likely to originate from surface water drainage. The preliminary assessments have concluded that the amount of flood water that may accumulate in this area can be suitably removed through a pumped drainage measure.

The groundwater vulnerability map in the EnviroCheck report indicates the soil to have a high leaching potential (H1) – soils which readily transmit liquid discharges because they are either shallow, or susceptible to rapid by-pass flow directly to rock, gravel or groundwater [Reference 3].

3.11.2 Man-made features

The existing Pont-ar-Ddyfi is a Grade II* listed road bridge. It was built in 1533, repaired in 1681 and rebuilt in 1805. It is a 5-arch rubble bridge, featuring rounded arches with arch rings, voussoirs, thin pilaster buttresses between each arch and very low pointed cutwaters. Modern reinforcements have also been added and numerous repairs are evident (see Photograph 19).

The bridge has been repeatedly damaged over the years by vehicle impacts leading to lengthy closures for repairs. Closures have also been triggered by flooding. These closures have been problematic as alternative routes to cross the Afon Dyfi involve long detours.

The old bridge has been the scene of a civil war battle in November 1644 between Cromwell’s Army under Thomas Myddleton of Chirk and the Royalists. Hence there is the potential for archaeological interest in the area.

Within the development corridor the only recent development is The Millennium Bridge, a cable-stayed bridge over the Afon Dyfi, now part of the Dyfi Cycleway

which in turn forms part of the National Cycle Network. Opened in 2001, the new footbridge and cyclebridge is built along the alignment of the former Corris Railway bridge.

Information has been requested from Powys County Council regarding the retaining structure supporting the existing A487 at the northern end of the scheme. No information has been received to date. However, if the information becomes available the report will be updated accordingly.

Natural Resources Wales operates a flow measurement station, approximately midway between the proposed route and the existing Pont-ar-Ddyfi Bridge.

4 Field and Laboratory Studies

4.1 Walkover Survey

A site walkover of the study area was completed on 14th August 2015 by two Chartered Geotechnical Engineers. A series of visual observations were made on the geology and geomorphology along the proposed route corridor and the neighbouring ground. The following paragraphs discuss the specific observations that were made. Chainages have been used as a point of reference as shown on the site features plan, Figure 4, along with the identified observations discussed below. Photographs are presented in Appendix A.

The proposed route leaves the existing A487, in a westerly direction at approximately Ch. 0+090m. At approximately 0+100m, there is a 290m long new section of road to tie-in the proposed route to the existing A487. This part of the scheme crosses fields and hedgerows.

At around Ch. 0+250m, the proposed route crosses over the existing A487. Drainage channels run along both sides of the existing A487 and are culverted under the access to the fields; see Photograph 1. Services also cross the A487 at this location including a high pressure gas main; see Photograph 2. Overhead power lines cross the A487 and run across the site in a north easterly direction; see Photograph 3.

Between Ch. 0+250m and Ch. 0+820m, the proposed alignment crosses fields and hedgerows; see Photograph 4. At around Ch. 0+290m the field is very marshy in places indicating impeded drainage; see Photograph 5. Marshy ground is also present between Ch. 0+450m and Ch. 0+480m; see Photograph 6, and around Ch. 0+765m to Ch. 0+795m; see Photograph 7. Also a number of ponds are present, see Photograph 8.

At Ch. 0+830m, the alignment crosses the existing footpath; see Photograph 9. It then crosses very uneven grassed area between Ch. 0+830m to Ch. 0+880m, potentially as a result of historic fill from the construction of the Millennium Bridge, which crosses the River Dyfi to the east of the proposed alignment.

Between Ch. 0+880m and Ch. 0+895m, the alignment crosses a gravel bank, associated with deposition within the River Dyfi; see Photograph 10. Downstream of the alignment stiff, grey brown, clayey silt over river terrace deposits comprising rounded gravels were exposed in the river bank; see Photograph 11. There also appeared to be some evidence of an old masonry wall, possibly historic river edge protection; see Photograph 12. Upstream of the Millennium Bridge, on the southern river bank, there were signs of significant instability with localised slumping; see Photograph 13.

On the northern bank of the river, between Ch. 0+780m and Ch. 0+800m, rock was shown outcropping; see Photograph 14. However just upstream, a retaining structure is present which supports the existing A487; see Photograph 15.

Between Ch. 0+895m and Ch. 0+920m the alignment crosses the River Dyfi.

Between Ch. 0+920m and Ch. 1+010m, the alignment crosses a field again, which is some 10m higher than the river. It appears that fill may have been placed on the southern area of the field as the ground was uneven and the drainage impeded, which is not expected for natural ground high above the river; see Photograph 16.

From around Ch. 1+010m the proposed alignment rejoins the existing A487. On the western side of the road, rock is shown outcropping; see Photographs 17 and 18. There is a public footpath which runs along the eastern side of the proposed alignment.

4.2 Geomorphology / Geological Mapping

The upper reaches and catchment area of the Afon Dyfi drains from the Aran Mountains and the channel is generally entrenched downstream within gravel and rock bed with little floodplain sedimentation. In the middle reaches, the valley broadens progressively towards the estuary. Here, the valley bottom contains an accumulation of mixed sediments within which three main terraces have been distinguished. The floodplain consists predominantly of sands and gravels from the mobile channel with alluvial silt and clay overburden, with evidence of extensive floodplain reworking. The lower reaches of the Afon Dyfi broaden out into the Dyfi estuary.

The proposed development lies in the middle reaches of the Afon Dyfi with the active channel and the flat floodplain being the most important features. During the walkover survey no evidence was found of the river terrace levels and little indication of former channel alignments (palaeochannels) were observed. Surface indications including reedy marsh, ponds and patches of wet ground are strong proof of the existence of these palaeochannels which are understood to have become obscured over time. However a review of the aerial photographs did reveal some evidence of the palaeochannels; see Section 3.3.

Some mapping of the small cutting adjacent to the existing A487, at approximately Ch. 1+060, was undertaken during the Key Stage 3 Ground Investigation. Two major joint sets were identified typically dipping at 82º to the horizontal at a bearing of 020º and 76º to the horizontal at a bearing of 290º. However, it is recommended that a detailed geological mapping survey is undertaken prior to detailed design stage.

4.3 Ground Investigation

4.3.1 Description of fieldwork

The preliminary ground investigation for Key Stage 3 was carried out by CC Geotechnical Ltd between 23rd November 2015 and 5th January 2016. Groundwater monitoring was undertaken up until 24th February 2016.

This investigation was scoped based on the scheme proposals prior to the changes commissioned by Welsh Government in March 2016 (see Section 2.2.2 of this report). The impact of the scheme proposals changes on the scope of investigation is not considered significant at this stage of the scheme.

The investigation comprised:-

- 24No. machine dug trial pits.
- 5No. cable percussive boreholes, 1No. followed on with rotary coring.

Based on preliminary pile design calculations, all boreholes have been advanced to depths below piled foundation as recommended in Annex B of Eurocode 7 Part 2. This is considered sufficient for Key Stage 3 design.

The factual information for this investigation is provided in Volume 2. The as-built exploratory hole locations are shown on Figure 6 in relation to proposed scheme and historical ground investigation.

The intention of the ground investigation prior to changes of March 2016 was to provide adequate design information for the Key Stage 3 preliminary design. The ground investigation was aimed to:-

- Provide additional information on ground conditions along the proposed route, in particular, in areas not previously investigated.
- Permit derivation of geotechnical parameters to inform preliminary design.
- To identify the thickness of potentially soft deposits beneath the approach embankment.
- To identify ground conditions to appropriate depths below the foundations to the proposed structures. In particular, the depth to bedrock where pier foundations require a rock socket, and soil and rock parameters for pile design.
- To identify the made ground at the northern end of the scheme Ch.0+920m to Ch. 1+000m.
- Gain additional information about the rock for the proposed cutting for the side road at the northern end of the scheme.
- Confirm the groundwater conditions along the proposed route.
- Obtain soil and groundwater contamination information for the identification of baseline conditions and sources of potential contamination issues.

In light of scheme proposals changes of March 2016, the scope of this ground investigation is not covering the following extents of the scheme:

- To identify the thickness of potentially soft deposits beneath the southern tie-in between Ch. 0+080m and Ch. 0+210m.
- To identify the thickness of potentially soft deposits beneath the approach embankment between Ch. 0+060m and Ch. 0+210m where the scheme alignment has moved by up to 20m to the west.

However based on site walkover observations and information gathered in the Preliminary Site Study Report [Reference 1], the ground conditions beneath these extents within the floodplain are anticipated to be similar to the area covered by this investigation in the southern end of the scheme. This will be confirmed during the Phase 2 (Key Stage 6) ground investigation.

4.3.2 In situ testing and sampling

The in-situ testing comprised:-

- Standard penetration tests (SPT) in all the cable percussive and rotary boreholes.
- 1No. rising head test within a borehole.

The sampling comprised:-

- Disturbed and bulk samples from the cable percussive boreholes and the trial pits.
- Environmental sampling of potentially contaminated material.
- Core samples from the rotary borehole.
- Groundwater environmental sampling taken from installations following completion of the fieldwork.

4.4 Drainage Studies

No drainage studies have been undertaken.

4.5 Geophysical Survey

No geophysical surveys have been undertaken on the site.

4.6 Pile Tests

No pile tests have been carried out on the site.

4.7 Other Fieldwork

4.7.1 Groundwater monitoring

Groundwater standpipes were installed within three of the boreholes. Monitoring of the groundwater levels has been undertaken for a period of six weeks following the completion of the fieldwork. However due to the prolonged period of heavy rain and the numerous flood events which took place both during the fieldwork in November and December 2015, and on completion of the fieldwork, it is anticipated that further groundwater monitoring will be undertaken at a later date.

The recorded groundwater monitoring standpipe details are presented in Table 2 below:-

Table 2 – Installation Details

Borehole	Installation Type	Response Zone	Formation
BH2	Slotted groundwater monitoring standpipe	15m -25m	Sand and Gravel
BH3	Slotted groundwater monitoring standpipe	15m – 25m	Sand and Gravel
BH4	Slotted groundwater monitoring standpipe	1m to 10m	Sand and Gravel

A rising head test was attempted during the fieldwork. However due to the high rate of groundwater inflow during the test, which was due to the high groundwater level during a period of flooding, it was not possible to pump the groundwater out of the borehole. Therefore, the permeability tests will need to be undertaken at a later date or incorporated into Phase 2 (Key Stage 6) of the ground investigation. It should be noted that the attempted test is indicative that high permeabilities are likely to be recorded.

4.8 Laboratory Investigation

The laboratory tests were scheduled by Arup. The tests were carried out by or through CC Geotechnical Ltd. Laboratory test results are presented in the Geotechnical Factual Report [Volume 2].

The following tests were undertaken on various samples from the boreholes and trial pits:-

- Moisture content determination.
- Atterberg limit tests.
- Particle size distribution (PSD) tests.
- 4.5kg compaction tests.
- Unconsolidated undrained (UU) triaxial compression tests.
- One dimensional consolidation tests, with determination of the co-efficient of secondary consolidation.
- Point Load Index (PLI) tests.
- Uniaxial Compressive Strength (UCS) tests.
- pH and sulphate tests on soil and groundwater samples.

- Organic content determination.
- Contamination testing on soil and groundwater samples.

5 Ground Summary

A summary of the ground conditions are presented in Table 3 on the following page. A geological cross-section along the length of the proposed route is presented on Figure 7.

Table 3 – Summary of Ground Conditions

Alignment		Feature	Geology								Reference (from Key Stage 3 investigation unless stated otherwise)
Approx. Chainage			Superficial Deposits					Solid Geology			
Start (m)	Finish (m)		Topsoil	Made Ground	Cohesive Alluvium	Head Deposits	Glacial Sand and Gravel	Weathered Bedrock	Bedrock	Groundwater	
			Estimated thickness (m)	Estimated thickness (m)	Estimated thickness (m)	Estimated thickness (m)	Estimated thickness (m)	Estimated thickness (m)	Estimated depth to rockhead (m)	Depth (m)	
060	210	South embankment and tie-in	0.00 – 0.50	0.00 to 0.90	1.60 – >3.00 (locally containing 1.1m of glacial sands and gravels)	absent	23.0 max proven			1.0 – 1.50	BH1, TP01, TP02, TP03, TP04, TP05 TP1, TP2, TP3, BH3, BH14 (CJ Associates 2001)
210	820	Viaduct	0.20 - 0.30	absent	0.80 - >3.0	absent	28.4 max proven			0.40 – 2.50	BH1, TP01, TP02, TP03, TP04, TP05, BH2, BH3, BH4, TO06, TP07, TP08, TP09, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18
865	865	River Bridge- southern supports	0.25	absent	absent - 1.5	absent	13.5 - 18.9		15.6 – 20.4	1.0 – 1.80	TP17 to TP19 BH17 to BH19 (CJ Associates 2001)
940	940	River Bridge - northern abutment	0.10	4.80		absent	4.00	0.40	9.2	9.00	TP20, TP21, BH5
940	1025	Northern embankment	0.60	absent	absent	0.80	1.50 max proven			None encountered	TP22
1025	1100	Side road cutting	0.10	absent	absent	0.70 - 1.10	absent	0.30 - 0.9 max proven	1.5 - 1.7	None encountered	TP24, TP25

6 Ground Conditions and Material Properties

6.1 General

Details of ground and groundwater conditions along the route from current and historical investigation are presented in sections 6.2 to 6.10. It should be noted that the previous investigations were undertaken prior to the adoption of Eurocode 7, hence the descriptions are in accordance with BS5930. All SPT "N" values reported are uncorrected in relation to overburden pressure, however when deriving strength parameters consideration has been given to corrected values to account for overburden in accordance with CIRIA 143 It should also be noted that in light of the additional information obtained from this site investigation, the information from the previous ground investigations has been re-assessed, with ground reclassified as different formations at some locations.

A summary of the stratigraphy at the various locations along the proposed route is provided in Section 5 and a geological section along the route is presented on Figure 7.

Characteristic parameters are derived in this section for the preliminary design of the earthworks and structures, and are provided in Section 6.10. It should be noted that additional ground investigation will be carried out at Key Stage 6 for detailed design and consideration will be taken of this additional information for derivation of detailed design parameters.

6.2 Topsoil

6.2.1 Coverage

Topsoil has been encountered in all the exploratory holes carried out along the alignment of the proposed route.

6.2.2 Description

The topsoil was generally recorded as being dark brown, clayey silty topsoil. It was recorded as being between 0.10m and 0.60m thick, with a typical thickness of 0.20m to 0.30m over the majority of the site.

Topsoil may be considered for re-use as "landscape fill" for future proposals, although its suitability for this purpose will need to be confirmed in accordance with the Earthworks Specification that will be prepared for the scheme prior to construction.

6.3 Made Ground

6.3.1 Coverage

Made ground has been identified at five locations along the alignment of the proposed route. At the southern end of the viaduct structure it was encountered in trial pits TP01 and TP02, between Ch. 0+230m and 0+280m, where it was encountered with thickness between 0.40m and 0.60m. At the northern abutment in Trial Pits TP20 and TP21, between Ch. 0+935m and Ch. 1+025m, where it extended to the bottom of the trial pits at 3.1m depth.

The log for BH5 did not identify any made ground. However, based on ground conditions encountered in TP20 and TP21 along with the hummocky ground identified during the site walkover, the 4.5m thick strata beneath the topsoil in BH5 is interpreted as made ground.

6.3.2 Description

The made ground at the southern end of the scheme generally comprised brown, clayey, silty gravel with occasional red brick and mudstone gravels. In TP02 the made ground coincided with the presence of a 200mm diameter pipe. The pipe was not shown on any service plans and appeared to possibly be a disused gas main. It did not appear to be a land drain.

In the locality of the northern abutment, it was described as dark brown/grey, slightly silty, clayey, sand and gravel and some cobble. The gravel and cobble comprised ceramics, tarmac, concrete, brick and stone, with plastic, wood, metal and disused tools present in the trial pits.

6.3.3 Classification

Natural moisture content and Atterberg Limit tests were undertaken on two disturbed samples taken from BH5 at depths of 2.0m and 4.0m. 31% and 32% of material was reported as passing a 425µm sieve. Moisture contents of 12% and 15% were recorded. The sample taken from 2.0m depth was recorded as being non-plastic. Whereas the sample taken from 4.0m depth recorded a liquid limit of 30%, a plastic limit of 21% and a plasticity index of 9% indicating that the finer fraction of the sample passing through the 425µm sieve is a silt of intermediate plasticity.

Particle size distribution tests were taken from the same samples indicating a well graded material. The results are presented in Table 4 below.

Table 4 – Made Ground Particle Size Distribution Test Results

	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH5 2.0m	55	25	20	0
BH5 4.0m	49	30	20	1

6.3.4 Standard Penetration Tests

The SPT 'N' values were in the range of 50 for 70mm (N = 214) to 50 for 20mm (N = 750), however these corresponded to the description of cobbles of concrete and stone and the large pieces of steel. The actual soil mass observed in the trial pits by the site engineer was generally of a medium dense consistency, with pockets of very loose to loose material due to the presence of the detritus.

6.3.5 Strength

The nature of the made ground, which appears to be derived from tipped material, is likely to be highly variable. This is also evident from the hummocky ground surface and impeded drainage which was witnessed during the site walkover, along with the interpreted geological section; see Figure 7.

Due to its variable nature, a characteristic constant volume effective angle of shearing resistance ($\varphi'_{cv,k}$) of 30º would be appropriate for this type of material. However, the existing slope is currently standing at an angle of close to 35° to 40°. This would indicate that a characteristic peak angle of internal friction (φ_{pk}') of 35° may be used for the stability analysis associated with the slope during the preliminary design stage.

It was noted by the designers' supervising engineer that the ground conditions observed in the exploratory holes had a particularly high proportion of degradable wood debris. Therefore standard correlations for strength parameters based on the log descriptions should be used with caution.

It is recommended that further investigation of the consistency and composition of the made ground is investigated further prior to detailed design.

6.3.6 Compressibility and Consolidation

The made ground is very variable and contains detritus including pockets of very loose material. Due to its variable nature high total and differential settlements could potentially occur. This will need to be considered further at the detailed design stage.

6.3.7 Potential Contamination

Ground investigations undertaken along the proposed route encountered made ground in the south, possibly associated with a field track, and in the north associated with the Millennium Bridge and the former Corris Railway Bridge.

Made ground encountered in the southern end of the proposed route typically comprised clayey, silty gravel as well as brick fragments at one location. Thicknesses were between 0.3m and 0.5m beneath the topsoil.

Made ground typically comprising clayey, silty sands and gravel and fragments of man-made materials, including plastic, glass, ceramic, brick, mortar, glass, tarmac, concrete, slate, roofing tile, coal and cinders were encountered on the northern bank of the Afon Dyfi from the ground surface to maximum proven depth of 8.6m.

Inclusions of tarmac, coal and cinders present potential sources of metals or hydrocarbons contamination, primarily of Polycyclic Aromatic Hydrocarbons (PAHs).

Inclusions of concrete and bricks may indicate the presence of demolition materials, a potential source of asbestos.

No other evidence of contamination (including hydrocarbon or asbestos) was encountered during the fieldwork or subsequent groundwater monitoring.

Laboratory chemical testing has been undertaken on soil samples. The laboratory results are provided in the ground investigation factual report (Volume 2 of this report). The results indicate the presence of some contaminants including metals, PAHs and TPH within the soils at maximum recorded concentrations as follows:

- Arsenic at 21.3 mg/kg in TP3 at 0.4m
- Beryllium at 1.2 mg/kg in TP2 at 0.4m
- Cadmium at 0.9 mg/kg in TP14 at 0.6m
- Chromium at 43.1 mg/kg in TP19 at 0.4m
- Copper at 128 mg/kg in TP5 at 0.25m
- Lead at 718 mg/kg in TP14 at 0.6m
- Nickel at 52 mg/kg in TP19 at 0.4m
- Vanadium at 42.6 mg/kg in TP20 at 0.3m
- Zinc at 258 mg/kg in TP6 at 0.3m
- Total Petroleum Hydrocarbons at 343 mg/kg in TP20 at 0.3m
- Total PAHs at 6.08 mg/kg in TP01 at 0.4m

No asbestos has been identified within the analysed samples.

Although the measured concentrations of contaminants in soils are relatively low, a risk assessment of potential impact on human health and controlled waters in a context of the proposed scheme will be required.

The chemical testing undertaken on groundwater samples is discussed in Section 6.8.3.

6.4 Alluvial Deposits

6.4.1 Coverage

Brown clayey silt was recorded over the length of the proposed route to the south of the Afon Dyfi, in the low lying flood plain. These correspond to alluvial deposits shown on published geology map.

The thickness of the alluvium increased from typically around 1.50m in TP01, TP02 and TP03 close to the existing A487 at around Ch. 0+255m, to 2.75m in TP07 at Ch. 0+400m in the southern end of the viaduct. The alluvium was generally less than 2.0m thick under the remainder of the viaduct section, with the exception of TP16, close to the pond at Ch. 0+765m, where it was greater than 3.0m in thickness. A 1.30m thick layer of granular alluvial deposits was present within the cohesive deposits at this location.

In Trial Pits TP05 and TP06, close to Ch. 0+375m and Ch. 0+440m, a 100mm thick layer of organic matter comprising leaf matter was recorded at depths of 2.80m (5.11mAOD) and 3.0m (5.22mAOD) respectively.

The previous investigation (CJ Associates 2001 – Reference 11) indicates that alluvium is present along the alignment of the embankment and tie-in in the southern end of the scheme with thickness comprised between 1.9m and 3.2m. This is generally consistent with the ground conditions that were encountered in the recent investigation.

6.4.2 Description

The deposits were described as brown clayey silt in this investigation.

The previous site investigation (CJ Associates 2001 – Reference 11) described the alluvial deposits as soft and soft to firm, grey brown, silty clay.

6.4.3 Classification

A particle size distribution tests was undertaken on a sample of alluvial deposits taken from TP01 at a depth of 2.10m. The test reported the following composition:

Gravel	2%
Sand	52%
Silt/clay	46%

The test results are presented on Figure 8.

Natural moisture Content and Atterberg limit tests were undertaken on 18 disturbed samples during this investigation; the results are presented on Table 5 below.

Table 5 – Alluvial Deposits – Atterberg Limit Test Results

Exploratory hole	Depth/m	Natural Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Percentage passing 425µm sieve
BH1	1.00	44	44	28	16	98
BH2	1.00	48	38	26	12	99
BH3	0.50	52	59	35	24	99
BH4	1.00	50	46	32	14	98
TP01	0.60	40	44	29	15	100
TP01	1.30	64	53	31	22	100
TP02	1.40	56	52	31	21	100
TP03	0.80	35	43	26	17	100
TP03	1.20	48	54	28	26	100
TP04	0.60	43	48	30	18	100
TP04	1.70	42	57	33	24	100
TP05	1.30	40	46	30	16	100
TP06	0.80	43	42	27	15	100
TP06	2.20	41	43	26	17	100
TP07	1.60	39	42	18	14	100
TP07	2.30	42	45	29	16	100
TP13	0.80	33	39	24	15	100

Exploratory hole	Depth/m	Natural Moisture content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Percentage passing 425µm sieve
TP16	2.10	40	50	28	22	100

The test results are presented on Figure 9.

Natural moisture contents of 33% to 64% were recorded. The liquid limits were in the range of 38% to 59%, plastic limits in the range of 18% to 35% and plasticity indices in the range of 12% to 26%, generally indicating a silt of intermediate plasticity. From EN ISO 14688-2:2004 this generally corresponds to a consistency index of very soft to soft [Reference 16].

6.4.4 Standard penetration tests

In this site investigation SPT "N" values of between 1 and 4 were recorded indicating an extremely low to very low strength. This is consistent with the pocket penetrometer tests, which recorded a shear strength of less than 5kPa.

However in silt material the results of pocket penetrometers can be unreliable and should be treated with caution. Similarly, the dilation of the silt during drilling can result in slightly lower SPT 'N' values being recorded at shallow depth. Therefore it is recommended that the strength determination is made from a number of sources so comparisons and correlations can be made.

In the previous site investigation undertaken by CJ Associates in 2001, SPT "N" values of less than 8 were recorded in the boreholes. This is consistent with the hand shear vane tests undertaken in the trial pits, which recorded undrained shear strengths in the range of 20kPa to 58kPa, with an average value of 37kPa, corresponding to a low strength.

6.4.5 Strength

Hand vane tests were undertaken in the alluvial deposits in the 2001 investigation. Undrained shear strengths in the range of 20kPa to 58kPa were recorded, with an average value of 37kPa. The undrained triaxial tests recorded values of 12kPa to 48kPa, with an average value of 23kPa.

During this investigation undrained triaxial tests were scheduled for disturbed samples from boreholes BH3 and BH4 at depths of 1.20m. However due to a high silt content it was not possible to undertake the test. As shown in Section 6.4.3, the natural moisture content for these disturbed samples are frequently close (with some exceeding) the liquid limit.

From Reference 17 and 18, the undrained shear strength is given by:

$$c_u = f_1 N \qquad \text{where N is the SPT'N' value}$$

For a soil with a plasticity index in the range of 12% to 26% and an average of 20%, then f_1 is equal to 5.4. Hence the undrained shear strength (c_u) would be in

the range of 5kPa to 20kPa, which is consistent with the in-situ and laboratory testing.

These values are consistent with Reference 19, whereby the characteristic strength for fine soils may be estimated from the following equation:

$$(c_{u,k}/p'_{v)} = k_1 \, Ro^{k2} = k_1 \, (p'_{v,\,max}/p'_v)^{k2}$$

where $k_1 = 0.23 \pm 0.04$

$k_2 = 0.8$

$(p'_{v,\,max}/p'_v)$ is the over - consolidation ratio

Therefore for normally consolidated alluvial deposits, at 1.0m depth the undrained shear strength would be around 4kPa and it would be around 12kPa at 3.0m depth, which corresponds to the values determined from other sources.

The variation in the clay and silt content recorded in the site investigations has resulted in a range of undrained shear strengths being recorded and calculated. It is recommended that a value of 20kPa is used for the preliminary design, which is an upper bound value for this investigation and a lower bound value from the previous investigations. However, a sensitivity analysis should be undertaken, to determine the effect of an undrained shear strength of around 10kPa on the design.

Further investigation of the composition and consistency of the alluvial deposits will be required prior to detailed design.

From Reference 19, for fine soils the characteristic constant volume effective angle of shearing resistance ($\varphi'_{cv,k}$) is given by:

$\varphi'_{cv,k} = (42^o - 12.5 \log_{10} I_p)$ for $5\% \leq I_p \leq 100\%$ where I_p is the plasticity index

Hence, characteristic constant volume effective angle of shear resistance ($\varphi'_{cv,k}$) is estimated at 26°.

The peak angle of shearing resistance ($\varphi'_{pk)}$) is related to the $\varphi'_{cv,k}$ by an additional contribution from soil dilatancy (φ'_{dil}) [Reference 19]. The value of φ'_{dil} increases with an increase in the over consolidation ratio and is usually between 0 and 4. Since alluvial deposits are normally consolidated, the over-consolidation ratio will be 1. Therefore, φ'_{dil} will be zero, and the peak angle of shearing resistance (φ'_{pk}) is 26º.

6.4.6 Stiffness

From Reference 16, Figure 2.33 gives a relationship for the undrained Young's modulus (Eu) between over-consolidation ratio, plasticity index and undrained shear strength. For an over-consolidation ratio of 1.0 and a mean plasticity index value of 20%, the relationship is as follows:

$$\underline{E_u} = 1200 \, c_u$$

Hence the undrained Young's Modulus (Eu) is in the range of 6000kN/m² and 24000kN/m². The lower bond value of 6000kN/m² is recommended.

From Stroud 1975 [Reference 20], a commonly used equation to obtain the drained Young's modulus (Ed') of fine grained soil is:

$E'_d = 1000\ N$ where N is the SPT'N' value

Based on SPT 'N' values between 1 and 4, the drained Young's modulus ranges from 1000kN/m^2 to 4000kN/m^2.

From Reference 28, the interrelationship between Eu and E'_d can be expressed as follows:

$E_d = 2/3\ (1+V_d)\ E_u$ where V_d is the drained Poisson Ratio, conservatively assumed as 0.2

Taking the E_u lower bond value of 6000kN/m^2, the undrained Young's Modulus is calculated as 4800kN/m^2.

Based on the values calculated from this equation and the correlation from SPT'N' values, a value of 4000kN/m^2 is assumed for design.

6.4.7 Compressibility and Consolidation

In this investigation, one dimensional consolidation tests were scheduled for disturbed samples taken from BH1 and BH2 at depths of 1.0m. However due to the low clay content and the high moisture content it was not possible to prepare the sample for the test and the tests had to be aborted.

During the 2001 investigation one dimensional consolidation tests were undertaken on a material recorded as sandy clay. However, all the tests were from boreholes to the north of the proposed alignment and close to the Afon Dyfi, not in the vicinity of the proposed embankment and tie-in in the southern end of the scheme.

From the 2001 investigation, for an 80kN/m² stress increase, values for the co-efficients of volume change (m_v) of 0.31m²/MN to 0.33m²/MN were recorded, with corresponding values of coefficient of consolidation (c_v) of around 2.9m²/yr to 6.0m²/yr.

From References 17 and 18, co-efficient of volume change (m_v) is given by

$m_v = 1/(f_2 . N)$ where N – SPT'N' value

Again for an average plasticity index of 20%, and an average N value of 2, then f_2 = 0.545, hence m_v is equal to 0.917m²/MN. This corresponds well to typical values quoted in Reference 17 of 0.30m²/MN to 1.50m²/MN for normally consolidated alluvial clays.

6.4.8 Californian bearing Ratio

CBR values of typically 0.5% and 1% were recorded between 0.7m and 0.9m depth in the trial pits undertaken in the 2001 investigation by CJ Associates.

At preliminary design stage (Key Stage 3) it is recommended that a CBR value of 0.5% is used for any pavement design with a formation in the alluvial deposits.

6.4.9 Compaction

No compaction tests were undertaken on this material as it is considered to be unsuitable for re-use, unless treatement is undertaken to improve the material, due to the very high moisture content which was generally close to the liquid limit.

6.5 Head Deposits

6.5.1 Coverage

Slightly sandy gravelly silt was encountered on the northern side of the Afon Dyfi in trial pits TP22, TP24 and TP25 in the vicinity of the cutting associated with the side road. This corresponds with head deposits shown on the published geology plan. The head deposits were encountered beneath the topsoil, and above the weathered bedrock.

6.5.2 Description

The head deposits were described as brown, slightly sandy, gravelly silt. The gravel was fine to coarse, and comprised siltstone and mudstone. The designer's supervising engineer noted that the deposits were typically of loose becoming medium strength in consistency, and were stable in the trial pits.

6.5.3 Classification

One Atterberg limit test was undertaken on a disturbed sample taken from TP24 at a depth of 0.90m. The material had a moisture content of 12%. Only 29% of the material passed a 425µm sieve and was recorded as non-plastic.

A particle size distribution tests was undertaken on one sample from TP24 at a depth of 0.90m. The deposits comprised the following composition (see Figure 8):

Cobbles	10%
Gravel	55%
Sand	12%
Silt	21%
Clay	2%

6.5.4 Standard penetration tests

Head deposits were not encountered in the boreholes so no standard penetration tests are available for the strata.

6.5.5 Strength

Head deposits will be encountered in the cutting for the side road. Since the Atterberg limit tests revealed that the material was non-plastic, it should be considered as a granular material.

From Reference 19, for granular material, the characteristic constant volume effective angle of shearing resistance ($\varphi'_{cv,k}$) is given by:

$\varphi'_{cv,k} = 30° + \varphi'_{ang} + \varphi'_{PSD}$

where φ'_{ang} is the contribution from the angularity of the particles

φ'_{PSD} is the contribution from the soils particle size distribution.

Therefore constant value effective angle of shearing resistance ($\varphi'_{cv,k}$) is equal to 36°.

Also from Reference 19, for granular material, the characteristic peak effective angle of shearing resistance ($\varphi'_{pk,k}$) is given by:

$\varphi'_{pk,k} = 30° + \varphi'_{ang} + \varphi'_{PSD} + \varphi'_{dil}$

where φ'_{ang} is the contribution from the angularity of the particles

φ'_{PSD} is the contribution from the soils particle size distribution

φ'_{dil} is the contribution from soil dilatancy

Since the material appeared to be loose, the density index (I_D) would be between 15% to 35% [Reference 21]. Therefore φ'_{dil} is equal to 0º and the peak effective angle of shearing resistance ($\varphi'_{pk,k}$) is 36°.

6.5.6 Compressibility and Consolidation

In the vicinity of the northern embankment, the head deposits are less than 1.0m thick and overlie sand and gravel. Since the material is granular and the strata is thin then the likely settlement will be rapid and likely to occur during construction. In addition, the northern embankment between Ch. +930m and 1+025m will be relatively low since it will tie-in with the existing carriageway.

6.6 Glacial Sands and Gravels

6.6.1 Coverage

Along the alignment of the southern embankment, the trial pits from the CJ Associates 2001 investigation did not encounter glacial sands and gravels. However these trial pits were limited to 3.0m depth and the glacial deposits are anticipated to be present within a short distance below.

Glacial sands and gravels were encountered in all the boreholes and trial pits on the low lying area between Ch. 0+230m, at the southern of the viaduct and Ch. 0+800m, at the southern river bridge pier. They were also encountered in BH5 on the northern side of the Afon Dyfi beneath the made ground and overlying the bedrock; see Figure 7.

On the southern bank of the Afon Dyfi, the glacial sand and gravel generally underlies the more recent alluvial deposits associated with the river. The surface of the glacial sands and gravels was typically at around 6.50mAOD, and the material was in excess of 30m thick, which is not unusual for a steep sided glacial valley.

6.6.2 Description

The ground investigation describes the glacial sands and gravels as medium dense becoming dense then very dense, grey, slightly silty, sand and gravel with occasional cobbles and boulders. The gravel was fine to coarse, angular to rounded and of various lithologies.

In the 2001 investigation, the glacial sands and gravels were recorded as granular alluvial deposits and generally comprised medium dense, grey, gravels with variable amounts of clay, silt and sand. Cobbles and boulders were also recorded in varying proportions. BH4 recorded quartz cobbles at between 13.50m and 13.80m depth.

6.6.3 Classification

Particle size distribution test were undertaken on 24 disturbed samples taken from the glacial sand and gravel during this investigation. Whilst the 2001 investigation stated that particle size distribution test had been undertaken the information was not included within the report. The results are presented in the following Table 6 and on Figure 8.

Table 6 – Glacial Sands and Gravels Particle Size Distribution Test Results

Expl Hole	Depth (m)	Cobble (%)	Gravel (%)	Sand (%)	Silt/clay (%)
BH1	5.0	0	68	31	0
BH1	14.0	0	80	18	2
BH1	22.0	0	69	30	1
BH2	4.0	0	83	16	1
BH2	8.0	0	96	4	0
BH2	12.50	0	70	28	2

Expl Hole	Depth (m)	Cobble (%)	Gravel (%)	Sand (%)	Silt/clay (%)
BH2	17.0	0	61	36	3
BH2	22.0	0	83	16	1
BH2	26.0	0	75	23	2
BH2	30.0	0	73	26	1
BH3	6.0	0	77	22	1
BH3	9.5	0	78	21	1
BH3	15.0	0	75	23	2
BH3	20.50	7	73	19	1
BH3	25.5	0	81	18	1
BH3	29.9	0	92	7	1
BH4	6.0	0	89	10	1
BH4	10.50	0	78	21	1
BH4	15.0	44	47	6	3
BH4	20.50	0	78	22	0
BH4	25.50	16	76	7	1
BH4	29.50	0	99	1	0
BH5	6.00	40	57	3	0
BH5	7.50	0	83	16	1
TP02	2.70	0	73	22	5
TP03	2.60	0	37	53	10
TP09	1.80	0	68	25	7

Expl Hole	Depth (m)	Cobble (%)	Gravel (%)	Sand (%)	Silt/clay (%)
TP10	1.90	0	21	73	6
TP11	1.70	0	39	57	4
TP12	1.90	0	71	25	4
TP13	2.30	0	66	28	6
TP15	2.00	0	77	19	4

Figure 8 shows the envelope for the material is a well graded sand and gravel, which would be a suitable earthworks material. It would satisfy the criteria for Class 1A or 1B material in accordance with the Specification for Highway Works, Series 600 Earthworks [Reference 22].

6.6.4 Standard penetration tests

Standard penetration tests were undertaken at around 1.0m intervals in the boreholes undertaken during this investigation. The SPT 'N' values are presented on Figure 10.

The SPT 'N' values indicate that the material has a medium dense consistency to an elevation of -7mAOD (approximately 15.50m below ground level). This is broadly consistent with the 2001 investigation, in which SPT 'N' values in the range of 16 to 42 were recorded in the boreholes, with typical values of 18 increasing to 35 with depth.

However in this investigation in Boreholes BH1 and BH4, some high SPT 'N' values were recorded throughout the strata. The lower 'N' values will be used in the determination of the soil parameters but the very dense material should be considered carefully when considering the pile type which may be utilised.

Between -7mAOD and -11mAOD (19.5m below ground level), the SPT 'N' values generally confirmed a dense to very dense consistency, with 'N' values of above 40.

Below -11mAOD, the typical 'N' values are more variable, ranging from 40 to greater than 200 with many results in excess of 100. The results indicate the Glacial Sands and Gravels to be of a very dense consistency.

6.6.5 Strength

Due to the granular nature of the glacial sand and gravel, it is unlikely that any significant areas will behave in an undrained manner under loading. Therefore the undrained shear strength has not been assessed.

No laboratory shear testing was carried out as part of this preliminary site investigation. Therefore in order to determine the drained shear strength parameters relationships from BS8002:2015 and CIRIA guidance (Reference 19 and 28) are used.

From Reference 19, for granular material, the characteristic constant volume effective angle of shearing resistance ($\varphi'_{cv,k}$) is given by:

$\varphi'_{cv,k} = 30° + \varphi'_{ang} + \varphi'_{PSD}$

where φ'_{ang} is the contribution from the angularity of the particles

φ'_{PSD} is the contribution from the soils particle size distribution.

Therefore the characteristic constant volume effective angle of shearing resistance ($\varphi'_{cv,k}$) is 36°.

Also from Reference 19, for granular material the characteristic peak effective angle of shearing resistance ($\varphi'_{pk,k}$) is given by:

$\varphi'_{pk,k} = 30° + \varphi'_{ang} + \varphi'_{PSD} + \varphi'_{dil}$

where φ'_{ang} is the contribution from the angularity of the particles

φ'_{PSD} is the contribution from the soils particle size distribution

φ'_{dil} is the contribution from soil dilatancy

From Reference 21, for a medium dense sand and gravel the density index will be between 35% and 65%, hence φ'_{dil} will be equal to 3º. Therefore, the peak effective angle of shearing resistance will be 39º.

Using the same methodology, below -7mOD, the density index increases to 85% to 100%, so φ'_{dil} will equal 9º, hence the peak effective angle of shearing resistance will be 45º.

Reference CIRIA 143 [Reference 28] provides a chart that can be used to determine the effective angle of shearing resistance for both sands and gravels. SPT 'N' values are corrected for two parameters. Firstly, the values are corrected to a standardised hammer energy ratio of 60% to account for variability between rigs. Secondly, the values are corrected for overburden pressure to reflect the increase in soil strength as the rod is driven deeper into the stratum.

The SPT 'N' values are corrected for energy ratio as follows:

$N_{(standard)} = N_{(measured)} . E_{(measured)} / E_{(standard)}$

The energy ratio of the rig used in the ground investigation was 75%. The standard energy ratio is 60% with the corrected SPT 'N' value referred to as N_{60}.

The correction for effective overburden pressure C_n is obtained graphically from CIRIA 143 and is applied to the N_{60} values as follows:

$N_1 = N_{60} . C_n$

Using the same typical SPT 'N' values as in Section 6.6.5, the characteristic peak effective angles of shearing resistance are obtained as follows:

Elevation	Depth below ground level	Typical N value	N_{60} value	Vertical effective stress (assuming effective density = 10kN/m^3*depth)	C_n (CIRIA 143)	N_1 (corrected for energy ratio and overburden pressure)	$\varphi'_{pk,k}$
6.50mAOD	2m	15	18.8	20kN/m^2	2.0	37.6	39º
-7mAOD	15.5m	40	50	155kN/m^2	0.8	40	39º
-11mAOD	19.5m	>100	>125	195kN/m^2	0.7	>87.5	43º
Below -17.0mAOD	Below 25.5m	>200	>250	255kN/m^2	0.6	>150	43º

CIRIA 143 mentions that this methodology tends to underestimate angle of shearing resistance values. These values are slightly lower than the ones calculated with Reference 19.

The characteristic peak angles of shearing resistance at this stage have been chosen based on the lower bond of the methods described in BS8002:2015 and CIRIA 143 (References 19 and 28). These v compare well with those presented in Annex F of BS EN 1997-2 [Reference 21].

6.6.6 Stiffness

The drained Youngs Modulus (E'_d) can be determined from the SPT 'N' value using the correlation from Stroud 1988 [Reference 20] as follows:

Elevation/mAOD	Typical N value	$E'_d = 1500N$
6.50mAOD	15	22,500kN/m²
-7mAOD	40	60,000kN/m²
-11mAOD	>100	>150,000kN/m²
Below -17.0mAOD	>200	>300,000kN/m²

Therefore, the following values are proposed for design:

- Between 6.50mAOD and -7mAOD

$E'_d = 22,500 + 2750h$ where h is depth below the top of the strata

- Between -7.0mAOD and -11.0mAOD

  $E'_d = 60,000 + 30,000h$ where h is depth below -7mOD

6.6.7 Compressibility and Consolidation

Due to the granular nature of the glacial sands and gravels, which is confirmed by the particle size distribution tests, long term consolidation settlement under loading is not considered an issue. Therefore, consolidation parameters have not been assessed.

6.6.8 Californian Bearing Ratio

In the 2001 investigation, CBR values greater than 10% were recorded in the trial pits. No CBR testing was undertaken in this investigation. Since the material is granular and well graded and at least medium dense, a CBR values of at least 10% would be reasonable.

6.6.9 Compaction

Compaction tests were undertaken on two samples from the boreholes in this investigation. The results are presented in the Table 7 below.

Table 7 – Glacial Sands and Gravels Compaction Test Results

Borehole	Depth (m)	Max Dry density (Mg/m^3)	Optimum moisture content (%)	As received moisture content (%)
BH1	5.0	2.11	6.0	9.0
BH2	4.0	2.16	7.0	8.0

Both samples would be suitable earthworks materials and should be considered as Class 1A or Class 1B in accordance with the Specification for Highway Works Series 600 Earthworks (SHW) [Reference 22]. However, the sample from BH1 was slightly too wet of optimum, and some drying out may be required to achieve 95% compaction. Bearing in mind the free draining nature of the material, and the fact that the samples were taken during a period of prolonged heavy rain, further tests are likely to show that the material can be compacted well.

Whilst no cuttings are proposed in these materials along the proposed route, depending on the type of piling utilised the arisings may be used for embankment construction. Alternatively, the material could be obtained for embankment construction from borrow pits.

If the material is identified as a source of material for embankment construction then further compaction tests should be undertaken during the main ground investigation in Key Stage 6.

6.7 Bedrock

6.7.1 Coverage

Based on the understanding of the geology of the area, there is potential for rockhead to be present at significant depth which would be uneconomic to prove across the scheme area. Based on preliminary pile design calculations, all boreholes from the recent ground investigation have been advanced to depths below piled foundation as recommended in Annex B of Eurocode 7 Part 2. This is considered sufficient for Key Stage 3 design.

Bedrock was encountered to the north of the Afon Dyfi during this investigation and it also outcrops in a roadside cutting on the A487 close to the junction with the side road at Ch. 1+030m.

The previous investigation encountered bedrock to the south of the river in BH18 and BH19 at depths of 20.8m and 15.60m respectively. Since bedrock was not encountered in BH4 of this investigation, which was drilled to a depth of 30m, it indicates that the rockhead profile falls away steeply to the south; see Figure 7 for indicative rockhead profile.

In this investigation bedrock was encountered at the locations shown in Table 8.

Table 8 – Location of Bedrock

Exploratory hole	Location	Depth (mbgl)	Elevation (mOD)	Notes
BH5	South of A487. North abutment	8.80	6.85	Top of intact rock at 9.20mbgl. 0.40m thick weathered zone
TP24	North of A487. Side road cutting	1.20	16.70	Top of intact rock at 1.70mbgl. 0.50m thick weathered zone
TP25	North of A487. Side road cutting	0.80	18.5	Top of intact rock at 1.90mbgl. 1.10m thick weathered zone.

6.7.2 Description

A weathered zone was encountered in both the trial pits and the boreholes. It was between 0.40m and 1.10m thick. In the borehole it was recovered as grey fragmented mudstone. However, in the trial pits, the weathered material was recovered as slightly silty, sand and gravel with occasional cobble. The sides of the trial pits were stable.

The intact bedrock could only be penetrated by approximately 0.20m in the trial pits excavated using a tracked excavator. However, in BH5, intact bedrock was encountered at a depth of 9.2m and drilled to a depth of 19.50m, hence 10.30m of core was recovered. In the 2001 investigation, bedrock was encountered to the

north of the river in boreholes BH20, BH21 and BH22 at depths of 6.80m, 10.10m and 7.40m respectively. In addition, bedrock was recorded in the 1999 investigation for The Millennium Bridge in boreholes BH3, BH4, BH5 and BH6 at depths of 4.10m, 5.90m, 1.50m and 4.0m respectively.

The bedrock was described as grey, very thickly bedded mudstone, which coincides with the descriptions in the 2001 Report, which recorded that the bedrock generally comprised moderately strong to strong, grey, slightly weathered siltstone (turbiditic mudstone). In the 1999 investigation, the bedrock was recorded as dark grey shale recovered as moderately weak to moderately strong fragment. No rock core was recovered in the 1999 investigation. The discontinuities were recorded as being very widely spaced and fresh.

6.7.3 Classification

In the 2001 investigation it was noted that very poor core recoveries were recorded on the borehole logs. However, the accompanying photographs show very good total core recovery (TCR) was achieved, but with low solid core recovery (SCR) and rock quality designation (RQD) due to the vertical jointing of the rock; see Photograph 18 in Appendix A.

However, in the 2015 investigation the TCR, SCR and RQD were all recorded as being 100%, since it was noted by the Site Investigation Contractor that there were “drilling induced fractures”, which are sub-vertical. The photographs of the cores show the fractures to be at a similar angle and frequency as those shown in the photographs from the 2001 investigation. However the interpretation of how they were caused was different between the investigations, hence resulting in different reporting of TCR, SCR and RQD.

Following discussions with the driller during this investigation, it was noted that the core was recovered as intact lengths. However it was reported that it was difficult to remove the rock from the core barrel and force had to be used. The driller confirmed that it is this process that resulted in the fractures along the natural cleavage. These fractures are visible in the core photographs and consideration should be given to whether these may have been artificially induced.

Therefore, a quality classification of good to excellent is reasonable for the cores recovered. This would result in an average mass factor (j) of 0.80 in accordance with Reference 17.

6.7.4 Standard penetration tests

Standard penetration tests were carried out at 1.5m intervals in BH5 and are reported below:

Depth (m)	Reported N value	Extrapolated N value*
9.2	25 for 20mm / 50 for 20mm	750
10.5	25 for 5mm / 50 for 10mm	1500
12	25 for 3mm / 50 for 7mm	2143

13.5	25 for 2mm / 50 for 4mm	3750
15	25 for 2mm / 50 for 1mm	15000
16.5	25 for 1mm / 50 for 1mm	15000
18	25 for 1mm / 50 for 1mm	15000
19.5	25 for 1mm / 50 for 1mm	15000

* extrapolated from main blows

The extrapolated N values increase with depth with values increasing from 750 to 3,750 between 9.2m and 13.5m, and are then equal to 15,000 between 15m and 19.5m. As these N values are extrapolated from limited penetration within the bedrock, consideration should be given to their intended use.

6.7.5 Strength

Point load index tests were undertaken on samples taken from the bedrock recovered in BH5 in both axial and diametral directions. No records of rock testing was available from previous ground investigations.

In the axial direction, tests were carried out on 10 samples between 9.50m and 17.20m. $Is_{(50)}$ values in the range of 0.61MPa to 1.42MPa were recorded. Tests in the diametral direction included five samples taken between 10.30m and 17.30m. $Is_{(50)}$ values were recorded in the range of 2.93MPa to greater than 6.43MPa. These values are greater than in the axial direction, and can be interpreted to reflect the direction of the point load test in relation to the cleavage. The cleavage - which was reported as sub-vertical by the drillers - forms planes of weakness in the rock. The axial point load tests will tend always to 'split' the sample along these weaker planes. For the diametral tests this will only be the case when the loading direction is in line with the cleavage; when it is at a greater angle to the cleavage (it could be perpendicular to the cleavage) then failure of the sample will be much less influenced by the cleavage weakness.

Uniaxial compressive strength tests were undertaken on five samples taken from BH5 at depths of between 10.70m to 17.0m. Uniaxial compressive strengths were recorded in the range of 41.2MPa to 69.9MPa. It was noted that the mode of failure was axial cleavage, hence supporting the interpretation that the rock strengths will be influenced by these weaker planes. However, given the sub-vertical direction of cleavage, which may not be the worst case angle of the weaker planes to the direction of loading, the UCS test results may not reflect the full effect of weakness along the cleavage.

A study by Bieniawski on rock of similar strengths to the rocks present at Dyfi suggests a correlation factor of 24 between UCS and $Is_{(50)}$ values (Reference 30). Using the average values of all tests results, namely UCS = 51.5MPa and $Is_{(50)}$ = 1.1MPa gives a correlation of 47; this is double the correlation found by Bieniawski. For the typical range of $Is_{(50)}$, from around 1MPa to 4MPa, using the correlation of 24 gives UCS values between approximately 25 and 100MPa. (The measured UCS test values fall within this range). For preliminary design a reasonable lower bound of 25MPa is proposed, which would reflect loading conditions where the cleavage has a significant impact on strength.

Further rock strength testing will be undertaken as part of the Key Stage 6 investigation.

6.7.6 Stiffness

The modulus of deformation of the rock mass (E_m) can be obtained from a relationship given in Reference 17 as follows:

$E_m = j \cdot M_r \cdot q_{uc}$

Referring to the likely range of UCS (q_{uc}) as given above, a lower bound value of 25MPa has been suggested. However, for the stiffness of the rock mass, a value of 50MPa closer to the UCS average value, would be more realistic. Using an average mass factor (j) of 0.80 as discussed in the above classification section and a modulus ratio (M_r) of 150 corresponding to a cemented mudstone, a modulus of deformation of $6x10^6$ kN/m^2 is calculated for preliminary design, which would be appropriate for loadings in the principal loading direction.

6.8 Groundwater

6.8.1 Groundwater depth

During this site investigation, groundwater was generally encountered at the base of the alluvial deposits on the southern side of the Afon Dyfi. On penetrating the glacial sands and gravels, the groundwater typically rose to a depth of between 1.10m and 2.50m.

Groundwater monitoring standpipes were installed in boreholes BH2, BH3 and BH4. The groundwater levels have been measured on three occasions in January and February. On one occasion a reading could not be taken since the borehole was flooded. On the other two occasions the groundwater level in all the boreholes was at 1.0m depth.

On the northern side of the river, groundwater was only encountered in BH5 at a depth of 9.0m (6.65mAOD), which corresponded closely to the rockhead level and the river level.

It is recommended that groundwater monitoring is continued on a monthly basis in order to understand the response in groundwater level in relation to weather and seasonal changes.

6.8.2 Permeability

It was proposed to undertake permeability tests during the site investigation. In Borehole BH1 groundwater was struck at 1.70m, and it rose rapidly to 0.50m. Due to the very high groundwater level, a rising head test was attempted in Borehole BH1 within the glacial sands and gravels. The base of the borehole at the start of the test was at 20m. Water was pumped from the borehole for 2.5 hours and there was no measureable drop in groundwater level, therefore the test was abandoned.

This, together with the very low fines content as shown in Table 6, is indicative of a very high permeability for the Glacial Sands and Gravels. This is supported by the findings from many of the trial pits, which experienced high rates of groundwater ingress under low driving heads during the short durations that the pits were open for.

Based on correlations from the particle size distribution tests supported by the difficulties pumping out the groundwater from the boreholes it is anticipated that the glacial sands and gravels will have a permeability of around 1 x 10^{-3} m/s [Reference 23].

6.8.3 Groundwater Quality

A total of two rounds of groundwater sampling was undertaken as part of the ground investigations. The samples were obtained from boreholes BH2, BH3 and BH4, all located to the south of the river. No groundwater sampling was undertaken on the northern river bank.

The first round of groundwater sampling was undertaken during this site investigation on 12 January 2016. The samples were tested, however there was a non-conformance regarding the time between sampling and testing for the hydrocarbon compounds. Therefore, another round of sampling and testing was undertaken on 23rd February 2016.

The testing results for metals and inorganic compounds obtained from the first round of testing met the quality assurance requirements and therefore are considered representative. However, the results of chemical analyses of organic compounds such as petroleum hydrocarbons or Polycyclic Aromatic Hydrocarbons (PAHs) can only be used as indicative. This is due to the holding time being exceeded resulting in the sample deterioration and the measured concentrations potentially being lower than those present within the original sample.

Results of the second round of testing meet the quality assurance requirements.

In summary, the following determinands were detected:

- Calcium at between 4.31 and 14.6 mg/l (Round 1 and 2)
- Magnesium at between 2.34 and 7.84 mg/l (Round 1 and 2)
- Zinc at between 15 and 29 ug/l (Round 1 and 2)
- Total Petroleum Hydrocarbons at between <5 and 39.5 ug/l (Round 1), and 1085 and 260 ug/l (Round 2)
- Total Polycyclic Aromatic Hydrocarbons (PAHs) at between 0.4 and 1.59 ug/l (Round 1) and 0.37 and 2.11 ug/l (Round 2)
- pH was measures at between 5.3 and 5.4, which is considered mildly acidic.

6.9 Chemistry, pH and Sulphate

Various samples of soil and water were taken during the site investigation and tested for pH and water soluble sulphate in accordance with BRE Special Digest 1 [Reference 24].

Design sulphate classes and associated ACEC classes have been derived for each of the geological formations and are presented in Table 9 and 10 below. Full results are presented in Volume 2.

Table 9 – Summary of design sulphate classes and ACEC classes for soil

Formation	SO_4 (mg/l)		pH		Number of samples	Design Sulphate Class	ACEC Class
	Range	Characteristic value	Range	Characteristic value			
Made Ground	<20 - 90	90	5.7 - 11.2	5.7	4	DS-1	AC-2z
Alluvial deposits	<20 - 20	20	5.4 - 6.0	5.4	6	DS-1	AC-2z
Glacial sands and gravels	<20 - 20	20	7.8 - 8.1	7.8	7	DS-1	AC-2z
Bedrock	<20 - 120	120	8.5 - 8.7	8.5	3	DS-1	AC-2z

Table 10 – Summary of design sulphate classes and ACEC classes for groundwater

Formation	SO_4 (mg/l)		pH		Number of samples	Design Sulphate Class	ACEC Class
	Range	Characteristic value	Range	Characteristic value			
Alluvial deposits	2.7 – 4.0	4.0	5.2 - 5.6	5.2	2	DS-1	AC-2z
Glacial sands and gravels	5.3 – 7.2	7.2	5.3 - 5.5	5.3	4	DS-1	AC-2z

6.10 Summary of parameters for Structures and Earthworks

The sections below provide summaries of the ground conditions for each of the major earthworks and structures along the alignment of the proposed route, and present recommended characteristic parameters for preliminary geotechnical design. It is noted that a more detailed ground investigation will be carried out during Key Stage 6, and following this, geotechnical parameters should be updated for use in the detailed design.

6.10.1 Ch. 0+060m to Ch. 0+210m - Southern Embankment, Tie-in and Southern Abutment

- Proposed Structures / Earthworks

  This section of the proposed route will be on an embankment. The embankment will rise from the level of the existing alignment up to less than 5m above existing ground level.

- Summary Ground Conditions

  The ground conditions over this length of the proposed route comprise topsoil overlying alluvial deposits, which in turn are anticipated to overlie glacial sands and gravels.

  The alluvial deposits were recorded between 1.6m and in excess of 3.0m in thickness. The Key Stage 6 investigation will need to prove the thickness of alluvium in this area.

  The base of the glacial sands and gravels was not proven but has been confirmed to be in excess of 22m below existing ground level.

- Recommended Characteristic Parameters

Formation	Characteristic Parameters
Alluvial Deposits	<u>Existing ground level to 6.50mAOD</u> Moist bulk unit weight (γ_m) = 17kN/m² Undrained shear strength (c_u) = 20kPa Drained Youngs Modulus (E'd) = 4000kN/m² Undrained Youngs Modulus (Eu) = 6000kN/m² $\varphi'_{cv:k}$ = 26° $\varphi'_{pk:k}$ = 26° cohesion c' = 0kPa mv = 0.917m²/MN Cv and Cα to be determined at detailed design stage. Poissons ratio = (μ) = 0.3

Glacial Sand and Gravel	<u>6.50mAOD to -7.0mAOD</u> Moist bulk unit weight (γ_m) = 18.5kN/m² E'_d = 22,500 + 2750h where h is depth below the top of the strata $\varphi'_{cv:k}$ = 36º $\varphi'_{pk:k}$ = 39º cohesion c' = 0kPa <u>-7.0mAOD to -11.0mAOD</u> Moist bulk unit weight (γ_m) = 19.5kN/m² E'_d = 60,000 + 30,000h where h is depth below -7mOD $\varphi'_{cv:k}$ = 36º $\varphi'_{pk:k}$ = 39º cohesion c' = 0kPa <u>Below -11.0mAOD</u> Moist bulk unit weight (γ_m) = 21kN/m² E'_d = 60,000 + 30,000h where h is depth below -7mOD $\varphi'_{cv:k}$ = 36º $\varphi'_{pk:k}$ = 43º cohesion c' = 0kPa
Groundwater	Assumed to be at ground level

6.10.2 Ch. 0+210m to Ch. 0+820m - Viaduct

- Proposed Structures / Earthworks

  This section of the proposed route will be on a viaduct, which will comprise 18 spans, typically 34m in length. Each span will be supported on piled foundations.

- Summary Ground Conditions

  The ground conditions over this length of the proposed route comprise topsoil overlying alluvial deposits, which in turn overlie glacial sands and gravels.

  The intention is to use sands and gravels as founding material for the piles to the viaduct. Boreholes have confirmed that bedrock is not present in the first 30m in the valley floor where the viaduct is to be constructed. Preliminary calculations have shown that piles need to be shorter than this depth and rock socket will not be required for the majority of the piers with the exception of potentially pier 17 where rockhead will be confirmed at Key Stage 6 ground investigation.

The alluvial deposits are around 1.6m thick at the southern end of the viaduct, increasing in thickness to in excess of 3.0m in TP07, which is close to the field boundary at Ch. 0+445m. The deposits then thin out again to around 2m in the north, with the exception of a slightly deeper area in the location of the pond close to TP16.

The base of the glacial sands and gravels was not proven. These deposits have been confirmed as extending to depths in excess of 27m below existing ground level.

- Recommended Design Parameters

Formation	Characteristic Parameters
Alluvial Deposits	Existing ground level to 6.50mAOD Moist bulk unit weight (γ_m) = 17kN/m² Undrained shear strength (Cu) = 20kPa Drained Youngs Modulus (E'd) = 4000kN/m² Undrained Youngs Modulus (Eu) = 6000kN/m² $\varphi'_{cv:k}$ = 26º $\varphi'_{pk:k}$ = 26º cohesion c' = 0kPa
Glacial Sand and Gravel	<u>6.50mAOD to -7.0mAOD</u> Moist bulk unit weight (γ_m) = 18.5kN/m² E'_d = 22,500 + 2750h where h is depth below the top of the strata $\varphi'_{cv:k}$ = 36º $\varphi'_{pk:k}$ = 39º cohesion c' = 0kPa <u>-7.0mAOD to -11.0mAOD</u> Moist bulk unit weight (γ_m) = 19.5kN/m² E'_d = 60,000 + 30,000h where h is depth below -7mOD $\varphi'_{cv:k}$ = 36º $\varphi'_{pk:k}$ = 39º cohesion c' = 0kPa <u>Below -11.0mAOD</u> Moist bulk unit weight (γ_m) = 21kN/m² E'_d = 60,000 + 30,000h where h is depth below -7mOD $\varphi'_{cv:k}$ = 36º $\varphi'_{pk:k}$ = 43º

	cohesion c' = 0kPa
Bedrock (if required TBC at KS6)	Refer to Section 6.10.3 below
Groundwater	Assumed to be at ground level
Other Issues	Negative skin friction will need to be considered for the foundations of the pier closest to the embankment. Consideration at detailed design for differential settlements between piers 16 and 17 based on potential shallow bedrock close to founding level at pier 17.

6.10.3 Ch. 0+815 and 0+865m River Bridge – Southern Piers

- Proposed Structures / Earthworks

  This section of the proposed route will be on a bridge structure with a 73m span across the river and a 50m backspan. They will both require piled foundations.

- Summary Ground Conditions

  The ground conditions over this length of the proposed route comprise topsoil overlying alluvial deposits, which in turn overlies glacial sands and gravels.

  The alluvial deposits are around 2m thick in this area, with the exception of the location of the pond close to TP16, where they increase in thickness to around 3m.

  The base of the glacial sands and gravels was not proven in BH4 during this investigation, which was drilled to a depth of 30m; see Figure 7. However, BH18 located close to the backspan pier position and undertaken during the 2001 investigation, recorded bedrock at 20.50m depth. Also BH19, located close to the southern pier recorded rock at 15.60m depth. However, it should be noted these previous boreholes have been positioned by overlaying. So caution must be used when interpreting the depth to bedrock due to the steep rockhead profile in this area. Further investigation will be undertaken prior to detailed design stage.

- Recommended Characteristic Parameters

Formation	Characteristic Parameters
Alluvial Deposits	Existing ground level to 6.50mAOD Moist bulk unit weight (γ_m) = 17kN/m² Undrained shear strength (c_u) = 20kPa Drained Youngs Modulus (E'd) = 4000kN/m² Undrained Youngs Modulus (Eu) = 6000kN/m² $\varphi'_{cv:k}$ = 26° $\varphi'_{pk:k}$ = 26°

	cohesion c' = 0kPa
Glacial Sand and Gravel	6.50mAOD to -7.0mAOD Moist bulk unit weight (γ_m) = 18.5kN/m² E'_d = 22,500 + 2750h where h is depth below the top of the strata $\varphi'_{cv:k}$ = 36° $\varphi'_{pk:k}$ = 39° cohesion c' = 0kPa -7.0mAOD to -11.0mAOD Moist bulk unit weight (γ_m) = 19.5kN/m² E'_d = 60,000 + 30,000h where h is depth below -7mOD $\varphi'_{cv:k}$ = 36° $\varphi'_{pk:k}$ = 39° cohesion c' = 0kPa Below -11.0mAOD Moist bulk unit weight (γ_m) = 21kN/m² E'_d = 60,000 + 30,000h where h is depth below -7mOD $\varphi'_{cv:k}$ = 36° $\varphi'_{pk:k}$ = 43° cohesion c' = 0kPa
Bedrock	Rockhead level varies (see Figure 7) Uniaxial compressive strength (UCS) = 25MPa RQD = 75 – 100% Good to Excellent Sub-vertical discontinuities Modulus of Deformation $E_m = 6x10^6$ kN/m²
Groundwater	Assumed to be at ground level

6.10.4 Ch. 0+940m River Bridge - Northern Abutment

- Proposed Structures / Earthworks

  This section of the proposed route will be on a bridge structure with a 73m span across the river. The bridge will land on the northern bank and an embankment in the region of 2m to 3m high will be required to tie the bridge into the existing alignment. Provision of a cattle pass under the viaduct in front of the abutment is currently proposed.

The foundations for the bridge will be piled. Wing walls are likely to be required to contain the embankment fill. A slope stability analysis may be required depending on the final position of the abutment. Also temporary stability will need to be considered for the construction of the foundations.

- Summary Ground Conditions

  The ground conditions over this length of the proposed route comprise topsoil overlying made ground, which in turn overlies glacial sand and gravels over bedrock.

  The made ground is around 5m thick in this area, but will vary depending on the position of the abutment; see Figure 7. The glacial sands and gravels are in the region of 4m thick. Bedrock was encountered at 8.80m depth and a 0.40m thick weathered zone was present.

- Recommended Characteristic Parameters

Formation	Characteristic Parameters
Made Ground	<u>Existing ground level to 11.0mAOD</u> Moist bulk unit weight (γ_m) = 17 to 21 kN/m² Drained Young's Modulus (E'd) = 6000kN/m² $\varphi'_{cv:k}$ = 30º $\varphi'_{pk:k}$ = 35º cohesion c' = 0kPa
Glacial Sand and Gravel	<u>11.0mAOD to 7mAOD</u> Moist bulk unit weight (γ_m) = 18.5kN/m² Drained Young's Modulus E'_d = 22,500 + 2750h where h is depth below the top of the strata $\varphi'_{cv:k}$ = 36º $\varphi'_{pk:k}$ = 39º cohesion c' = 0kPa
Bedrock	<u>Below 7mAOD</u> Moist bulk unit weight (γ_m) = 24kN/m² Uniaxial compressive strength (UCS) = 25MPa RQD = 75 – 100% Good to Excellent Sub-vertical discontinuities Modulus of Deformation $E_m = 6x10^6$ kN/m²
Groundwater	Ground water level at 8.5mAOD

Formation	Characteristic Parameters
Other Issues	Negative skin friction will need to be considered for the foundations of the northern abutment.

6.10.5 Side Road Cutting

- Proposed Structures/ Earthworks

  At the northern end of the proposed route, a cutting will be required in order to allow the existing road to be connected into the new alignment at the north western end of the scheme.

- Summary Ground Conditions

  The ground conditions over this length of the proposed route comprise head deposits overlying bedrock. The bedrock has a weathered zone which was generally less than 1.0m thick.

- Recommended Characteristic Parameters

Formation	Characteristic Parameters
Head Deposits	Steeply sloping sidelong ground so existing ground levels vary. Deposits typically around 1.20m thick. Moist bulk unit weight (γ_m) = 18kN/m² $\varphi'_{cv:k}$ = 36° $\varphi'_{pk:k}$ = 36° cohesion c' = 0kPa
Weathered bedrock	0.30m to 1.00m thick The weathered bedrock was recovered as slightly silty sand and gravel, so it considered that it will behave in a similar manner as the head deposits. Hence for preliminary design, the following parameters may be used. However further investigation is recommended at detailed design stage to confirm characteristic parameters for design. Unit weight (γ) = 18kN/m² $\varphi'_{cv:k}$ = 36° $\varphi'_{pk:k}$ = 36° cohesion c' = 0kPa
Bedrock	Moist bulk unit weight (γ_m) = 24kN/m² Uniaxial compressive strength (UCS) = 25MPa RQD = 75 – 100% Good to Excellent Sub-vertical discontinuities Modulus of Deformation $E_m = 6x10^6$ kN/m²
Groundwater	No groundwater encountered during the ground investigation. The full depth of the cutting is anticipated to be dry throughout much of the year, but further investigation is recommended at detailed design stage to confirm a groundwater level for design.

7 Geotechnical Risk Register

The following list of geotechnical, geo-environmental, historical and other factors have been identified as being likely to influence the project:

- Soft silty alluvium on the floodplain with the potential to cause excessive settlements.
- Lateral variability of the ground conditions due to the possible presence of palaeochannels, with the potential to cause differential settlements.
- Variable depths from surface to bedrock, which will determine the choice of technique for the construction of the pier foundations.
- Proximity to the National Cycle Network Route No. 8 and Welsh Millennium Bridge.
- Steep slopes and unusual alluvial fan and head deposits on north bank.
- Water table anticipated to be shallow and in certain places at or near ground level for at least part of the year.
- Outfall arrangements for highway drainage at the southern extremity.

The Geotechnical Risk Register is presented in Appendix B and has been developed from the one provided in the PSSR. In the register, risks of the primary hazards are assessed, the consequences of these risks to the project are determined, and details of how to manage the risks are given.

The Geotechnical Risk Register is a living document and will be updated as the scheme is progressed.

8 References

[1] Report No. 900237-ARP-ZZ-ZZ-RP-CG-00003, A487 New Dyfi Bridge, Preliminary Sources Study, DRAFT 1, 13 October 2015.

[2] A487 Fishguard to Bangor Trunk Road, Pont ar Ddyfi Improvement, Archaeological Watching Brief, CPAT Report No. 1387, December 2015.

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Figures

Figure 1 - Site Location

Figure 2 - Proposed Scheme

Figure 3 - (A to E) Site History from 1888 to 1995

Figure 4 - Site Features Plan

Figure 5 - Historical Borehole Locations

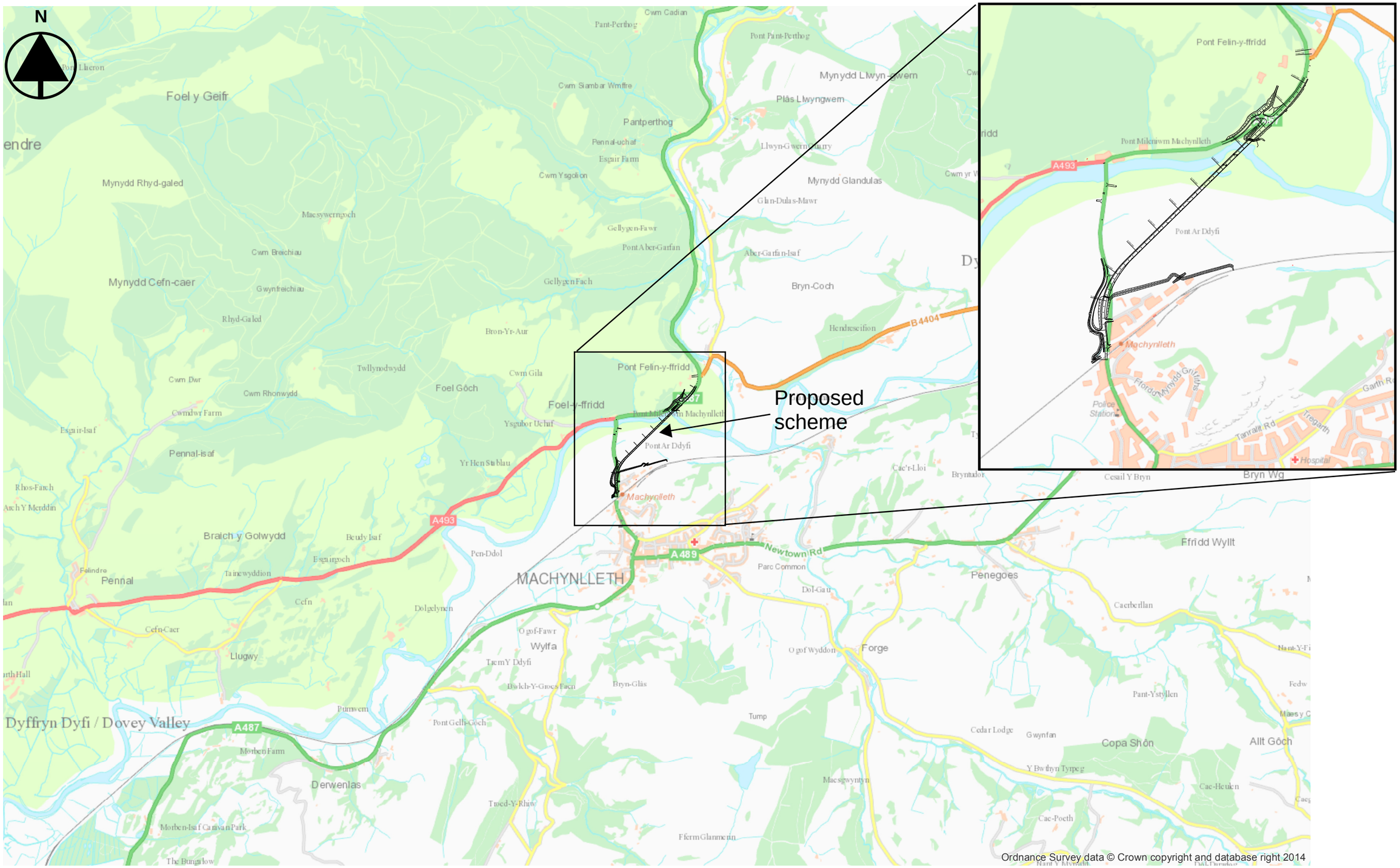
Figure 6 - Exploratory Hole Locations

Figure 7 - Geological Long Section

Figure 8 - Particle Size Distribution Tests

Figure 9 - Alluvial Deposits - Atterberg Limit Test Results v. Elevation

Figure 10 - Glacial Sands and Gravels - SPT 'N' Value v. Elevation



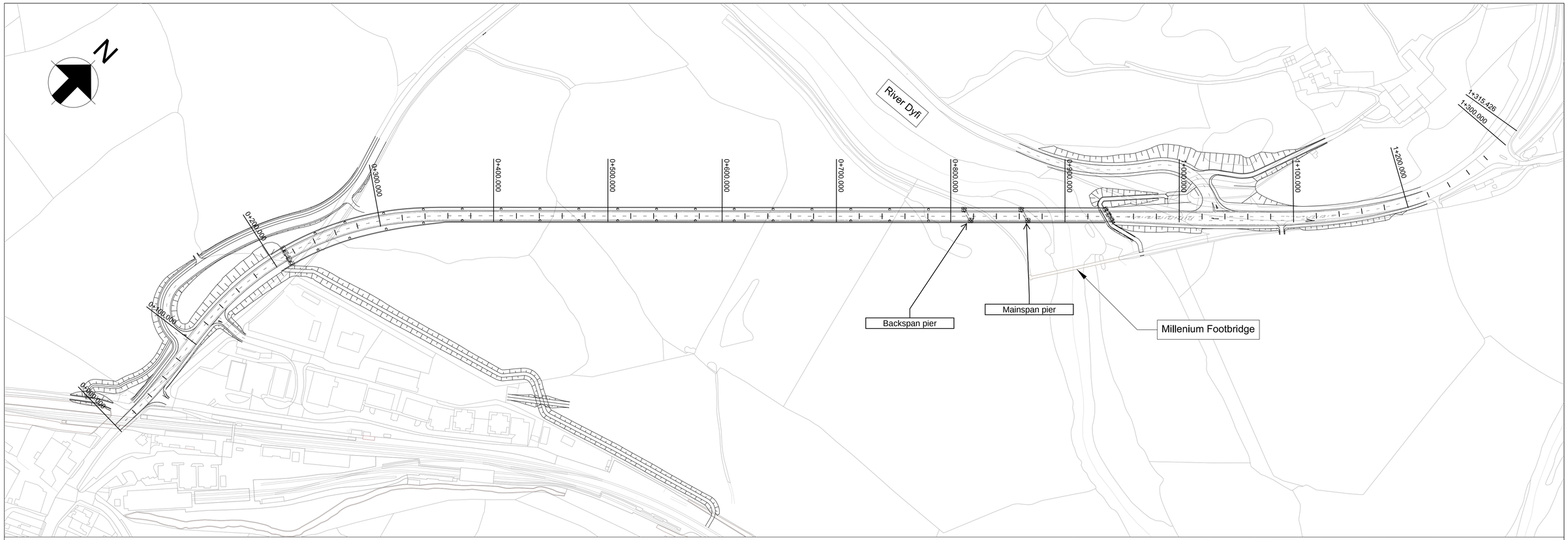
Ordnance Survey data © Crown copyright and database right 2014

The scheme is centred approximately at National Grid Reference 274600, 301700

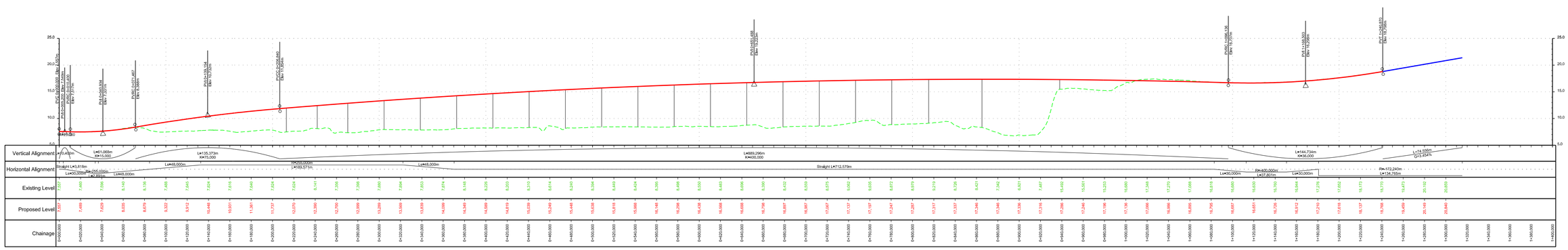
Site Location

244562

FIGURE **01**



The scheme is centered approximately at National Grid Reference 274600, 301700



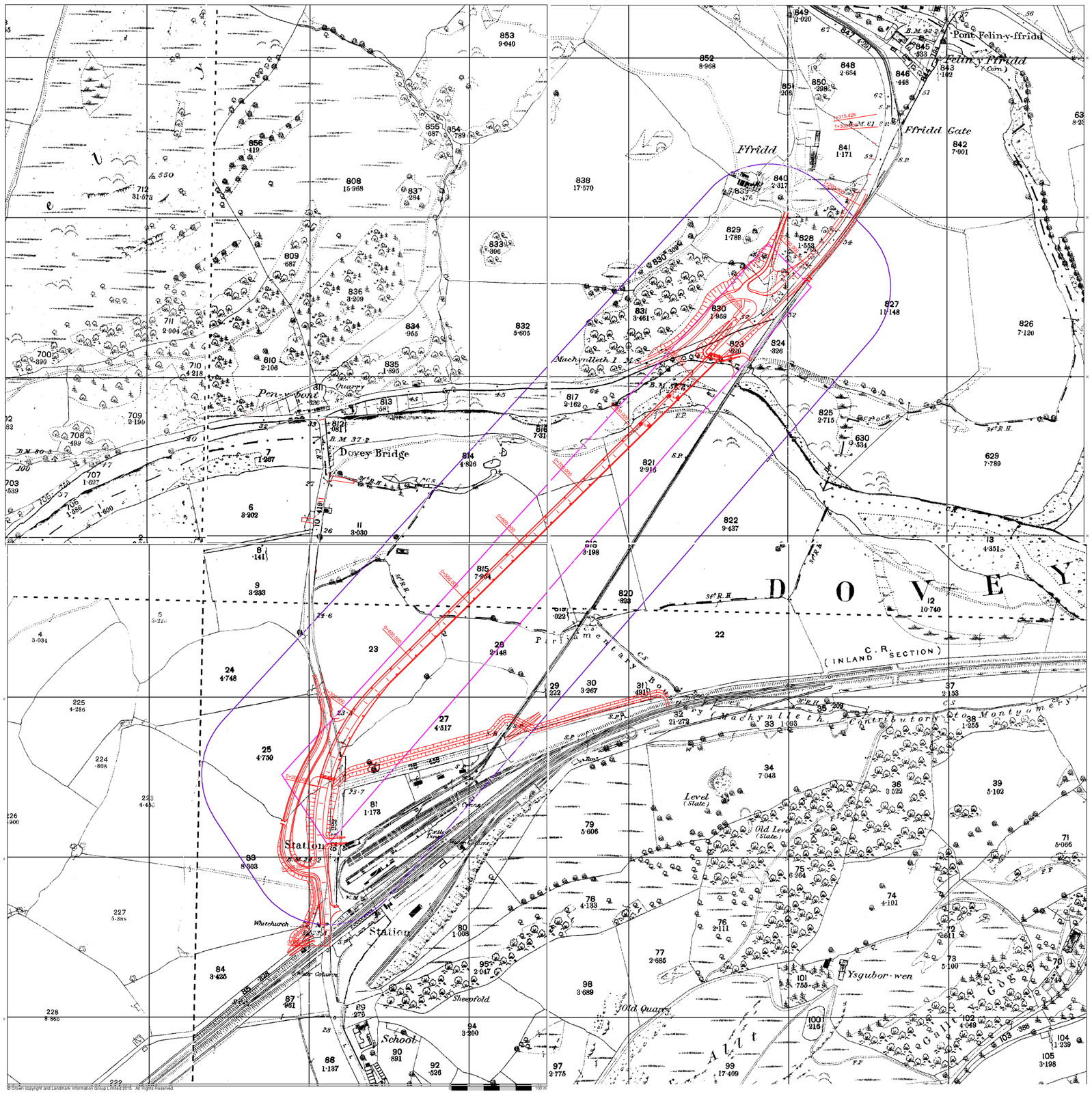
Profile Legend

- Existing Ground Level
- Proposed Ground Level

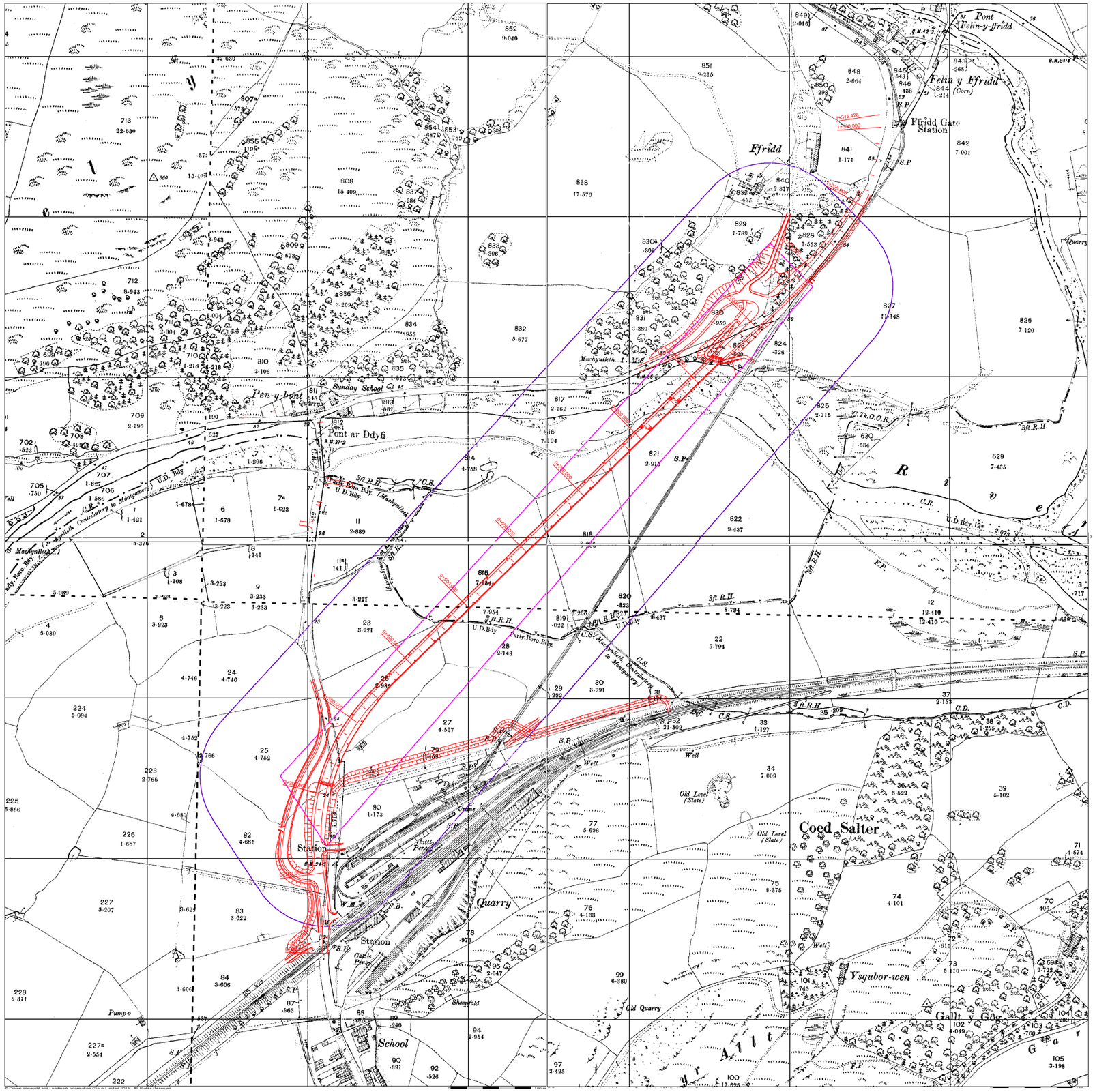
Proposed Scheme

FIGURE 02

The scheme is centred approximately at National Grid Reference 274600, 301700


Pont Felin-y-ffridd
Felin-y-Ffridd
Ffridd
Ffridd Gate
Machynlleth
Pen-y-bont
Quarry
Dovey Bridge
D O V E Y
Parliamentary Boundary
C.R. (INLAND SECTION)
Contributory to Montgomery
Level (State)
Old Level (State)
Station
Whitchurch
Sheeofold
Old Quarry
School
Ysgubor-wen
Gaucyngroes
Aut
Machynlleth 1 M.S.
B.M. 37·2
B.M. 40·3
B.M. 44·2
3rd R.H.
F.P.
S.P.
T.P.
Sch.
Cor.
Chy.
Sta.
Quy.
Ho.
Cott.
Wks.
Ch.
Ry.
Tel.
Cemy.
Pol.
Ind. Est.
Sub Sta.
Tk.
Fm.
Gdns.
Pk.
Rec.
Ct.
Cl.
Rd.
Ave.
Dr.
Ln.
Pl.
Sq.
Cres.
Gro.
Hse.
Bldgs.
Mkt.
Mus.
Lib.
Hosp.
Coll.
Univ.
Sch.
Ind.
Est.
Sub

The scheme is centred approximately at National Grid Reference 274600, 301700



N

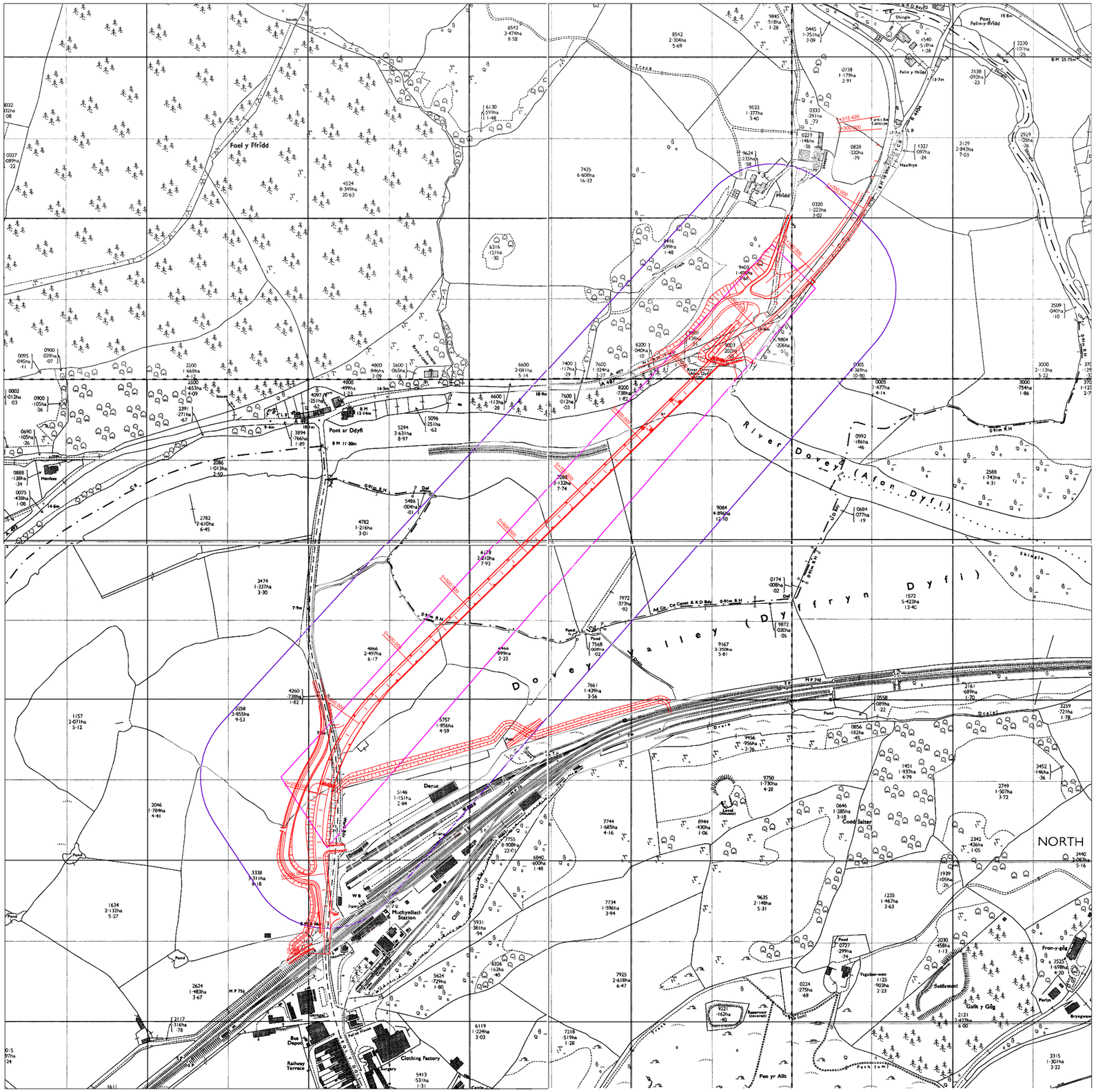
For full details of these extracts from historic OS plans, refer to the original master copies contained within the Landmark Envirocheck Report for the scheme.

Site History - 1901
(not to scale)

244562

FIGURE 3B

The scheme is centred approximately at National Grid Reference 274600, 301700



N

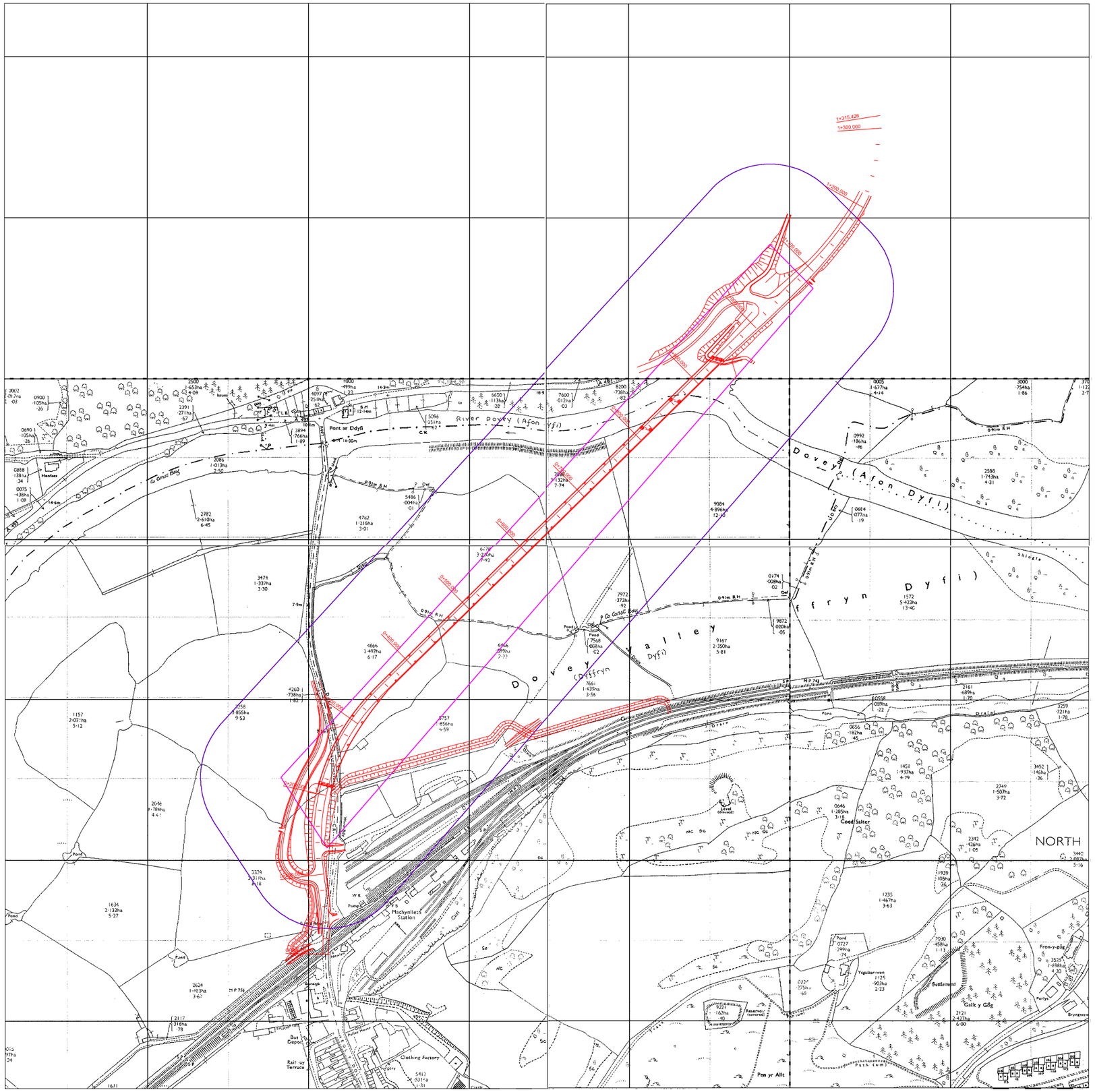
For full details of these extracts from historic OS plans, refer to the original master copies contained within the Landmark Envirocheck Report for the scheme.

Site History - 1974/75
(not to scale)

244562

FIGURE 3C

The scheme is centred approximately at National Grid Reference 274600, 301700



N

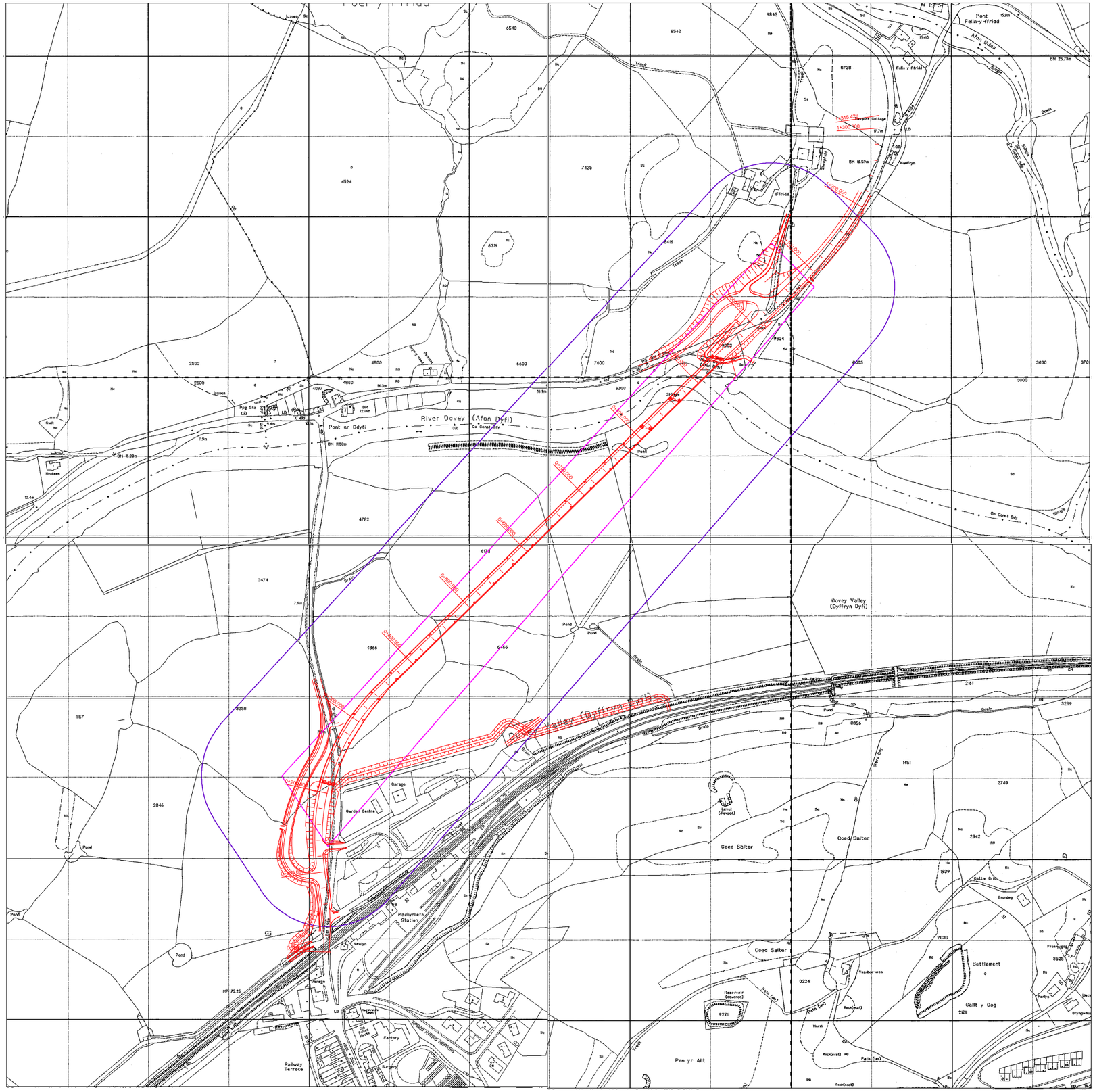
For full details of these extracts from historic OS plans, refer to the original master copies contained within the Landmark Envirocheck Report for the scheme.

Site History - 1987
(not to scale)

244562

FIGURE 3D

The scheme is centred approximately at National Grid Reference 274600, 301700



N

For full details of these extracts from historic OS plans, refer to the original master copies contained within the Landmark Envirocheck Report for the scheme.

Site History - 1995 (not to scale)

244562

FIGURE 3E

N

River Dyfi

Depression within alignment of potential historical course of river (1952). Interpreted palaeochannels

Area at lower elevation than surroundings indicating potential river floodplain (since 1953)

Retaining structure supporting A487

Masonary facing

SHFI silty clay over river terrace deposits

Approximate extents of previous lay by (1971)

Depression visible indicating possible watercourse link between pond and river (1963). Interpreted palaeochannels

Drain (open ditch)

Marshy Area

Culvert

Gas main crossing the road

Marshy Field

Marshy Area

Pond

Pond

Possible historical extents of pond (1946)

Possible Spring

Marshy Ground. Interpreted palaeochannels

Possible historical course of river and/or limits of floodplain (1946). Interpreted palaeochannels

Gravel

Bank Instability

Public Footpath

Impeded Drainage

Millenium Footbridge

Machynlleth Station

0+200.000
0+300.000
0+400.000
0+500.000
0+600.000
0+700.000
0+800.000
0+900.000
1+000.000
1+100.000
1+200.000
1+315.426
1+300.000

P01 P02 P03 P04 P05 P06 P07 P08 P09 P10 P11 P12 P13 P14 P15 P16 P17

Legend

- Ponds & Watercourses
- Marshy Ground
- Possible Made Ground
- P01 → Photograph (arrow shows direction of photograph)
- Rock Exposure
- Overhead Cables

The scheme is centered approximately at National Grid Reference 274600, 301700

Site Features

FIGURE 04

N

River Dyfi

TP4
BH2
BH1
TP5
TP3
TP7
TP9
TP10
BH9
BH8
BH7
BH5
BH3
BH4
TP8
BH6
BH12
BH10
BH13
BH19
BH18
TP16
BH16
BH17
BH2
BH7
BH4
BH3
BH6
BH5
BH1
TP17
TP18
BH21
BH22
BH20
TP15
TP13
TP14
BH14
TP2
TP6
TP12
BH15
TP1

0+300.000
0+400.000
0+500.000
0+600.000
0+700.000
0+800.000
0+900.000
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0+000.000
1+315.426
1+300.000

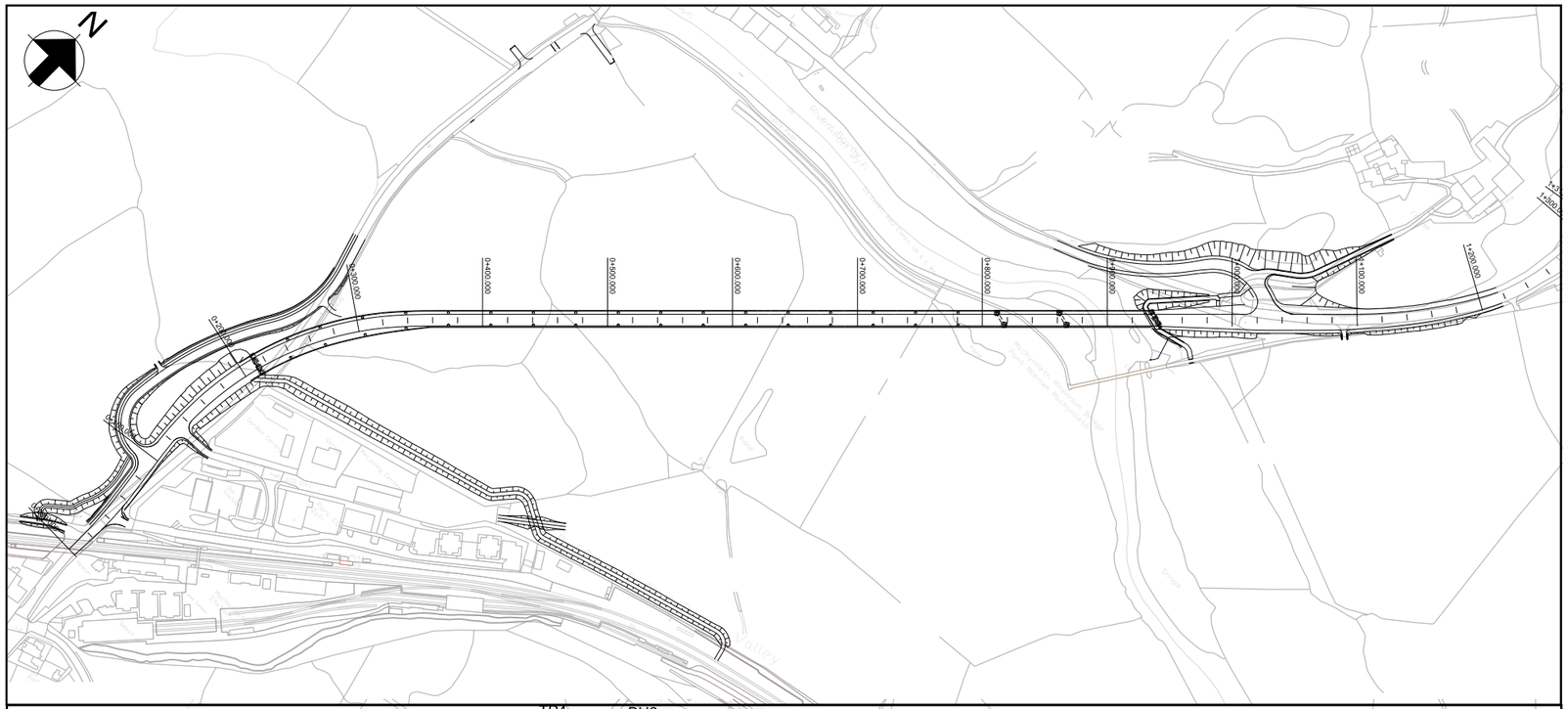
Legend

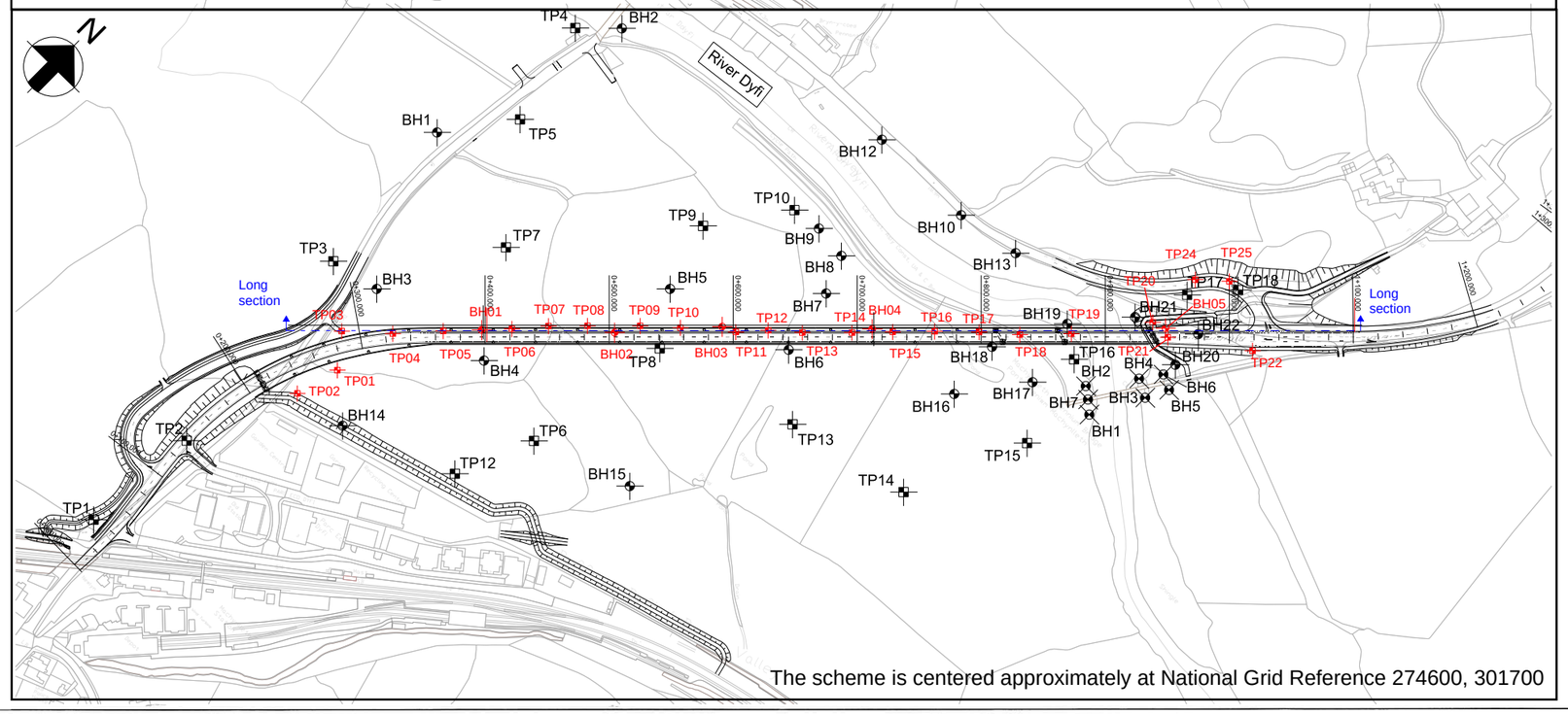
- TP1 - Trial Pits CJ Associates (2001)
- BH1 - Boreholes CJ Associates (2001)
- BH1 - Boreholes CJ Associates (1999) (Determined from plan overlay)

The scheme is centered approximately at National Grid Reference 274600, 301700

Historical Borehole Locations

FIGURE 05





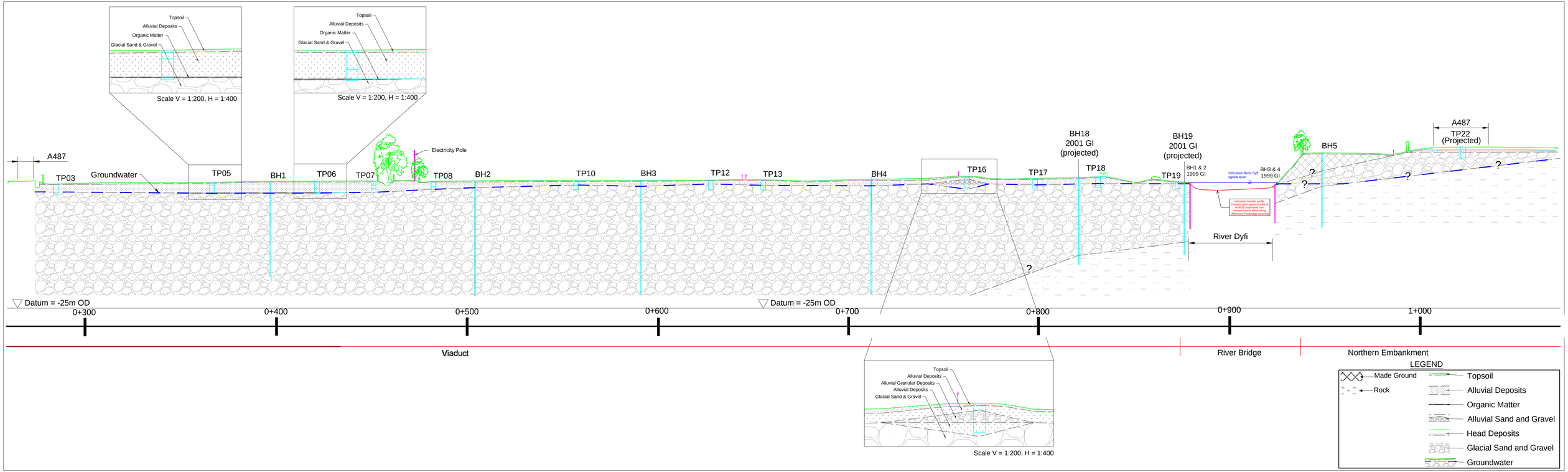
Legend

- TP1 - Trial Pits CJ Associates (2001)
- BH1 - Boreholes CJ Associates (2001)
- BH1 - Boreholes CJ Associates (1999)
- TP1 - Trial Pits CC Geotechnical (2015-2016) - Key Stage 3
- BH1 - Boreholes CC Geotechnical (2015-2016) - Key Stage 3

Figure Title

EXPLORATORY HOLE LOCATIONS

FIGURE 06

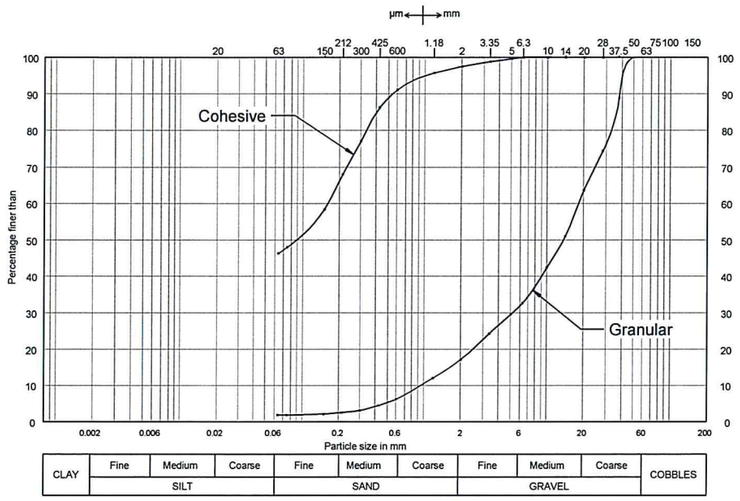


SCALE V = 1:500, H = 1:1000 @ A3

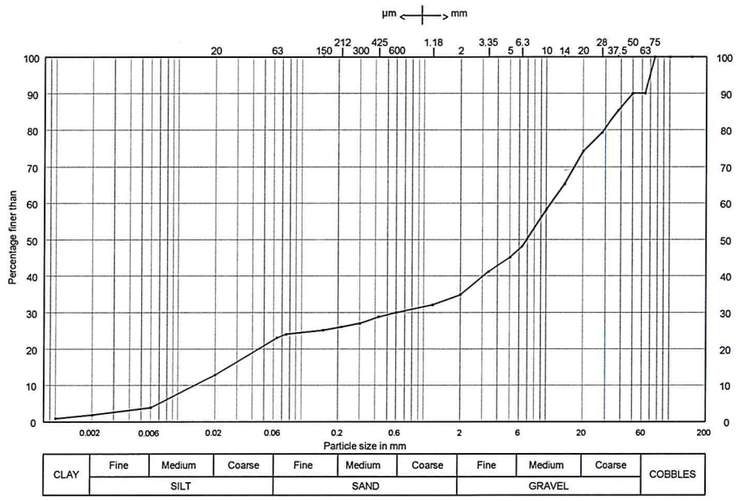
Figure Title

GEOLOGICAL LONG SECTION

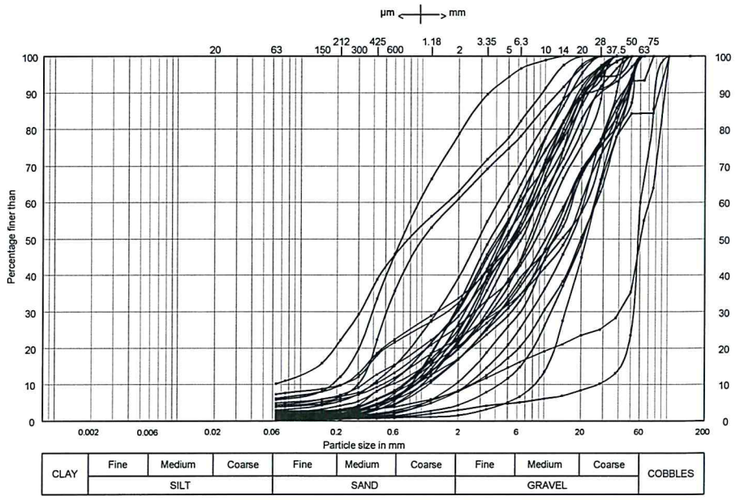
FIGURE 07



Alluvial Deposits (Granular)



Head Deposits

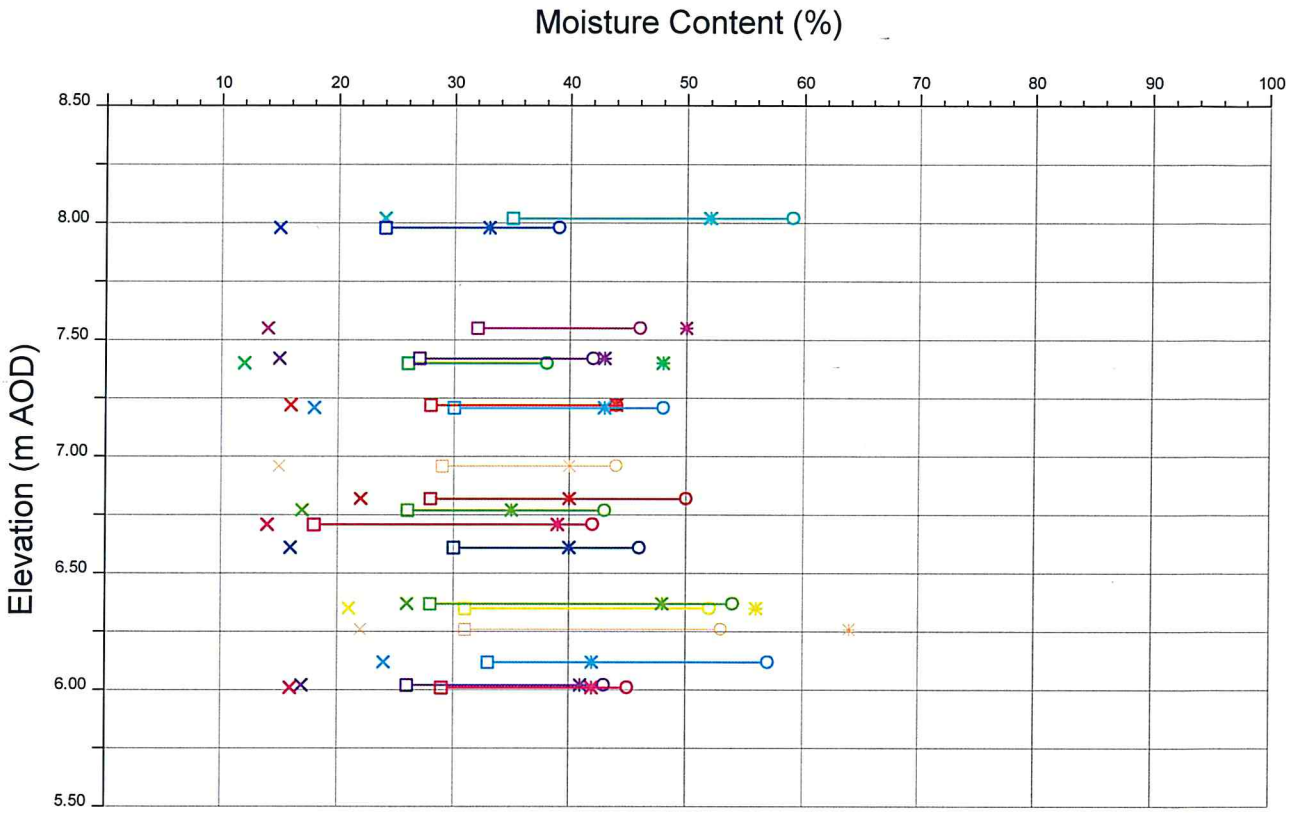


Glacial Sand & Gravel

Figure Title

PARTICLE SIZE DISTRIBUTION TEST RESULTS

FIGURE 08



LEGEND

- BH 1
- BH 2
- BH 3
- BH 4
- TP01
- TP02
- TP03
- TP04
- TP05
- TP06
- TP07
- TP13
- TP16

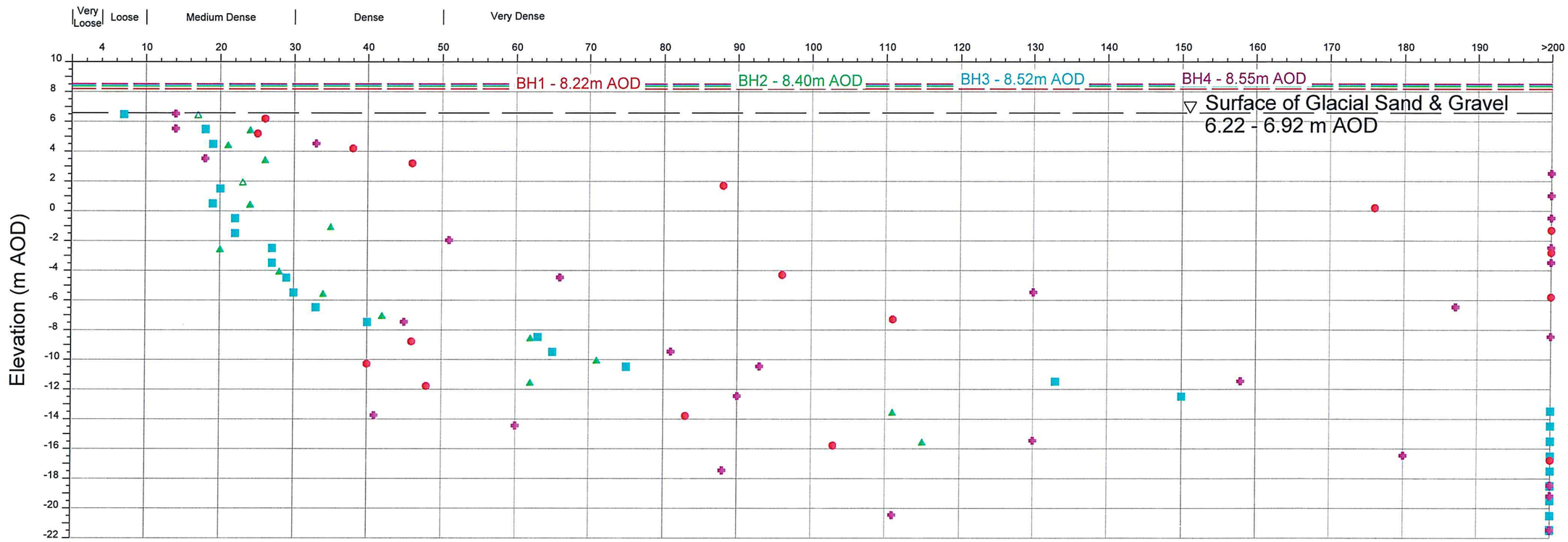
× Plasticity Index
□ Plastic Limit
○ Liquid Limit
✳ Natural Moisture Content

Figure Title

ALLUVIAL DEPOSITS
ATTERBERG LIMIT TEST
RESULTS v. ELEVATION

FIGURE 09

SPT 'N' Value



Note: All SPT 'N' values are uncorrected

LEGEND

- BH 1
- BH 2
- BH 3
- BH 4

Figure Title
GLACIAL SANDS & GRAVELS
SPT 'N' VALUE v.ELEVATION

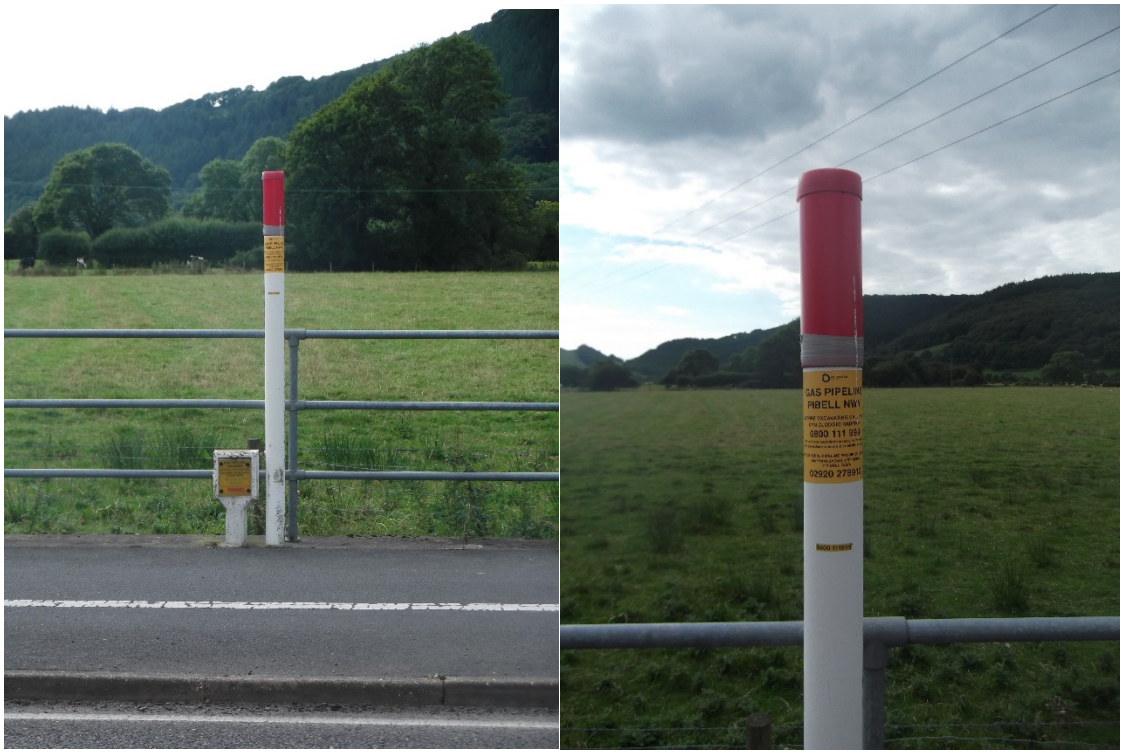
FIGURE 10

Appendix A

Site walkover survey photographs



Photograph 1 – Culvert passing under A487 at Ch. 0+250m



Photograph 2 – High pressure gas mains crossing the road.



Photograph 3 – Overhead power lines crossing A487



Photograph 4 – Ch. 0+420m looking north along the proposed alignment



Photograph 5 – Marshy ground at Ch. 0+290m, also showing overhead cables



Photograph 6 – Marshy field at Ch. 0+450m to Ch. 0+480m.



Photograph 7 – Marshy area between Ch. 0+765 to Ch. 0+795m, possible spring present.



Photograph 8 – Pond east of Ch. 0+620m



Photograph 9 – Uneven ground on the western side of the footpath at Ch. 0+830m to Ch. 0+830m



Photograph 10 – Gravel bank associated with River Dyfi



Photograph 11 – Exposure in the riverbank downstream of the alignment



Photograph 12 – Historic river edge protection works



Photograph 13 – Showing instability upstream of the Millennium Footbridge



Photograph 14 – Rock outcropping on the opposite bank at about Ch. 0+790m



Photograph 15 – Retaining structure supporting the existing A487



Photograph 16 – From Ch. 1+000m looking along the alignment towards Ch. 0+940m



Photograph 17 – Ch. 1+010m where the proposed alignment rejoins the existing A487



Photograph 18 – Vertical discontinuities in the rock cutting at around Ch. 1+100m



Photograph 19 – Showing repairs to existing Dyfi Bridge

Appendix B

Geotechnical Risk Register

HD22 Managing Geotechnical Risk: Geotechnical Risk Register for A487 New Dyfi Bridge – Rev C

Probability (P)	
1 in 10	5
1 in 100	4
1 in 1000	3
1 in 10000	2
1 in 100000	1

Impact (I)		Time	Cost
Very High	5	>10 weeks on completion	>20%
High	4	> 1 week on completion	5-20%
Medium	3	>4 weeks: < 1 week on completion	2-5%
Low	2	1-4 weeks: none on completion	0.5-2%
Very Low	1	< 1 week to activity: none on completion	<0.5%

Risk rating (R) = Probability (P) x Impact (I)

		I	I	I	I	I
		5	4	3	2	1
P	5	25	20	15	10	5
P	4	20	16	12	8	4
P	3	15	12	9	6	3
P	2	10	8	6	4	2
P	1	5	4	3	2	1

Risk ratings	
1 to 4	***Trivial***, but no action required
5 to 8	***Tolerable***, but must consider solutions or improvements
9 to 12	***Substantial*** and work must not start until risk has been reduced
13+	***Intolerable*** and work must not start until risk has been reduced

Geotechnical Risk Assessment

Item	Risk	Hazard	Construction Stage			Consequences	Mitigation	Following Mitigation Stage		
			Probability	Impact	Risk Rating			Probability	Impact	Risk Rating
1.	**Flooding**	High rainfall and rainstorms	5	3	15	Programme delay Cost impact	Proposed design for the majority of viaduct piers comprises a monopile for each pier column, hence, removing the need for construction of a pile cap in the flood plain. Installation of the viaduct deck will be through thrust launching from the southern embankment, rather than craning from the flood plain. Due consideration given to the prevailing ground and weather conditions when scheduling site works. Monitoring of rainfall and weather forecasts. Contingency plans for wet weather working.	5	2	10
2.	**Landslide of north bank due to construction works**	Concentrated loads placed at top of slope or on marginally stable ground	5	5	25	Rapid ground movements H&S risk to site workers Additional construction work Cost impact	Preliminary ground investigation has revealed around 5.0m of poorly compacted made ground on the northern bank. Consider location of north abutment to minimise effect on the stability of the slope. Consider of construction loading of slopes during detailed design. Possible replacement of made ground with suitable construction material. Adequate temporary works will be required. Potential to restrict construction works so that loading of slopes is limited during the construction works. Possible slope inspections / monitoring during the construction works.	4	2	8

Item	Risk	Hazard	Construction Stage			Consequences	Mitigation	Following Mitigation Stage		
			Probability	Impact	Risk Rating			Probability	Impact	Risk Rating
3.	**Landslide of north bank due to loss of toe support to slope**	Removal of toe support to slopes Erosion of toe of slope	3	3	9	Slow ground movements H&S risk to road users Future performance Potential for additional future maintenance	Ground investigation has revealed that around 5m of made ground is present. Position and structural form of the north abutment to accommodate potential groundloss if no slope stabilisation measures are incorporated. Slope stabilisation measures or replacement of the potentially unnstable made ground, if required. Suitable temporary surface water management and drainage measures.	3	2	6
4.	**Long term instability of north bank**	Steep slopes	3	4	12	Instability H&S risk to site workers Future performance Potential for additional future maintenance	Ground investigation will be carried out at the pre-construction stage, prior to detailed design. Due consideration of stability as part of detailed design. Suitable long term drainage and slope stability measures to be adopted as part of the design, if necessary.	2	4	8
5.	**Slope instability of side road, north of river bridge**	Steep slope	3	4	12	Damage to slopes and carriageway H&S risk to road users Reputational damage for scheme	Ground investigation will be carried out at the pre-construction stage, prior to detailed design. Geological mapping, in particular, mapping of bedding and fracture plane orientations in rock to enable Suitable assessment of stability of rock masses in slope faces, as part of slope stability design.	2	4	8
6.	**Differential settlements**	Palaeochannels beneath floodplain	3	2	6	Localised instability Future performance Potential for additional future maintenance	Detailed geotechnical desk study completed, with review of geological records, historic plans, historic aerial photographs and geotechnical site walkover to identify potential features. Key Stage 3 investigation has not revealed any different ground conditions across the floodplain. Detailed ground investigation of each pier location will be carried out at the pre-construction stage, prior to detailed design. Detailed design to allow for potential differential settlements. A programme of geotechnical inspections of formations for embankments to be considered during excavation works.	2	1	2
7.	**Differential settlements**	Pockets of soft wet ground	4	2	8	Localised defects in the carriageway Future performance Potential for additional future maintenance	Due consideration given to the prevailing ground and weather conditions when scheduling site works. Key Stage 3 Ground Investigation has not revealed any soft / wet areas below 3m depth except in the area of the pond near TP16. Detailed ground investigation of each pier location will be carried out at the pre-construction stage, prior to detailed design. Detailed design to allow for potential differential settlements. A programme of geotechnical inspections of formations for embankments to be considered during excavation works.	3	2	6

Item	Risk	Hazard	Construction Stage			Consequences	Mitigation	Following Mitigation Stage		
			Probability	Impact	Risk Rating			Probability	Impact	Risk Rating
8.	**Large settlements of southern tie-in and main road embankments**	Poor ground conditions	5	2	10	Excessive settlement Differential settlement at interface between embankment and viaduct Additional construction work to remediate issues Cost impact Programme impact Future performance Potential for additional future maintenance	Detailed geotechnical desk study completed, with review of geological records, historic plans, historic aerial photographs and geotechnical site walkover to identify potential features. Key Stage 3 ground investigation has been undertaken and further detailed ground investigation will be carried out at Key Stage 6, prior to detailed design. Key Stage 3 ground investigation has revealed soft material to a depth of 2.75m beneath the embankment footprint. This can be accommodated using conventional geotechnical solutions. Develop appropriate design, options include: allow programme allowance for settlement; accelerate settlements through surcharge and/or vertical band drains; dig and replace soft ground; mass ground improvement; stone columns; piled rafts. Consideration of settlement monitoring during the works, as verification of the design, with appropriate contingency measures should displacements differ from anticipated values. Programme construction of embankment, temporary works and completion of drainage and pavement, to account for anticipated settlements.	3	1	3
9.	**Large settlements of viaduct foundations**	Unanticipated / variable ground conditions, for example, due to historic infilled watercourses	3	4	12	Excessive differential settlement between pier positions Future performance Potential for additional future maintenance	Detailed geotechnical desk study. Key Stage 3 ground investigation has been completed which has not revealed any unusual ground conditions. Further ground investigation will be undertaken at each pier position to confirm specific ground positions at each pier location during the Key Stage 6 investigation. Range of possible ground conditions to be considered in detailed design.	1	2	2
10.	**Stability failure of embankment**	Construction loading and poor ground conditions	3	3	9	Bearing capacity failure of embankment Additional construction work to remediate issues Cost impact Programme impact	Refer to Point 8 of this Risk Register. Due consideration of stability as part of detailed design. Excavation of shallow soft soil beneath embankment, or design of ground improvement/support measures. Consider requirement for formation inspections prior to construction of embankment to verify stability design assumptions.	1	3	3

Item	Risk	Hazard	Construction Stage			Consequences	Mitigation	Following Mitigation Stage		
			Probability	Impact	Risk Rating			Probability	Impact	Risk Rating
11.	**Delays due to unexpected ground conditions**	Ground conditions differ from those indicated in the project ground investigations	4	3	12	Construction delayed Revisions to design required	Detailed site investigations will be carried out at Key Stage 3 and Key Stage 6 (prior to detailed design), at the pier and embankment formation locations. Potential variations in conditions to be considered as part of detailed design. Consider requirement for geotechnical inspections to verify ground conditions during the construction phase. Programme and cost contingencies.	3	3	9
12.	**Siltation of watercourses due to surface water runoff during construction**	Site clearance operations	4	3	12	Impacts on ecology Potential for action by regulators Delays to programme Damage to reputation of delivery team	Design allows for thrust launching from the southern embankment to minimise construction works, and vehicle tracking across the flood plain. For the majority of pier columns, a mono-pile is proposed, to avoid the need to construct pile caps in the flood plain. Appropriate drainage measures and phasing of site clearance to be adopted during the construction phase.	1	3	3
13.	**Buried obstructions impact on foundation construction**	Historic buildings, rail lines, bridge foundations, backfilled drainage channels and ponds	3	2	6	Changes to construction method Delays to construction	Review of site history form historic plans, geological plans, historic aerial photographs, site walkover and ground investigation works.	2	2	4
14.	**Biohazard – impact on site workers and third parties**	Potential historic animal burial pits in local farmland, and risk of anthrax, foot and mouth etc	2	5	10	Health of site workers and third parties	Review of site history form historic plans, geological plans, historic aerial photographs, site walkover and ground investigation works Inform risk to site workers. Adopt an appropriate watching brief during construction.	1	5	5
15.	**Unidentified contamination – impact on site workers and third parties**	Potential for areas of made ground of unknown origin – in particular at the north abutment to the river span and near the industrial estate in the south	4	2	8	Health of site workers and third parties Potential impact on ecology and watercourses	Review of site history form historic plans, geological plans, historic aerial photographs, site walkover and ground investigation works. Inform risk to site workers. Adopt an appropriate watching brief during construction.	3	2	6
16.	**High groundwater ingress into pile bores and difficult construction**	High groundwater level in valley floor in combination with potentially high permeability ground conditions	4	4	16	Delays to construction Washout of concrete during pile construction Unstable pile bores	Key Stage 3 ground investigation has revealed high groundwater levels. Rising head tests attempted but not able to lower groundwater level. Furtehr testing to be attempted. Further testing and monitoring during Key Stage 6 ground investigation. Adopt appropriate piling techniques that can accommodate the identified conditions. Concrete mix to be considered carefully.	3	4	12
17.	**Delays due to archaeological features encountered during construction**	Ffrydd Round Barrows – scheduled ancient monuments archaeological interest are present to the east of the proposed northern abutment to	3	5	15	Delays to construction	Desk study review of archaeological features ahead of site work. Archaeological trial pitting to be considered ahead of the construction phase.	2	5	10

Item	Risk	Hazard	Construction Stage			Consequences	Mitigation	Following Mitigation Stage		
			Probability	Impact	Risk Rating			Probability	Impact	Risk Rating
		the river crossing. The site is believed to lie within an area where a battle took place during the English Civil War (1644).					A watching brief to considered for the main works to help spot potential features at the earliest opportunity.			

Notes: 1. A ‘Hazard’ is a condition or physical situation with a potential for an undesirable event.
2. A ‘Risk’ is an uncertain event or set of circumstances that should it occur would have an effect on achieving the project objectives.
3. Mitigation Measures include:

- Avoid the risk – by eliminating the uncertainty or using an alternative approach.
- Transfer the risk – by transferring the liability of the risk to another party.
- Mitigate the risk – by reducing the risk to an acceptable level by making it less likely that the risk event will occur.
- Accept and manage the risk – by assuming the risk as reasonable given the cost or effect on time or quality and even life.

Llywodraeth Cymru
Welsh Government

Welsh Government

A487 New Dyfi Bridge

Preliminary Ground Investigation Report – Volume 2

900237-ARP-ZZ-ZZ-RP-CG-00003

Issue | 11 July 2016





This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 244562

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Volume 2 - Factual Information

Appendix C
Intrusive Ground Investigation on Land Adjacent A487 Dyfi Bridge, Machynlleth, Wales, SY20, Phase 1 Works. CC Geotechnical Ltd, January 2016.

Appendix D
Site Investigation No. M5025, Factual and Interpretative Report, A487 Pont-ar-Dyfi Improvement. CJ Associates Geotechnical Ltd, November 2001.

Appendix E
Extracts from Report No K0613 – Machynlleth. CJ Associates, November 1999

Appendix C

Intrusive Ground Investigation on Land Adjacent A487 Dyfi Bridge, Machynlleth, Wales, SY20, Phase 1 Works. CC Geotechnical Ltd, January 2016.

CCG-C-15-8700

INTRUSIVE GROUND INVESTIGATION ON LAND ADJACENT A487 DYFI BRIDGE MACHYNLLETH WALES SY20

PHASE I WORKS

JANUARY 2016

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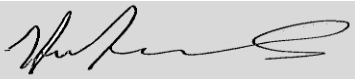
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1.0 INTRODUCTION

CC GEOTECHNICAL LIMITED (***CCG***) was instructed by ***OVE ARUP AND PARTNERS LIMITED*** / ***ALUN GRIFFITHS*** (***CONTRACTORS***) ***LIMITED*** via ***GROUNDSOLVE LIMITED*** to provide geotechnical fieldwork and laboratory testing services in connection with the construction of a new viaduct and transportation bridge spanning the River Dyfi and associated flood plain adjacent the existing A487 Dyfi Bridge (*Pont-ar-Ddyfi*) Machynlleth, Powys, Wales, SY20.

The proposed transport corridor comprises the construction of a c.850m long bridge and associated infrastructure forming a 2-lane vehicle carriageway and pedestrian paving to the east of the existing Grade II Listed bridge (Cadw Building ID: 8506).

The scope of the investigation was detailed by ***OVE ARUP AND PARTNERS LIMITED*** / ***ALUN GRIFFITHS*** (***CONTRACTORS***) ***LIMITED.*** The purpose of the site investigation was to provide geotechnical and geoenvironmental information pertaining to the ground conditions across the site, in particular collating factual data on the engineering and chemical properties of the soils. At the time of writing, the purpose of the investigation was to ascertain existing ground conditions prior to future bridge and infrastructure construction works.

A factual report was required. Hence this is the factual compilation of the data obtained in the 2015 ground investigation, and no interpretations have been placed on the findings.

The data contained in this report should be read in conjunction with the Notes on Limitations, given hereunder.

2.0 FIELDWORK

2.1 Introduction

The fieldwork for the investigation was undertaken in November 2015 - January 2016, and comprised the following works:

- The surveying of borehole / trial pit positions for Ordnance Survey (OS) coordinates and elevation (maOD)
- Sinking of 5nr boreholes using cable percussion (CP) boring rig and associated tools
- The advancement of 1nr CP using rotary coring methods
- The subsampling of borehole recovery for soil contamination and classification testing and rock strength testing
- Installation and monitoring of 3nr 50mm HDPE gas/groundwater monitoring standpipes together with associated gas valve and protective lockable cover
- The undertaking of a gas – groundwater monitoring programme comprising 3nr visits
- The mechanical excavation of 24nr trial pits using a tracked excavator
- The subsampling of trial pit arisings for soil contamination and classification testing
- The performance of a rising head permeability test in 1nr borehole

The fieldwork was carried out in accordance with the Specification for Ground Investigation published by Thomas Telford Services Ltd: 1993, BS10175: 2011, BS5930: 1999, and BS EN 1997-2: 2007 Eurocode 7, insofar as they related to the scope of the investigation.

The investigation layout is notionally as shown on ***GROUNDSOLVE LIMITED*** 'A487-New Dyfi Bridge GI Specification Phase I – Proposed SI Locations' (Draft) Drawing No.2a contained in Appendix 1.

The location of each element of the exploratory works was surveyed for Ordnance Survey positional coordinates and elevation level relative to Ordnance Datum, and resurveyed following completion of fieldworks for final positions. The coordinates and ground levels for each element of the works are tabulated in Appendix 2, and annotated on the respective borehole logs referred

to hereunder.

2.2 Cable Percussion Boreholes

5nr boreholes were sunk using light cable percussive boring methods using a Dando 150 Shell and Auger rig and associated tools to depths ranging between 9.20-30.00mbgl. Each borehole location was scanned using a CAT service detector before and during manual excavation of a 1.2m deep service clearance pit.

Boring tools were decontaminated prior to commencement, and between borehole moves.

Standard Penetration Tests (SPT) were carried out at regular intervals throughout the borehole depths. Undisturbed (U100) samples were recovered at incremental depths within cohesive strata where soil conditions allowed. Small disturbed samples were recovered from selected test locations. Bulk disturbed samples, small-disturbed jar samples and vials were recovered at regular incremental depths and changes in stratum within each borehole.

Logs of the boreholes, annotated with OS coordinates, elevation, sampling details, standpipe construction details, SPT 'N' values, and details are given in Appendix 3.

2.2 Rotary Cored Boreholes

In accordance with ***OVE ARUP AND PARTNERS LIMITED*** instructions, 1nr CP borehole (BH5) was further advanced into the underlying bedrock using rotary coring methods using a tracked Apageo rotary coring rig deploying 90mm diameter coring tools and water mist flush to a termination depth of 19.5mbgl.

The log of the borehole, annotated with recovery details, are given in Appendix 3.

2.2 Rising Head Test

A rising head test was attempted at 20mbgl in BH1 with the casing flush with the bottom of the borehole. The test was terminated after 2.5hrs due to inability to significantly draw down the water table (standing at approx. 0.5mbgl).

2.3 Trial Pit Excavations

24nr trial pit excavations were undertaken by a tracked mechanical excavator deploying a 600mm bucket to a maximum termination depth of 3.1mbgl. Each trial pit was scanned for services using a CAT service detector before and during excavation.

Materials were excavated in thin layers and all arisings placed adjacent to the excavation. The stratigraphy at each position was carefully logged and photographed, with *in-situ* undrained shear strength estimates being obtained in cohesive soils using a pocket penetrometer.

Bulk disturbed samples were recovered at appropriate depth increments and at changes of strata. Small-disturbed samples and vials were also recovered at regular depth increments and at changes of strata.

The arisings were then returned in the reverse sequence of their excavation to preserve, insofar as was practical, the original lithology.

The trial pit logs annotated with sampling details and undrained cohesion estimates are given in Appendix 4.

Trial pit photographs are provided in Appendix 5.

2.4 Monitoring installations

Standpipes comprising 50mm diameter HDPE plain and slotted well-tube sections respectively set in bentonite and pea gravel

surrounds, were installed at each borehole position with headworks at each installation comprising gas valves protected by a steel upright or flush cover set in concrete.

Details of the monitoring installations are summarised hereunder and included on borehole logs given in Appendix 3.

Table 1: Borehole Installation Details

BOREHOLE	ELEVATION maOD	DEPTH OF STANDPIPE mbgl	RESPONSE ZONE	
			FROM mbgl	TO mbgl
BH2	8.40	25.0	15.0	25.0
BH3	8.52	25.0	15.0	25.0
BH4	8.55	10.0	1.0	10.0

2.5 Monitoring Programme

A programme of standpipe monitoring comprising 3nr visits was instigated in accordance with the sampling and monitoring protocol adopted by ***CCG*** as included in Appendix 6. It must be borne in mind that that all borehole positions were not accessible for monitoring on the 27th January 2016 due to flooding.

The standpipe installations were monitored periodically for gas concentrations using an infra-red gas analyser and for standing water levels using an electronic dipmeter. The results of gas and groundwater monitoring are given in Appendix 9 along with calibration certificates for the gas monitoring equipment used.

Groundwater samples were recovered from standpipes for inclusion in the chemical analysis programme summarised in Appendix 8.

2.6 Laboratory Testing

A programme of soil engineering testing was undertaken as specified by ***OVE ARUP AND PARTNERS LIMITED***.

A tabulation of the testing programme is given in Table 3 hereunder, and the soil engineering test results are presented in Appendix 7.

Table 3: Soil Laboratory Testing

Test Method	No of Tests
Determination of Moisture Content in accordance with BS 1377: Part 2: 1990	23
Determination of Atterberg Limits in accordance with BS 1377: Part 2: 1990	19
Determination of Particle Size Distribution using wet sieving methods in accordance with BS 1377: Part 2: 1990	27
Dry Density & Moisture Content Relationship Test in accordance with BS 1377 Part 4: Clauses 3.3	2
Determination of Particle Size Distribution using wet sieving methods in accordance with BS 1377: Part 2	3
Soil pH	26
SO^4 (2:1 Water Extract)	26

A programme of rock strength testing was undertaken as specified by ***OVE ARUP AND PARTNERS LIMITED***.

A tabulation of the testing programme is given in Table 4 hereunder, and the soil engineering test results are presented in Appendix 7.

Table 4: Rock Strength Laboratory Testing

Test Method	No of Tests
Uniaxial compressive strength (USC) test in accordance with ISRM Vol 16 No 2, pp 135-140 (1979)	5
Point load test on rock in accordance with Int. J. Rock Mech. Sci. & Geomech. Abstr. Vol.22, No.2, pp. 51 - 60, 1985	10

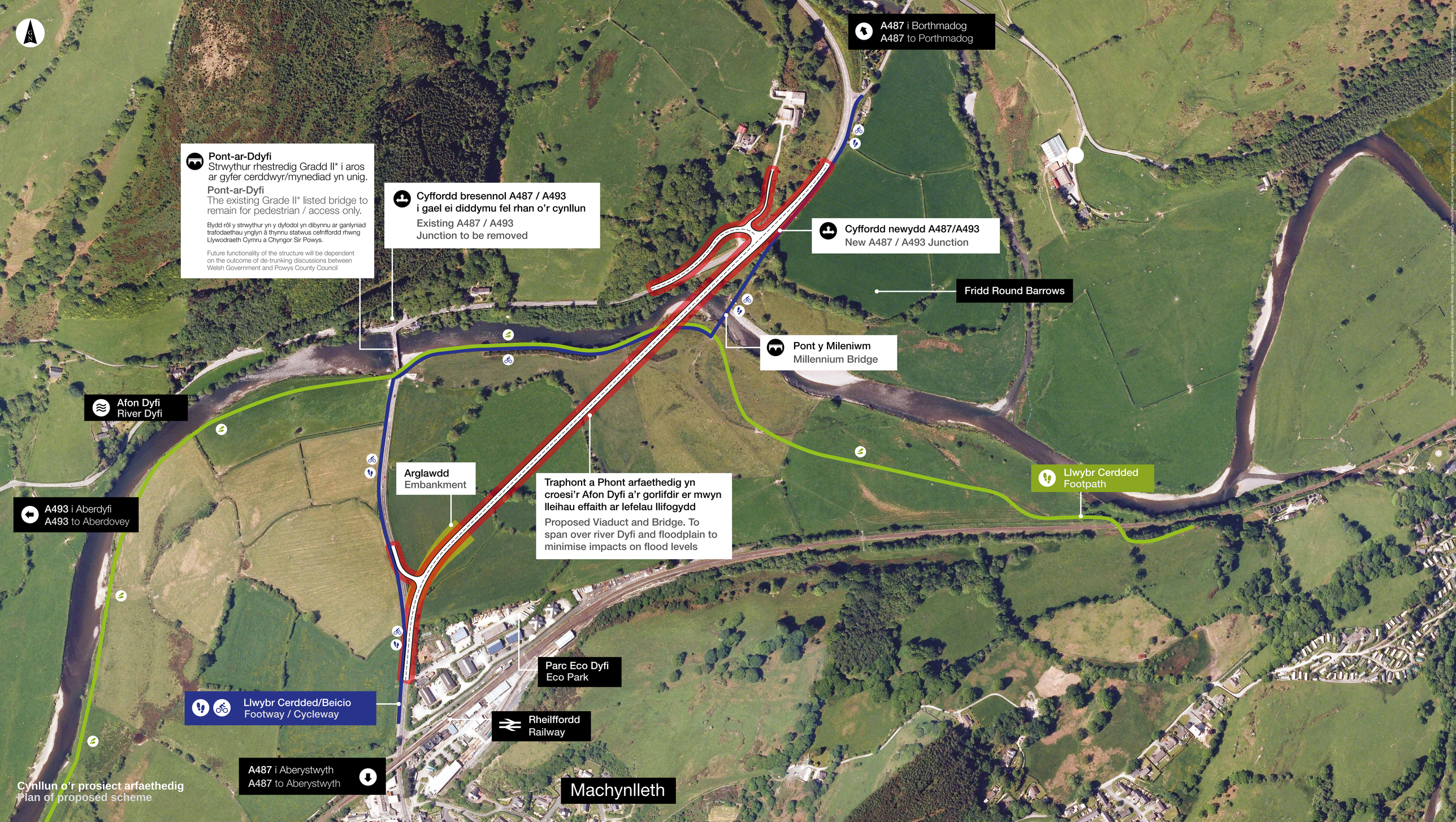
A laboratory chemical analysis programme was undertaken at a UKAS / MCERTS accredited laboratory and comprised the analysis of soil and water samples to a broad spectrum contamination suite as specified by ***OVE ARUP AND PARTNERS LIMITED***.

A tabulation of the testing programme undertaken is given hereunder in Table 5 and, the results of the soil and groundwater chemical analyses are presented in Appendix 8.

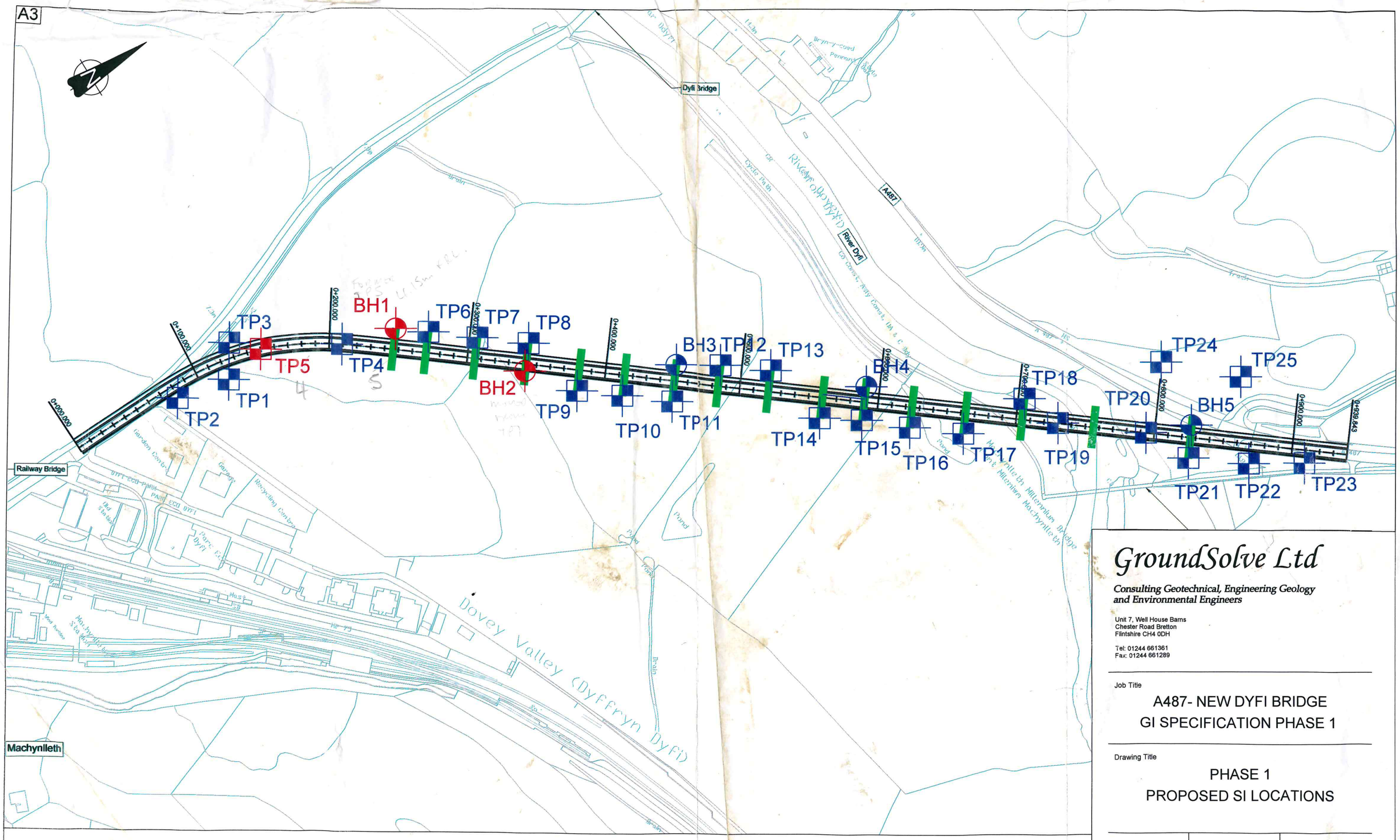
Table 5: Soil and Groundwater Contamination Testing

Test Method	No of Tests
Sulphate Content of Acid Extract	9
Sulphide Content	9
Arup Suite E1 Soil samples general	16
Arup Suite E2 Soil Samples Asbestos	4
Arup Suite E3 Soil Samples PAH and BTEX	4
Arup Suite E4 Soil Samples PAH and BTEX	14
Arup Suite E5 Soil Samples VOC and SVOC	2
Arup Suite E6 Soil Samples PCB	2
Arup Suite E7 Soil Samples Hydrocarbon Fuel Identification	12
Arup Suite F1 Water Sample General	3
Arup Suite F2 Water Sample Speciated TPH	3
Arup Suite F3 Water Sample PAH & BTEX	3
Arup Suite F4 Water Sample VOC & SVOC	3
Arup Suite F5 Water Sample PCB	1
Arup Suite F6 Water Sample Hydrocarbon Fuel Identification	1

APPENDIX 1: DRAWINGS


A487 i Borthmadog
A487 to Porthmadog
Pont-ar-Ddyfi
Strwythur rhestredig Gradd II* i aros ar gyfer cerddwyr/mynediad yn unig.
Pont-ar-Dyfi
The existing Grade II* listed bridge to remain for pedestrian / access only.
Bydd rôl y strwythur yn y dyfodol yn dibynnu ar ganlyniad trafodaethau ynglyn â thynnu statwus cefnffordd rhwng Llywodraeth Cymru a Chyngor Sir Powys.
Future functionality of the structure will be dependent on the outcome of de-trunking discussions between Welsh Government and Powys County Council
Cyffordd bresennol A487 / A493 i gael ei diddymu fel rhan o'r cynllun
Existing A487 / A493 Junction to be removed
Cyffordd newydd A487/A493
New A487 / A493 Junction
Fridd Round Barrows
Pont y Mileniwm
Millennium Bridge
Afon Dyfi
River Dyfi
Arglawdd
Embankment
Traphont a Phont arfaethedig yn croesi'r Afon Dyfi a'r gorlifdir er mwyn lleihau effaith ar lefelau llifogydd
Proposed Viaduct and Bridge. To span over river Dyfi and floodplain to minimise impacts on flood levels
Llwybr Cerdded
Footpath
A493 i Aberdyfi
A493 to Aberdovey
Parc Eco Dyfi
Eco Park
Llwybr Cerdded/Beicio
Footway / Cycleway
Rheilffordd
Railway
A487 i Aberystwyth
A487 to Aberystwyth
Machynlleth
Cynllun o'r prosiect arfaethedig
Plan of proposed scheme

A3



KEY

Proposed Pier Positions

BH Proposed Phase 1 Borehole Locations

TP Proposed Phase 1 Trial Pit Locations

GroundSolve Ltd

Consulting Geotechnical, Engineering Geology and Environmental Engineers

Unit 7, Well House Barns
Chester Road Bretton
Flintshire CH4 0DH

Tel: 01244 661361
Fax: 01244 661289

Job Title

A487- NEW DYFI BRIDGE
GI SPECIFICATION PHASE 1

Drawing Title

PHASE 1
PROPOSED SI LOCATIONS

Drawing Scale	Drawn By	Approved By
@ A3	PBG	

Drawing Status	Date of Issue
DRAFT	

Drawing No	Issue
DRAWING 2a	

APPENDIX 2: EXPLORATORY WORKS - COORDINATES AND LEVELS

Position			
Location	X	Y	Elevation (maOD)
		Boreholes	
BH01	274519.062	301641.495	8.22
BH02	274596.520	301715.715	8.40
BH03	274654.576	301780.493	8.52
BH04	274741.614	301864.209	8.55
BH05	274908.831	302030.915	15.65
		Trial Pits	
TP01	274459.587	301537.001	7.56
TP02	274449.864	301500.919	7.75
TP03	274440.123	301561.358	7.57
TP04	274470.571	301589.154	7.82
TP05	274497.780	301619.337	7.91
TP06	274535.711	301659.442	8.22
TP07	274555.090	301681.908	8.31
TP08	274577.156	301704.218	8.31
TP09	274607.220	301734.032	8.44
TP10	274631.301	301755.935	8.23
TP11	274665.693	301785.071	8.53
TP12	274682.860	301804.056	8.52
TP13	274703.484	301822.274	8.78
TP14	274732.013	301850.459	8.59
TP15	274755.042	301874.176	9.64
TP16	274778.650	301898.355	8.92
TP17	274804.365	301922.904	9.30
TP18	274829.116	301944.270	8.24
TP19	274858.165	301974.659	8.44
TP20	274898.062	302027.396	15.70
TP21	274915.116	302027.207	15.48
TP22	274971.352	302067.731	15.04
TP24	274897.970	302075.327	17.90
TP25	274918.335	302093.790	19.30

APPENDIX 3: BOREHOLE LOGS & ROCK CORE PHOTOGRAPHS

Contract Name: A487 New Dyfi Bridge			Client: Alun Griffiths Contractors Limited	Borehole ID: **BH1**
Contract Number: CCG-C-15-8700	Date Started: 05/12/2015	Logged By: DK	Checked By: TG/CB	Status: FINAL
Cable Percussion Borehole Log	Easting: 274519.1	Northing: 301641.5	Ground Level: 8.22mAOD	Plant Used: Dando 150 Shell & Auger Rig
			Print Date: 06/07/2016	Scale: 1:50
Weather: Wet	Termination:		SPT Hammer: N/R, Energy Ratio: 75%	Sheet 1 of 3

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
			8.02	0.20		Grassed TOPSOIL		
0.50	ES					Loose clayey SILT		
1.00	B			(1.80)				
1.20 - 1.65	UT	SPT(S) 1.20m, N=4 (1,1/1,1,1,1)						
2.00	B	SPT(S) 2.00m, N=26 (2,3/5,5,8,8)	6.22	2.00		Medium dense becoming dense grey slightly silty SAND and GRAVEL. Gravel is fine to coarse subangular to round of various lithologies		
3.00	B	SPT(S) 3.00m, N=25 (4,4/4,5,7,9)						
4.00	B	SPT(S) 4.00m, N=38 (4,5/5,8,10,15)						
5.00	B	SPT(S) 5.00m, N=46 (8,6/6,10,14,16)						
				(7.45)				
6.50	B	SPT(S) 6.50m, 50 (10,11/50 for 170mm)						
8.00	B	SPT(S) 8.00m, 50 (25 for 140mm/50 for 85mm)						
9.50	B	SPT(S) 9.50m, 50 (25 for 125mm/50 for 40mm)	-1.23	9.45		Dense becoming very dense grey slightly silty cobbly SAND and GRAVEL. Gravel is fine to coarse subangular to round of various lithologies		
						Continued next sheet		

Start & End of Shift Observations

Date	Time	Depth (m)	Casing (m)	Water (m)
08-12-2015	08:30	9.50	9.50	0.50
08-12-2015	16:00	25.00	25.00	0.40

Borehole Diameter

Depth (m)	Dia (mm)

Casing Diameter

Depth (m)	Dia (mm)
16.00	250
25.00	200

Chiselling

From (m)	To (m)	Duration	Remarks
14.00	25.00	03:00	

Installation

Top (m)	Base (m)	Type	Dia (mm)

Remarks:

1 hour hand excavating1.20mbgl service avoidance pit. Attempted to access site 1pm 1st December 2015, unable to access due to high river levels affecting nearby bridge. Total standing time due to flooding = 4hrs. 5th December 2015:, Attempted rising head test at 20mbgl. Terminated after 2.5hrs of pumping due to no measurable drop of groundwater.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.70	1.70		20	0.50	

Contract Name: A487 New Dyfi Bridge		Client: Alun Griffiths Contractors Limited		Borehole ID: **BH1**
Contract Number: CCG-C-15-8700	Date Started: 05/12/2015	Logged By: DK	Checked By: TG/CB	Status: FINAL
Cable Percussion Borehole Log	Easting: 274519.1	Northing: 301641.5	Ground Level: 8.22mAOD	Plant Used: Dando 150 Shell & Auger Rig
Print Date: 06/07/2016	Scale: 1:50	Sheet 2 of 3		
Weather: Wet	Termination:	SPT Hammer: N/R, Energy Ratio: 75%		

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
						Continued boring in same stratum		
11.00	B	SPT(S) 11.00m, 50 (25 for 140mm/50 for 50mm)						
12.50	B	SPT(S) 12.50m, 50 (8,12/50 for 155mm)						
14.00	B	SPT(S) 14.00m, 50 (25 for 10mm/50 for 20mm)						
				(15.55)				
15.50	B	SPT(S) 15.50m, 50 (10,15/50 for 135mm)						
17.00	B	SPT(S) 17.00m, N=46 (7,10/10,10,14,12)						
18.50	B	SPT(S) 18.50m, N=40 (4,6/5,8,12,15)						
20.00	B					*Continued next sheet*		

Start & End of Shift Observations				
Date	Time	Depth (m)	Casing (m)	Water (m)

Borehole Diameter	
Depth (m)	Dia (mm)

Casing Diameter	
Depth (m)	Dia (mm)
16.00	250
25.00	200

Remarks:

1 hour hand excavating1.20mbgl service avoidance pit. Attempted to access site 1pm 1st December 2015, unable to access due to high river levels affecting nearby bridge. Total standing time due to flooding = 4hrs. 5th December 2015:, Attempted rising head test at 20mbgl. Terminated after 2.5hrs of pumping due to no measurable drop of groundwater.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Chiselling			
From (m)	To (m)	Duration	Remarks

Installation			
Top (m)	Base (m)	Type	Dia (mm)

Contract Name: A487 New Dyfi Bridge		Client: Alun Griffiths Contractors Limited		Borehole ID: **BH1**
Contract Number: CCG-C-15-8700	Date Started: 05/12/2015	Logged By: DK	Checked By: TG/CB	Status: FINAL
Cable Percussion Borehole Log	Easting: 274519.1	Northing: 301641.5	Ground Level: 8.22mAOD	Plant Used: Dando 150 Shell & Auger Rig
			Print Date: 06/07/2016	Scale: 1:50
Weather: Wet	Termination:		SPT Hammer: N/R, Energy Ratio: 75%	Sheet 3 of 3

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
		SPT(S) 20.00m, N=48 (6,8/8,10,14,16)				*Continued boring in same stratum*		
22.00	B	SPT() 22.00m, 50 (10,15/50 for 180mm)						
24.00	B	SPT(S) 24.00m, 50 (25 for 100mm/50 for 145mm)						
25.00	B	SPT(S) 25.00m, 50 (25 for 60mm/50 for 70mm)	-16.78	25.00		End of Borehole at 25.00m		

21 22 23 24 25 26 27 28 29 30

Start & End of Shift Observations				
Date	Time	Depth (m)	Casing (m)	Water (m)

Borehole Diameter	
Depth (m)	Dia (mm)

Casing Diameter	
Depth (m)	Dia (mm)
16.00	250
25.00	200

Remarks:

1 hour hand excavating1.20mbgl service avoidance pit. Attempted to access site 1pm 1st December 2015, unable to access due to high river levels affecting nearby bridge. Total standing time due to flooding = 4hrs. 5th December 2015:, Attempted rising head test at 20mbgl. Terminated after 2.5hrs of pumping due to no measurable drop of groundwater.

Chiselling			
From (m)	To (m)	Duration	Remarks

Installation			
Top (m)	Base (m)	Type	Dia (mm)

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Contract Name: A487 New Dyfi Bridge		Client: Alun Griffiths Contractors Limited		Borehole ID: **BH2**
Contract Number: CCG-C-15-8700	Date Started: 10/12/2015	Logged By: DK	Checked By: TG/CB	Status: FINAL
Cable Percussion Borehole Log	Easting: 274596.5	Northing: 301715.7	Ground Level: 8.40mAOD	Plant Used: Dando 150 Shell & Auger Rig
			Print Date: 06/07/2016	Scale: 1:50
Weather:	Termination:		SPT Hammer: N/R, Energy Ratio: 75%	Sheet 1 of 4

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
			8.10	(0.30) 0.30		Grassed TOPSOIL		
0.50	ES					Very loose brown clayey SILT		
1.00	B			(1.50)				
1.20 - 1.65	UT	SPT(S) 1.20m, N=1 (1,0/0,0,1,0)						
			6.60	1.80				
2.00	B	SPT(S) 2.00m, N=17 (2,3/4,4,4,5)				Medium dense becoming dense then very dense grey slightly silty occasionally cobbly/bouldery SAND and GRAVEL. Gravel is fine to coarse angular to round of various lithologies		
3.00	B	SPT(S) 3.00m, N=24 (4,4/6,5,6,7)						
4.00	B	SPT(S) 4.00m, N=21 (3,4/5,5,5,6)						
5.00	B	SPT(S) 5.00m, N=26 (3,4/6,6,8,6)						
6.50	B	SPT(S) 6.50m, N=23 (3,3/4,6,6,7)						
8.00	B	SPT(S) 8.00m, N=24 (4,4/5,5,6,8)						
9.50	B	SPT(S) 9.50m, N=35 (4,7/8,8,10,9)						
						Continued next sheet		

Start & End of Shift Observations

Date	Time	Depth (m)	Casing (m)	Water (m)
10-12-2015	16:00	4.00	4.00	0.70
14-12-2015	08:30	4.00	4.00	0.60
24-02-2016	08:30	18.50	18.50	

Borehole Diameter

Depth (m)	Dia (mm)

Casing Diameter

Depth (m)	Dia (mm)
16.00	250
25.00	200

Chiselling

From (m)	To (m)	Duration	Remarks
17.00	25.00	02:30	

Installation

Top (m)	Base (m)	Type	Dia (mm)
0.00	15.00	PLAIN	50
15.00	25.00	SLOTTED	50

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 10th December 2015: 3hrs moving rig & associated tools on to borehole position from BH1.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.80	1.80		20	0.70	

Contract Name: A487 New Dyfi Bridge		Client: Alun Griffiths Contractors Limited		Borehole ID: **BH2**
Contract Number: CCG-C-15-8700	Date Started: 10/12/2015	Logged By: DK	Checked By: TG/CB	Status: FINAL
Cable Percussion Borehole Log	Easting: 274596.5	Northing: 301715.7	Ground Level: 8.40mAOD	Plant Used: Dando 150 Shell & Auger Rig
			Print Date: 06/07/2016	Scale: 1:50
Weather:	Termination:		SPT Hammer: N/R, Energy Ratio: 75%	Sheet 2 of 4

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
						Continued boring in same stratum		
11.00	B	SPT(S) 11.00m, N=20 (2,3/4,5,5,6)						
12.50	B	SPT(S) 12.50m, N=28 (3,4/6,6,7,9)						
14.00	B	SPT(S) 14.00m, N=34 (6,5/8,8,9,9)						
				(28.20)				
15.50	B	SPT(S) 15.50m, N=42 (4,6/8,10,10,14)						
17.00	B	SPT(S) 17.00m, N=50 (8,13/50 for 240mm)						
18.50	B	SPT(S) 18.50m, 50 (9,14/50 for 220mm)						
20.00	B					*Continued next sheet*		

Start & End of Shift Observations				
Date	Time	Depth (m)	Casing (m)	Water (m)

Borehole Diameter	
Depth (m)	Dia (mm)

Casing Diameter	
Depth (m)	Dia (mm)
16.00	250
25.00	200

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 10th December 2015: 3hrs moving rig & associated tools on to borehole position from BH1.

Chiselling			
From (m)	To (m)	Duration	Remarks

Installation			
Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Contract Name: A487 New Dyfi Bridge			Client: Alun Griffiths Contractors Limited	Borehole ID: **BH2**
Contract Number: CCG-C-15-8700	Date Started: 10/12/2015	Logged By: DK	Checked By: TG/CB	Status: FINAL
Cable Percussion Borehole Log	Easting: 274596.5	Northing: 301715.7	Ground Level: 8.40mAOD	Plant Used: Dando 150 Shell & Auger Rig
			Print Date: 06/07/2016	Scale: 1:50
Weather:	Termination:		SPT Hammer: N/R, Energy Ratio: 75%	Sheet 3 of 4

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
		SPT(S) 20.00m, N=50 (8,14/50 for 240mm)				*Continued boring in same stratum*		
22.00	B	SPT(S) 22.00m, 50 (35 for 145mm/50 for 135mm)						
24.00	B	SPT(S) 24.00m, 50 (25 for 105mm/50 for 100mm)						
26.00	B	SPT(S) 26.00m, 50 (26 for 75mm/50 for 65mm)						
28.00	B	SPT(S) 28.00m, 50 (25 for 60mm/50 for 50mm)						
30.00	B		-21.60	30.00		Continued next sheet		

21 22 23 24 25 26 27 28 29 30

Start & End of Shift Observations				
Date	Time	Depth (m)	Casing (m)	Water (m)

Borehole Diameter	
Depth (m)	Dia (mm)

Casing Diameter	
Depth (m)	Dia (mm)
16.00	250
25.00	200

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 10th December 2015: 3hrs moving rig & associated tools on to borehole position from BH1.

Chiselling			
From (m)	To (m)	Duration	Remarks

Installation			
Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

CCG	Contract Name: A487 New Dyfi Bridge		Client: Alun Griffiths Contractors Limited		Borehole ID: **BH2**
	Contract Number: CCG-C-15-8700	Date Started: 10/12/2015	Logged By: DK	Checked By: TG/CB	Status: FINAL — Sheet 4 of 4
Cable Percussion Borehole Log	Easting: 274596.5	Northing: 301715.7	Ground Level: 8.40mAOD	Plant Used: Dando 150 Shell & Auger Rig	Print Date: 06/07/2016 — Scale: 1:50
Weather:		Termination:		SPT Hammer: N/R, Energy Ratio: 75%	

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
		SPT(S) 30.00m, 50 (25 for 40mm/50 for 30mm)				End of Borehole at 30.00m		

31 32 33 34 35 36 37 38 39 40

Start & End of Shift Observations				
Date	Time	Depth (m)	Casing (m)	Water (m)

Borehole Diameter	
Depth (m)	Dia (mm)

Casing Diameter	
Depth (m)	Dia (mm)
16.00	250
25.00	200

Chiselling			
From (m)	To (m)	Duration	Remarks

Installation			
Top (m)	Base (m)	Type	Dia (mm)

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 10th December 2015: 3hrs moving rig & associated tools on to borehole position from BH1.

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Contract Name: A487 New Dyfi Bridge			Client: Alun Griffiths Contractors Limited	Borehole ID: **BH3**
Contract Number: CCG-C-15-8700	Date Started: 31/12/2015	Logged By: DK	Checked By: TG/CB	Status: FINAL
Cable Percussion Borehole Log	Easting: 274654.6	Northing: 301780.5	Ground Level: 8.52mAOD	Plant Used: Dando 150 Shell & Auger Rig
			Print Date: 06/07/2016	Scale: 1:50
Weather: Wet	Termination:		SPT Hammer: N/R, Energy Ratio: 75%	Sheet 1 of 4

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
				(0.30)		Grassed dark brown silty clayey TOPSOIL		
			8.22	0.30		Loose brown clayey SILT		
0.50	B							
				(1.30)				
1.30 - 1.75	UT							
			6.92	1.60		Loose becoming medium dense becoming dense then very dense grey slightly silty SAND and GRAVEL with frequent cobbles and boulders. Gravel is fine to coarse subangular to round of various lithologies		
1.80	B							
		SPT(S) 2.00m, N=7 (1,2/2,1,2,2)						
2.50	B							
		SPT(S) 3.00m, N=18 (3,5/4,4,4,6)						
3.50	B							
		SPT(S) 4.00m, N=19 (2,2/5,4,5,5)						
4.50	B							
		SPT(S) 5.00m, N=18 (3,5/4,5,4,5)						
6.00	B	SPT(S) 6.00m, 50 (3,3/50 for 75mm)						
		SPT(S) 7.00m, N=20 (2,3/5,5,5,5)						
7.50	B							
		SPT(S) 8.00m, N=19 (1,3/4,5,5,5)						
		SPT(S) 9.00m, N=22 (2,4/5,5,6,6)						
9.50	B							
						Continued next sheet		

Start & End of Shift Observations

Date	Time	Depth (m)	Casing (m)	Water (m)
02-01-2016	16:00	7.00	7.00	1.00
03-01-2016	08:30	7.00	7.00	1.10
03-01-2016	16:00	15.50	15.50	1.20
04-01-2016	08:30	15.50	15.50	1.40
04-01-2016	16:00	21.00	21.00	2.10

Chiselling

From (m)	To (m)	Duration	Remarks
17.00	25.00	03:00	

Borehole Diameter

Depth (m)	Dia (mm)

Casing Diameter

Depth (m)	Dia (mm)
16.00	250
25.00	200

Installation

Top (m)	Base (m)	Type	Dia (mm)
0.00	15.00	PLAIN	50
15.00	25.00	SLOTTED	50

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 31st December 2015: 3hrs moving rig & associated tools to borehole position. 6th January 2016: 3hrs getting rig & associated tools off site on completion of boring

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.60	1.60		20	0.40	

Contract Name: A487 New Dyfi Bridge		Client: Alun Griffiths Contractors Limited		Borehole ID: **BH3**
Contract Number: CCG-C-15-8700	Date Started: 31/12/2015	Logged By: DK	Checked By: TG/CB	Status: FINAL
Cable Percussion Borehole Log	Easting: 274654.6	Northing: 301780.5	Ground Level: 8.52mAOD	Plant Used: Dando 150 Shell & Auger Rig
			Print Date: 06/07/2016	Scale: 1:50
Weather: Wet	Termination:		SPT Hammer: N/R, Energy Ratio: 75%	Sheet 2 of 4

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
		SPT(S) 10.00m, N=22 (3,5/5,7,5,5)						
11.00	B	SPT(S) 11.00m, N=27 (4,6/7,7,6,7)						
12.00	B	SPT(S) 12.00m, N=27 (2,5/8,6,6,7)						
		SPT(S) 13.00m, N=29 (4,7/7,8,7,7)						
13.50	B							
		SPT(S) 14.00m, N=30 (3,7/8,7,7,8)						
15.00	B	SPT(S) 15.00m, N=33 (4,9/9,8,8,8)		(28.40)				
		SPT(S) 16.00m, N=40 (4,8/9,10,11,10)						
		SPT(S) 17.00m, N=50 (6,10/50 for 255mm)						
17.50	B							
		SPT(S) 18.00m, N=50 (8,12/50 for 241mm)						
18.50	B							
		SPT(S) 19.00m, N=50 (7,13/50 for 235mm)						

Continued next sheet

Start & End of Shift Observations

Date	Time	Depth (m)	Casing (m)	Water (m)
05-01-2016	08:30	21.00	21.00	1.70
05-01-2016	16:00	30.00	30.00	1.50

Borehole Diameter

Depth (m)	Dia (mm)

Casing Diameter

Depth (m)	Dia (mm)
16.00	250
25.00	200

Chiselling

From (m)	To (m)	Duration	Remarks

Installation

Top (m)	Base (m)	Type	Dia (mm)

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 31st December 2015: 3hrs moving rig & associated tools to borehole position. 6th January 2016: 3hrs getting rig & associated tools off site on completion of boring

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Contract Name: A487 New Dyfi Bridge			Client: Alun Griffiths Contractors Limited	Borehole ID: **BH3**
Contract Number: CCG-C-15-8700	Date Started: 31/12/2015	Logged By: DK	Checked By: TG/CB	Status: FINAL — Sheet 3 of 4
Cable Percussion Borehole Log	Easting: 274654.6	Northing: 301780.5	Ground Level: 8.52mAOD	Plant Used: Dando 150 Shell & Auger Rig — Print Date: 06/07/2016 — Scale: 1:50
Weather: Wet	Termination:		SPT Hammer: N/R, Energy Ratio: 75%	

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
		SPT(S) 20.00m, 50 (25 for 135mm/50 for 90mm)						
20.50	B							
		SPT(S) 21.00m, 50 (7,18/50 for 100mm)						
		SPT(S) 22.00m, 50 (25 for 110mm/50 for 90mm)						
22.50	B							
		SPT(S) 23.00m, 50 (40 for 125mm/50 for 20mm)						
23.90	B	SPT(S) 24.00m, 50 (41 for 135mm/50 for 30mm)						
		SPT(S) 25.00m, 50 (25 for 20mm/50 for 35mm)						
25.50	B							
		SPT(S) 26.00m, 50 (25 for 15mm/50 for 25mm)						
26.90	B	SPT(S) 27.00m, 50 (25 for 10mm/50 for 20mm)						
27.90	B	SPT(S) 28.00m, 50 (25 for 10mm/50 for 20mm)						
28.90	B	SPT(S) 29.00m, 50 (25 for 10mm/50 for 15mm)						
29.90	B		-21.48	30.00				
						Continued next sheet		

21 22 23 24 25 26 27 28 29 30

Start & End of Shift Observations				
Date	Time	Depth (m)	Casing (m)	Water (m)

Borehole Diameter	
Depth (m)	Dia (mm)

Casing Diameter	
Depth (m)	Dia (mm)
16.00	250
25.00	200

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 31st December 2015: 3hrs moving rig & associated tools to borehole position. 6th January 2016: 3hrs getting rig & associated tools off site on completion of boring

Chiselling			
From (m)	To (m)	Duration	Remarks

Installation			
Top (m)	Base (m)	Type	Dia (mm)

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Contract Name: A487 New Dyfi Bridge			Client: Alun Griffiths Contractors Limited	Borehole ID: **BH3**
Contract Number: CCG-C-15-8700	Date Started: 31/12/2015	Logged By: DK	Checked By: TG/CB	Status: FINAL — Sheet 4 of 4
Cable Percussion Borehole Log	Easting: 274654.6	Northing: 301780.5	Ground Level: 8.52mAOD	Plant Used: Dando 150 Shell & Auger Rig — Print Date: 06/07/2016 — Scale: 1:50
Weather: Wet	Termination:		SPT Hammer: N/R, Energy Ratio: 75%	

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
		SPT(S) 30.00m, 50 (25 for 10mm/50 for 20mm)				End of Borehole at 30.00m		

31 32 33 34 35 36 37 38 39 40

Start & End of Shift Observations				
Date	Time	Depth (m)	Casing (m)	Water (m)

Borehole Diameter	
Depth (m)	Dia (mm)

Casing Diameter	
Depth (m)	Dia (mm)
16.00	250
25.00	200

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 31st December 2015: 3hrs moving rig & associated tools to borehole position. 6th January 2016: 3hrs getting rig & associated tools off site on completion of boring

Chiselling			
From (m)	To (m)	Duration	Remarks

Installation			
Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Contract Name: A487 New Dyfi Bridge			Client: Alun Griffiths Contractors Limited		Borehole ID: **BH4**
Contract Number: CCG-C-15-8700	Date Started: 21/12/2015	Logged By: JE	Checked By: TG/CB	Status: FINAL	Sheet 1 of 4
Cable Percussion Borehole Log	Easting: 274741.6	Northing: 301864.2	Ground Level: 8.55mAOD	Plant Used: Dando 150 Shell & Auger Rig	Print Date: 06/07/2016	Scale: 1:50
Weather: Wet	Termination:		SPT Hammer: N/R, Energy Ratio: 75%		

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
				(0.30)		Grassed brown silty TOPSOIL		
			8.25	0.30		Very loose brown clayey SILT		
0.50	ES							
1.00	B			(1.40)				
1.20 - 1.65	UT	SPT(S) 1.20m, N=1 (1,0/0,1,0,0)						
			6.85	1.70				
2.00	B	SPT(S) 2.00m, N=14 (2,3/3,3,4,4)				Medium dense becoming dense then very dense grey slightly silty cobbly SAND and GRAVEL with occasional boulders. with occasional thin (c.100mm) bands of sand. Gravel is fine to coarse subangular to round of various lithologies		
3.00	B	SPT(S) 3.00m, N=14 (2,2/3,4,4,3)						
4.00	B	SPT(S) 4.00m, N=19 (2,3/4,5,5,5)						
5.00	B	SPT(S) 5.00m, N=18 (3,4/4,5,5,4)						
6.00	B	SPT(S) 6.00m, 50 (25 for 10mm/50 for 10mm)						
7.50	B	SPT(S) 7.50m, 50 (25 for 15mm/50 for 20mm)						
9.00	B	SPT(S) 9.00m, 50 (25 for 20mm/50 for 15mm)						
10.00	B					Continued next sheet		

Start & End of Shift Observations

Date	Time	Depth (m)	Casing (m)	Water (m)
22-12-2015	08:00	10.50	10.50	1.70
29-12-2015	08:00	15.00	15.00	0.60
29-12-2015	16:30	20.50	20.50	1.70
30-12-2015	08:00	20.50	20.50	0.90
30-12-2015	16:30	29.00	29.00	2.10

Borehole Diameter

Depth (m)	Dia (mm)

Casing Diameter

Depth (m)	Dia (mm)
16.00	250
30.00	200

Chiselling

From (m)	To (m)	Duration	Remarks
6.00	30.00	05:00	

Installation

Top (m)	Base (m)	Type	Dia (mm)
0.00	1.00	PLAIN	50
1.00	10.00	SLOTTED	50

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 21st December 2015: 3hrs getting rig & associated tools on to borehole position. 22nd December 2015: 1.5hrs getting rig off borehole position to due rising river levels. 30th December 2015: 2hrs getting rig & associated tools back on to borehole position.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.70	1.70		5	0.70	

CCG	Contract Name: A487 New Dyfi Bridge		Client: Alun Griffiths Contractors Limited		Borehole ID: **BH4**
	Contract Number: CCG-C-15-8700	Date Started: 21/12/2015	Logged By: JE	Checked By: TG/CB	Status: FINAL — Sheet 2 of 4
Cable Percussion Borehole Log	Easting: 274741.6	Northing: 301864.2	Ground Level: 8.55mAOD	Plant Used: Dando 150 Shell & Auger Rig	Print Date: 06/07/2016 — Scale: 1:50
Weather: Wet	Termination:		SPT Hammer: N/R, Energy Ratio: 75%		

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
						Continued boring in same stratum		
		SPT(S) 10.50m, N=50 (8,8/50 for 290mm)						
11.00	B	SPT(S) 11.00m, 50 (25 for 30mm/50 for 20mm)						
12.00	B	SPT(S) 12.00m, 50 (10,14/50 for 70mm)						
		SPT(S) 13.00m, 50 (25 for 70mm/50 for 90mm)						
13.50	B							
		SPT(S) 14.00m, 50 (8,10/50 for 115mm)						
15.00	B	SPT(S) 15.00m, 50 (25 for 40mm/50 for 80mm)		(28.30)				
15.50	B							
		SPT(S) 16.00m, N=45 (10,10/10,9,10,16)						
16.50	B							
		SPT(S) 17.00m, 50 (2,5/50 for 15mm)						
		SPT(S) 18.00m, 50 (7,16/50 for 185mm)						
18.50	B							
		SPT(S) 19.00m, 50 (10,10/50 for 160mm)						
						Continued next sheet		

Start & End of Shift Observations

Date	Time	Depth (m)	Casing (m)	Water (m)
31-12-2015	08:00	29.00	29.00	0.90
31-12-2015	16:00	30.00	30.00	2.10

Borehole Diameter

Depth (m)	Dia (mm)

Casing Diameter

Depth (m)	Dia (mm)
16.00	250
30.00	200

Chiselling

From (m)	To (m)	Duration	Remarks

Installation

Top (m)	Base (m)	Type	Dia (mm)

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 21st December 2015: 3hrs getting rig & associated tools on to borehole position. 22nd December 2015: 1.5hrs getting rig off borehole position to due rising river levels. 30th December 2015: 2hrs getting rig & associated tools back on to borehole position.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Contract Name: A487 New Dyfi Bridge			Client: Alun Griffiths Contractors Limited	Borehole ID: **BH4**
Contract Number: CCG-C-15-8700	Date Started: 21/12/2015	Logged By: JE	Checked By: TG/CB	Status: FINAL
Cable Percussion Borehole Log	Easting: 274741.6	Northing: 301864.2	Ground Level: 8.55mAOD	Plant Used: Dando 150 Shell & Auger Rig
			Print Date: 06/07/2016	Scale: 1:50
Weather: Wet	Termination:		SPT Hammer: N/R, Energy Ratio: 75%	Sheet 3 of 4

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
		SPT(S) 20.00m, 50 (2,5/50 for 95mm)				*Continued boring in same stratum*		
20.50	B							
21.00	B	SPT(S) 21.00m, 50 (9,8/50 for 165mm)						
		SPT(S) 22.30m, N=41 (4,7/10,10,10,11)						
		SPT(S) 23.00m, N=50 (5,4/50 for 255mm)						
23.50	B							
		SPT(S) 24.00m, 50 (10,13/50 for 115mm)						
		SPT(S) 25.00m, 50 (25 for 40mm/50 for 83mm)						
25.50	B							
		SPT(S) 26.00m, 50 (5,16/50 for 170mm)						
		SPT(S) 27.00m, 50 (25 for 10mm/50 for 15mm)						
27.50	B							
		SPT(S) 28.00m, 50 (25 for 5mm/50 for 10mm)						
		SPT(S) 29.00m, 50 (8,14/50 for 135mm)						
29.50	B							
			-21.45	30.00		Continued next sheet		

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)
							16.00	250
							30.00	200

Chiselling			
From (m)	To (m)	Duration	Remarks

Installation			
Top (m)	Base (m)	Type	Dia (mm)

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 21st December 2015: 3hrs getting rig & associated tools on to borehole position. 22nd December 2015: 1.5hrs getting rig off borehole position to due rising river levels. 30th December 2015: 2hrs getting rig & associated tools back on to borehole position.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Contract Name: A487 New Dyfi Bridge			Client: Alun Griffiths Contractors Limited	Borehole ID: **BH4**
Contract Number: CCG-C-15-8700	Date Started: 21/12/2015	Logged By: JE	Checked By: TG/CB	Status: FINAL — Sheet 4 of 4
Cable Percussion Borehole Log	Easting: 274741.6	Northing: 301864.2	Ground Level: 8.55mAOD	Plant Used: Dando 150 Shell & Auger Rig — Print Date: 06/07/2016 — Scale: 1:50
Weather: Wet	Termination:		SPT Hammer: N/R, Energy Ratio: 75%	

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
		SPT(S) 30.00m, 50 (25 for 30mm/50 for 50mm)				End of Borehole at 30.00m		

31 32 33 34 35 36 37 38 39 40

Start & End of Shift Observations				
Date	Time	Depth (m)	Casing (m)	Water (m)

Borehole Diameter	
Depth (m)	Dia (mm)

Casing Diameter	
Depth (m)	Dia (mm)
16.00	250
30.00	200

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 21st December 2015: 3hrs getting rig & associated tools on to borehole position. 22nd December 2015: 1.5hrs getting rig off borehole position to due rising river levels. 30th December 2015: 2hrs getting rig & associated tools back on to borehole position.

Chiselling			
From (m)	To (m)	Duration	Remarks

Installation			
Top (m)	Base (m)	Type	Dia (mm)

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Contract Name: A487 New Dyfi Bridge		Client: Alun Griffiths Contractors Limited		Borehole ID: **BH5**
Contract Number: CCG-C-15-8700	Date Started: 02/12/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL
Cable Percussion Borehole Log	Easting: 274908.8	Northing: 302030.9	Ground Level: 15.65mAOD	Plant Used: Dando 150 S/A Rig
Print Date: 09/07/2016	Scale: 1:50			Sheet 1 of 2
Weather:	Termination:	SPT Hammer: CCG4 Energy Ratio: 75%		

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
				(0.30)		TOPSOIL		
			15.35	0.30				
0.50	B					Very dense slightly silty occasionally clayey cobbly SAND and GRAVEL. Gravel is fine to coarse subround and round of various lithologies		
1.00	B	SPT(S)50 (8,10/50 for 70mm)						
2.00	B	SPT(S)50 (25 for 80mm/50 for 65mm)						
				(4.50)				
3.00	B	SPT(S)50 (25 for 100mm/50 for 70mm)						
4.00	B	SPT(S)50 (25 for 20mm/50 for 20mm)						
			10.85	4.80				
5.00	B	SPT(S)50 (25 for 70mm/50 for 65mm)				Very dense slightly silty occasionally clayey cobbly SAND and GRAVEL. Gravel is fine to coarse subround and round of various lithologies		
6.00	B							
		SPT(S)50 (25 for 50mm/50 for 30mm)						
				(4.00)				
7.50	B							
		SPT(S)50 (25 for 60mm/50 for 40mm)						
			6.85	8.80				
9.00	B			(0.40)		Grey fragmented MUDSTONE		
~~9.20 - 10.50~~	~~C~~	~~SPT(S)50 (25 for 20mm/50 for 20mm)~~	6.45	9.20				
9.20 - 10.50	100	100 100				Grey very thickly bedded MUDSTONE. Fresh with occasional drilling induced subvertical fractures. Discontinuities are very widely spaced. Drilling induced fractures are subvertical, clean, smooth and stepped		
						Drilling induced subvertical fracture		
						Drilling induced subvertical fractures		
	TCR	SCR RQD Fracture Water				Continued next sheet		

Start & End of Shift Observations				
Date	Time	Depth (m)	Casing (m)	Water (m)
03-12-2015	16:00	9.20	9.20	9.00
04-02-2016	08:30	9.20	9.20	7.00

Borehole Diameter	
Depth (m)	Dia (mm)

Casing Diameter	
Depth (m)	Dia (mm)
19.50	200

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 2nd December 2015: 2.5hrs getting rig & associated tools to BH5 due to high river levels affecting nearby bridge. 2hr waiting for land owner permission to access site.

Chiselling

From (m)	To (m)	Duration	Remarks
4.50	4.80	02:00	Mudstone boulder
5.00	5.30	02:00	Cobble / boulder
8.90	9.10	01:30	

Installation

Top (m)	Base (m)	Type	Dia (mm)

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Contract Name: A487 New Dyfi Bridge			Client: Alun Griffiths Contractors Limited	Borehole ID: **BH5**
Contract Number: CCG-C-15-8700	Date Started: 02/12/2015	Loggged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 2 of 2
Rotary Core Drilling Log	Easting: 274908.8	Northing: 302030.9	Ground Level: 15.65mAOD	Plant Used: Dando 150 S/A Rig — Print Date: 09/07/2016 — Scale: 1:50
Weather:	Termination:		SPT Hammer: CCG4 Energy Ratio: 75%	

Samples & In Situ Testing						Strata Details				Groundwater	
Depth	TCR	SCR	RQD	Fracture Spacing	Water Added	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
									Continued boring in same stratum		
10.50 - 12.00	100	100	100						*Drilling induced subvertical fractures*		
12.00 - 13.50	100	100	100						*Drilling induced subvertical fractures*		
13.50 - 15.00	100	100	100				(10.30)		*Drilling induced subvertical fractures*		
15.00 - 16.50	100	100	100						*Drilling induced subvertical fractures*		
16.50 - 18.00	100	100	100						*Drilling induced subvertical fractures*		
18.00 - 19.50	100	100	100						*Drilling induced subvertical fractures*		
						-3.85	19.50		End of Borehole at 19.50m		

11 12 13 14 15 16 17 18 19 20

Start & End of Shift Observations				
Date	Time	Depth (m)	Casing (m)	Water (m)
03-12-2015	16:00	9.20	9.20	9.00
04-02-2016	08:30	9.20	9.20	7.00

Borehole Diameter	
Depth (m)	Dia (mm)

Casing Diameter	
Depth (m)	Dia (mm)
19.50	200

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 2nd December 2015: 2.5hrs getting rig & associated tools to BH5 due to high river levels affecting nearby bridge. 2hr waiting for land owner permission to access site.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Flush Information				
Top (m)	Base (m)	Flush Type	Return	Flush Colour

Installation			
Top (m)	Base (m)	Type	Dia (mm)

Fracture spacing reported in mm as min, Average and Max values. TCR, SCR and RQD reported in %

Contract Name: A487 New Dyfi Bridge			Client: Alun Griffiths Contractors Limited	Borehole ID: **BH5**
Contract Number: CCG-C-15-8700	Date Started: 02/12/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL
Cable Percussion Borehole Log	Easting: 274908.8	Northing: 302030.9	Ground Level: 15.65mAOD	Plant Used: Dando 150 S/A Rig
			Print Date: 09/07/2016	Scale: 1:50
Weather:	Termination:		SPT Hammer: CCG4 Energy Ratio: 75%	Sheet 1 of 2

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
				(0.30)		TOPSOIL		
			15.35	0.30		Very dense slightly silty occasionally clayey cobbly SAND and GRAVEL. Gravel is fine to coarse subround and round of various lithologies		
0.50	B							
1.00	B							
		SPT(S) 1.20m, 50 (8,10/50 for 70mm)						
2.00	B	SPT(S) 2.00m, 50 (25 for 80mm/50 for 65mm)						
				(4.50)				
3.00	B	SPT(S) 3.00m, 50 (25 for 100mm/50 for 70mm)						
4.00	B	SPT(S) 4.00m, 50 (25 for 20mm/50 for 20mm)						
			10.85	4.80		Very dense slightly silty occasionally clayey cobbly SAND and GRAVEL. Gravel is fine to coarse subround and round of various lithologies		
5.00	B	SPT(S) 5.00m, 50 (25 for 70mm/50 for 65mm)						
6.00	B							
		SPT(S) 6.50m, 50 (25 for 50mm/50 for 30mm)						
				(4.00)				
7.50	B							
		SPT(S) 8.00m, 50 (25 for 60mm/50 for 40mm)						
			6.85	8.80		Grey fragmented MUDSTONE		
9.00	B			(0.40)				
9.20 - 10.50	C	SPT(S) 9.20m, 50 (25 for 20mm/50 for 20mm)	6.45	9.20		Grey very thickly bedded MUDSTONE. Fresh with occasional drilling induced subvertical fractures. Discontinuities are very widely spaced. Drilling induced fractures are subvertical, clean, smooth and stepped		
						Drilling induced subvertical fracture		
						Drilling induced subvertical fractures		

Continued next sheet

Start & End of Shift Observations

Date	Time	Depth (m)	Casing (m)	Water (m)
03-12-2015	16:00	9.20	9.20	9.00
04-02-2016	08:30	9.20	9.20	7.00

Borehole Diameter

Depth (m)	Dia (mm)

Casing Diameter

Depth (m)	Dia (mm)
19.50	200

Chiselling

From (m)	To (m)	Duration	Remarks
4.50	4.80	02:00	Mudstone boulder
5.00	5.30	02:00	Cobble / boulder
8.90	9.10	01:30	

Installation

Top (m)	Base (m)	Type	Dia (mm)

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 2nd December 2015: 2.5hrs getting rig & associated tools to BH5 due to high river levels affecting nearby bridge. 2hr waiting for land owner permission to access site.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

	Contract Name: A487 New Dyfi Bridge		Client: Alun Griffiths Contractors Limited		Borehole ID: **BH5**
	Contract Number: CCG-C-15-8700	Date Started: 02/12/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 2 of 2
Cable Percussion Borehole Log	Easting: 274908.8	Northing: 302030.9	Ground Level: 15.65mAOD	Plant Used: Dando 150 S/A Rig	Print Date: 09/07/2016 — Scale: 1:50
Weather:		Termination:		SPT Hammer: CCG4 Energy Ratio: 75%	

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
						Continued boring in same stratum		
10.50 - 12.00	C	SPT(S) 10.50m, 50 (25 for 5mm/50 for 10mm)						
						Drilling induced subvertical fractures		
12.00 - 13.50	C	SPT(S) 12.00m, 50 (25 for 3mm/50 for 7mm)						
						Drilling induced subvertical fractures		
13.50 - 15.00	C	SPT(S) 13.50m, 50 (25 for 2mm/50 for 4mm)						
						Drilling induced subvertical fractures		
				(10.30)				
15.00 - 16.50	C	SPT(S) 15.00m, 50 (25 for 2mm/50 for 1mm)						
						Drilling induced subvertical fractures		
16.50 - 18.00	C	SPT(S) 16.50m, 50 (25 for 1mm/50 for 1mm)						
						Drilling induced subvertical fractures		
18.00 - 19.50	C	SPT(S) 18.00m, 50 (25 for 1mm/50 for 1mm)						
						Drilling induced subvertical fractures		
		SPT(S) 19.50m, 50 (25 for 1mm/50 for 1mm)	-3.85	19.50		End of Borehole at 19.50m		

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)
							19.50	200

Chiselling			
From (m)	To (m)	Duration	Remarks

Installation			
Top (m)	Base (m)	Type	Dia (mm)

Remarks:

1 hour hand excavating 1.20mbgl service avoidance pit. 2nd December 2015: 2.5hrs getting rig & associated tools to BH5 due to high river levels affecting nearby bridge. 2hr waiting for land owner permission to access site.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks



Figure 1: BH5 9.2m - 12mbgl



Figure2: BH5 12m – 15mbgl

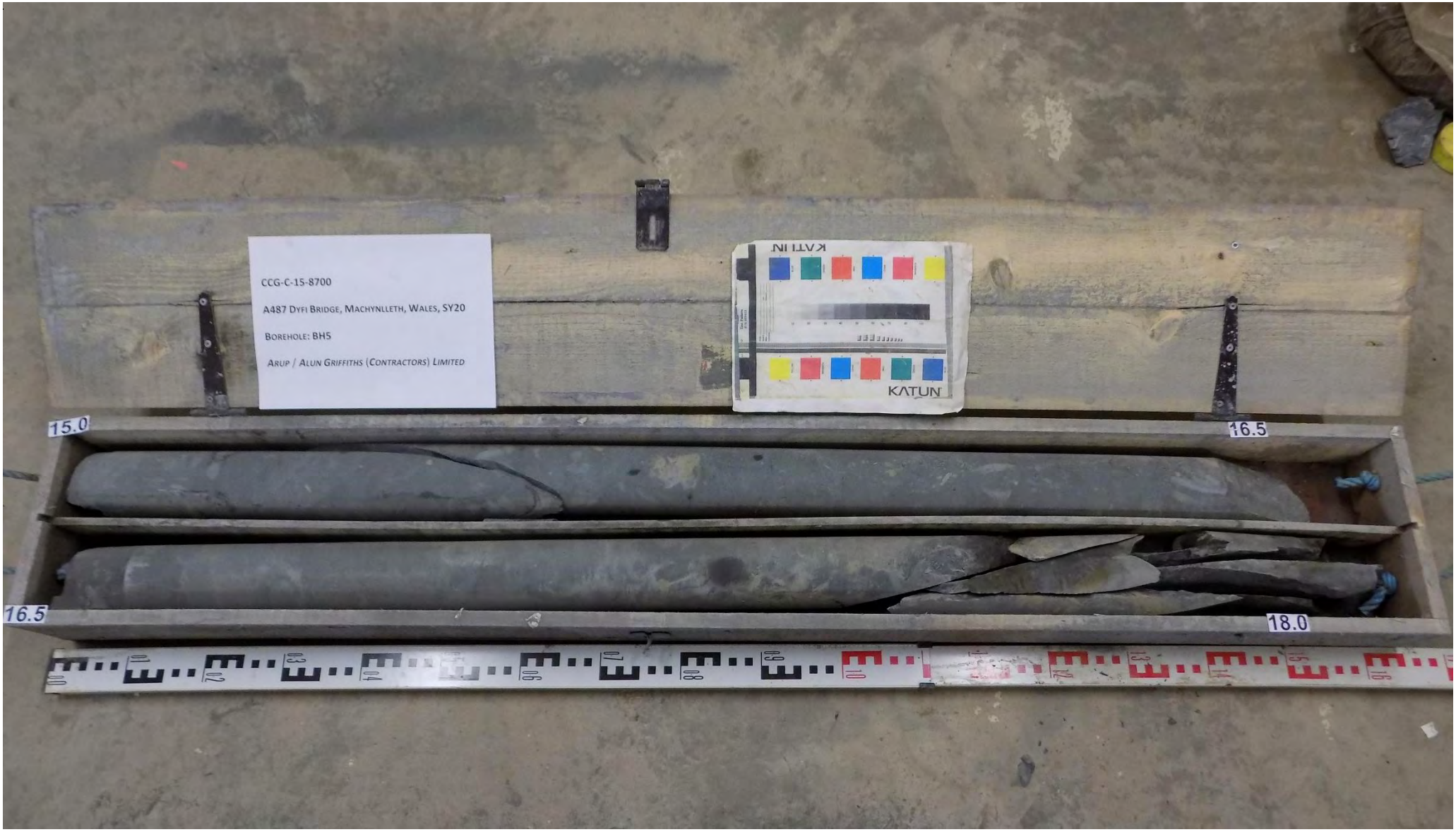


Figure3: BH5 15m – 18mbgl



Figure 4: BH5 18m – 19.5mbgl

APPENDIX 4: TRIAL PIT LOGS

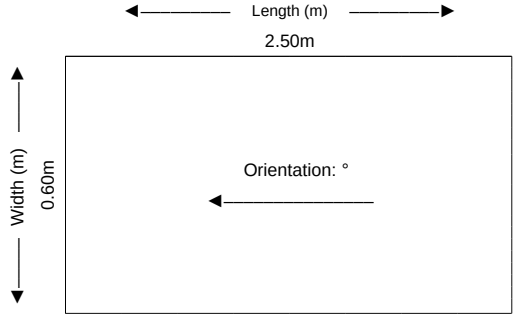
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP01
	Contract Number: CCG-C-15-8700	Date Started: 25/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274459.6	Northing: 301537.0	Ground Level: 7.56mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details					
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description	Water	Backfill
			7.41	0.15		Grassed brown clayey silty TOPSOIL		
						MADE GROUND comprising brown clayey silty gravel with occasional red brick cobbles. Gravel is fine to coarse angular to subround of brick		
0.40	ES		7.16	0.40		Very loose/very soft brown becoming grey clayey SILT		
0.60	B							
				(1.60)				
1.30	B							
1.30	EW	PP 1.40m, <5kPa						
		PP 1.70m, <5kPa						
		PP 1.90m, <5kPa						
			5.56	2.00		Grey sandy slightly gravelly SILT. Gravel is fine to coarse subangular to round of mudstone siltstone and quartz		
2.10	B		5.46	2.10		Grey slightly silty sandy GRAVEL with occasional small cobbles. Gravel is fine to coarse subangular to round of mudstone sandstone siltstone and quartz		
				(0.30)				
2.40	B		5.16	2.40		End of Trial Pit at 2.40m		

1 2 3

Dimensions:

Final Depth: 2.40m



Inclination: °

General Remarks:

PP = Pocket Penetrometer Test. Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.30			0		Groundwater slowly continuing to rise from

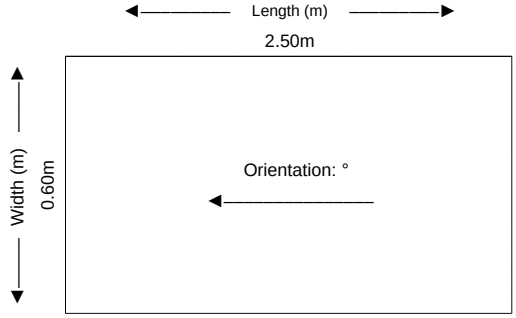
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP02
	Contract Number: CCG-C-15-8700	Date Started: 25/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274449.9	Northing: 301500.9	Ground Level: 7.75mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			7.65	0.10		Grassed brown clayey silty TOPSOIL		
				(0.50)		MADE GROUND comprising brown clayey silty with occasional thin - thick roots and small mudstone gravels and cobbles		
0.40	ES							
			7.15	0.60		200mm unspecified pipe		
0.70	B		6.95	0.80		Brown clayey SILT		
1.20	B							
1.40	B							
				(1.50)				
			5.45	2.30		Grey slightly silty occasionally cobbly SAND and GRAVEL. Gravel is fine to coarse subangular to round of mudstone sandstone and siltstone		
2.40	B			(0.40)				
2.70	B		5.05	2.70		End of Trial Pit at 2.70m		

1 2 3

Dimensions:

Final Depth: 2.70m



Inclination: °

General Remarks:

Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.50			0		Groundwater slowly continuing to rise from

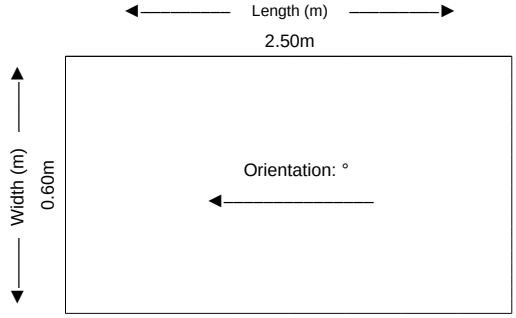
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP03
	Contract Number: CCG-C-15-8700	Date Started: 25/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274440.1	Northing: 301561.4	Ground Level: 7.57mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			7.37	0.20		Grassed brown clayey silty TOPSOIL		
						Brown clayey SILT		
0.40	ES			(0.80)				
0.80	B							
			6.57	1.00		Very soft brown becoming grey slightly sandy silty CLAY		
1.20	B	PP 1.20m, <5kPa						
1.40	EW							
		PP 1.50m, <5kPa		(1.10)				
		PP 1.90m, <5kPa						
2.00	B							
			5.47	2.10		Grey slightly silty SAND and GRAVEL with occasional small cobbles. Gravel is fine to coarse subangular to round of mudstone siltstone quartz feldspar and sandstone		
				(0.60)				
2.60	B							
			4.87	2.70		End of Trial Pit at 2.70m		

1 2 3

Dimensions:

Final Depth: 2.70m



Inclination: °

General Remarks:

PP = Pocket Penetrometer Test. Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.40			0		Groundwater slowly continuing to rise from

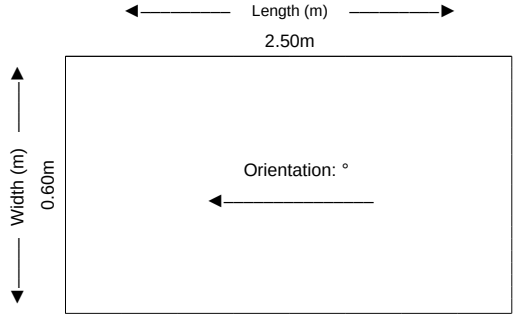
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP04
	Contract Number: CCG-C-15-8700	Date Started: 25/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274470.6	Northing: 301589.2	Ground Level: 7.82mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			7.82			Grassed brown clayey silty TOPSOIL		
0.25	ES		7.57	0.25		Brown clayey SILT with occasional fine - medium mudstone - siltstone gravel inclusions		
0.60	B							
				(1.25)				
			6.32	1.50		Very loose/very soft brown becoming grey clayey SILT		
1.70	B	PP 1.70m, <5kPa		(0.40)				
			5.92	1.90		Grey slightly silty SAND and GRAVEL with occasional cobbles. Gravel is fine to coarse angular to subround of mudstone siltstone and quartz		
2.00	B							
				(0.90)				
2.50	B							
2.60	B							
			5.02	2.80		End of Trial Pit at 2.80m		

1 2 3

Dimensions:

Final Depth: 2.80m



Inclination: °

General Remarks:

PP = Pocket Penetrometer Test. Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.20			0		Groundwater slowly continuing to rise from

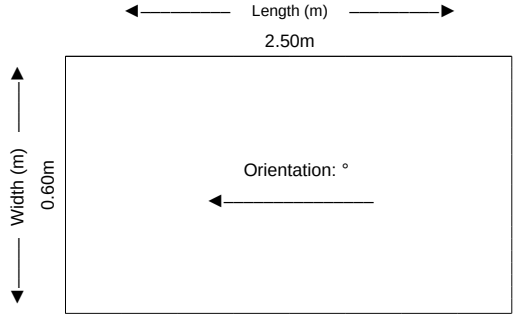
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP05
	Contract Number: CCG-C-15-8700	Date Started: 25/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274497.8	Northing: 301619.3	Ground Level: 7.91mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
						Grassed brown clayey silty TOPSOIL		
0.25	ES		7.66	0.25		Brown clayey SILT		
0.60	B			(0.65)				
			7.01	0.90		Very loose/very soft brown becoming grey slightly gravelly clayey SILT. Gravel is fine to coarse angular to round of mudstone and siltstone		
1.00	EW							
1.30	B	PP 1.30m, <5kPa						
		PP 1.70m, <5kPa		(1.90)				
		PP 2.10m, <5kPa						
2.20	B							
2.60	B	PP 2.60m, <5kPa						
			5.11	2.80		100mm band of organic matter comprising leaf litter		
			5.01	2.90		Grey slightly silty SAND and GRAVEL with occasional small - medium cobbles. Gravel is fine to coarse angular to round of mudstone quartz siltstone and sandstone		
			4.81	3.10		End of Trial Pit at 3.10m		

1 2 3

Dimensions:

Final Depth: 3.10m



Inclination: °

General Remarks:

PP = Pocket Penetrometer Test. Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.00			0		Groundwater slowly continuing to rise from

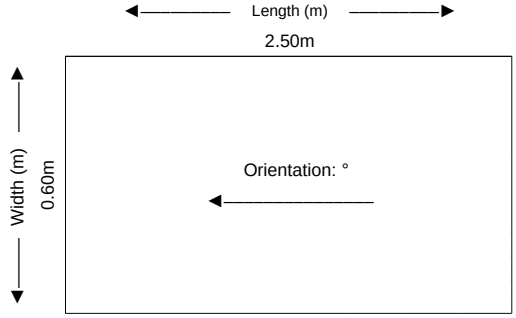
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP06
	Contract Number: CCG-C-15-8700	Date Started: 25/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274535.7	Northing: 301659.4	Ground Level: 8.22mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details					
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description	Water	Backfill
			7.97	0.25		Grassed dark brown clayey silty TOPSOIL		
0.30	ES					Very loose/very soft brown clayey SILT		
0.80	B							
		PP 1.20m, <5kPa		(1.75)				
		PP 1.60m, <5kPa						
1.80	B							
		PP 2.10m, <5kPa	6.22	2.00		Very loose/very soft grey clayey SILT with some mudstone / siltstone gravel inclusions at the base		
2.20	B							
		PP 2.70m, <5kPa		(1.00)				
			5.22	3.00		Organic layer comprising leaf litter		
3.10	B		5.12	3.10		Grey slightly silty SAND and GRAVEL with occasional small cobbles. Gravel is fine to coarse angular to round of mudstone and siltstone		
			5.02	3.20		End of Trial Pit at 3.20m		

1 2 3

Dimensions:

Final Depth: 3.20m



Inclination: °

General Remarks:

PP = Pocket Penetrometer Test. Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.30			0		Groundwater slowly continuing to rise from

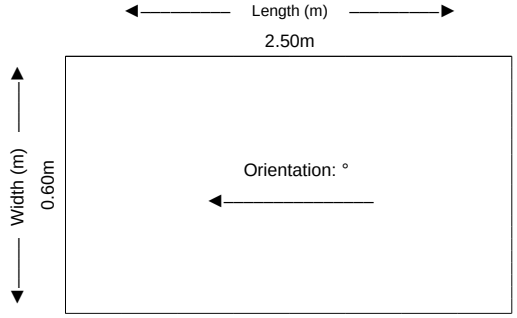
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP07
	Contract Number: CCG-C-15-8700	Date Started: 26/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 374555.1	Northing: 3016841.9	Ground Level: 8.31mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain		Hole Termination:		Stability: Unstable	

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			8.06	0.25		Grassed dark brown clayey silty TOPSOIL		
0.30	ES					Brown clayey SILT		
0.60	B			(0.85)				
			7.21	1.10		Very loose/very soft brown clayey SILT		
1.20	B	PP 1.30m, <5kPa						
1.60	B	PP 1.80m, <5kPa		(0.90)				
			6.31	2.00		Very loose/very soft grey clayey SILT		
2.30	B	PP 2.20m, <5kPa						
2.50	EW	PP 2.70m, <5kPa		(1.00)				
			5.31	3.00		End of Trial Pit at 3.00m		

1 2 3

Dimensions:

Final Depth: 3.00m



Inclination: °

General Remarks:

PP = Pocket Penetrometer Test. Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
2.50			0		Groundwater slowly continuing to rise from

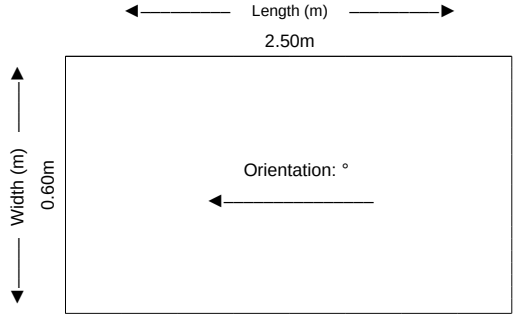
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP08
	Contract Number: CCG-C-15-8700	Date Started: 25/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274577.2	Northing: 301704.2	Ground Level: 8.31mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain		Hole Termination:		Stability: Unstable	

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			8.11	0.20		Grassed dark brown clayey silty TOPSOIL		
0.30	ES					Brown clayey SILT		
0.70	B			(1.20)				
1.10	B							
1.10	EW							
			6.91	1.40		Very loose/very soft grey clayey SILT		
		PP 1.60m, <5kPa						
				(0.70)				
		PP 1.90m, <5kPa						
			6.21	2.10		Grey slightly silty SAND and GRAVEL with occasional cobbles. Gravel is fine to coarse subangular to round of mudstone siltstone quartz feldspar and sandstone		
2.20	B							
				(0.60)				
2.60	B							
			5.61	2.70		End of Trial Pit at 2.70m		

1 2 3

Dimensions:

Final Depth: 2.70m



Inclination: °

General Remarks:

PP = Pocket Penetrometer Test. Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.10			0		Groundwater slowly continuing to rise from

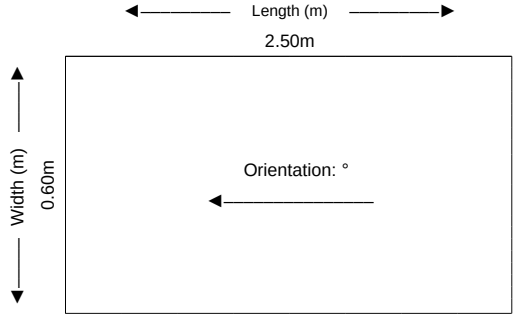
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP09
	Contract Number: CCG-C-15-8700	Date Started: 24/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274607.2	Northing: 301734.0	Ground Level: 8.44mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			8.24	0.20		Grassed dark brown silty clayey TOPSOIL		
						Brown clayey SILT		
0.50	ES							
0.80	B			(1.50)				
1.60	B							
			6.74	1.70		Grey slightly silty SAND and GRAVEL with occasional cobbles. Gravel is fine to coarse angular to subround of mudstone siltstone quartz and sandstone		
1.80	B							
2.30	B			(1.10)				
2.70	B							
			5.64	2.80		End of Trial Pit at 2.80m		

1 2 3

Dimensions:

Final Depth: 2.80m



Inclination: °

General Remarks:

Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.50			0		Groundwater slowly continuing to rise from

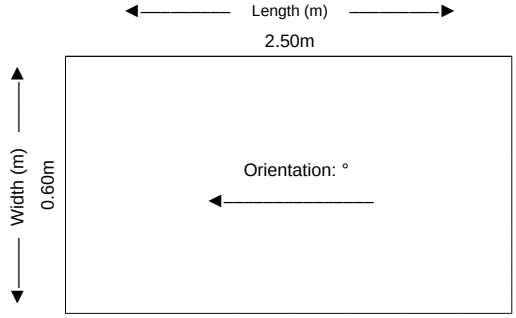
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP10
	Contract Number: CCG-C-15-8700	Date Started: 24/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274631.3	Northing: 301755.9	Ground Level: 8.23mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			7.98	0.25		Grassed dark brown silty clayey TOPSOIL		
						Brown clayey SILT		
0.50	ES			(0.95)				
0.90	B							
1.20	B		7.03	1.20		Grey slightly silty SAND and GRAVEL with occasional cobbles. Gravel is fine to coarse angular to subround of mudstone quartz feldspar siltstone and sandstone		
1.90	B			(1.20)				
2.20	B							
			5.83	2.40		End of Trial Pit at 2.40m		

1 2 3

Dimensions:

Final Depth: 2.40m



Inclination: °

General Remarks:

Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.30			0		Groundwater slowly continuing to rise from

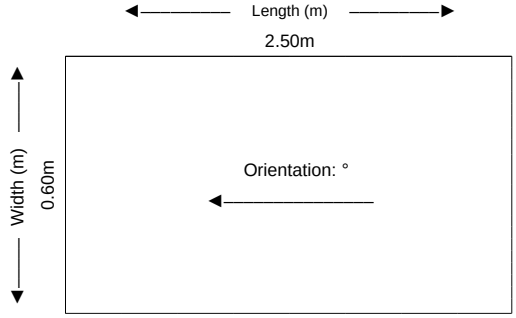
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP11
	Contract Number: CCG-C-15-8700	Date Started: 24/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274665.7	Northing: 301785.1	Ground Level: 8.53mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			8.33	0.20		Grassed dark brown silty clayey TOPSOIL		
						Brown clayey SILT		
0.50	ES			(0.80)				
0.90	B		7.53	1.00				
						Grey slightly silty gravelly SAND with occasional cobbles. Gravel is fine to coarse angular to round of mudstone quartz sandstone and siltstone		
1.40	B							
1.70	B			(1.50)				
2.40	B		6.03	2.50		End of Trial Pit at 2.50m		

1 2 3

Dimensions:

Final Depth: 2.50m



Inclination: °

General Remarks:

Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.50			0		Groundwater slowly continuing to rise from

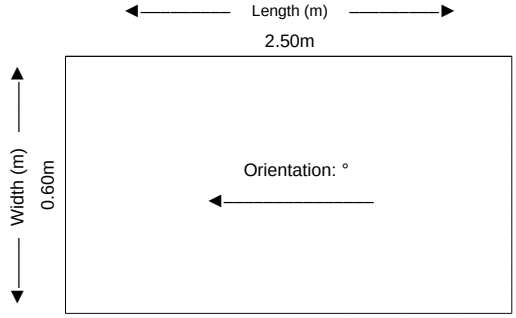
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP12
	Contract Number: CCG-C-15-8700	Date Started: 24/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274682.9	Northing: 301804.1	Ground Level: 8.52mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			8.32	0.20		Grassed dark brown silty clayey TOPSOIL		
						Brown clayey SILT		
0.60	ES			(0.80)				
1.00	B		7.52	1.00		Grey slightly silty gravelly SAND with occasional cobbles. Gravel is fine to coarse angular to round of mudstone sandstone quartz and siltstone		
1.20	B							
				(1.40)				
1.90	B							
2.40	B		6.12	2.40		End of Trial Pit at 2.40m		

1 2 3

Dimensions:

Final Depth: 2.40m



Inclination: °

General Remarks:

Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.10			0		Groundwater slowly continuing to rise from

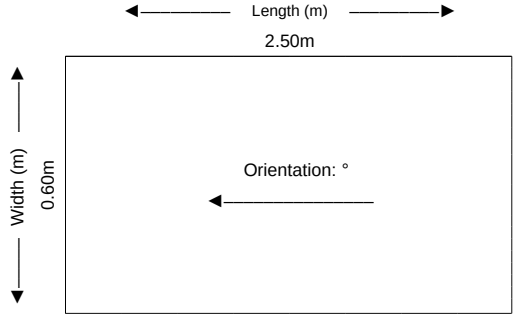
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP13
	Contract Number: CCG-C-15-8700	Date Started: 24/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274703.5	Northing: 301822.3	Ground Level: 8.78mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			8.58	0.20		Grassed dark brown clayey silty TOPSOIL		
						Brown clayey SILT		
0.60	ES							
0.80	B			(1.30)				
1.40	B		7.28	1.50				
						Grey slightly silty SAND and GRAVEL. Gravel is fine to coarse angular to subround of quartz feldspar rhyolite mudstone siltstone and sandstone		
1.70	B							
				(1.20)				
2.30	B							
2.60	B		6.08	2.70		End of Trial Pit at 2.70m		

1 2 3

Dimensions:

Final Depth: 2.70m



Inclination: °

General Remarks:

Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.50			0		Groundwater slowly continuing to rise from

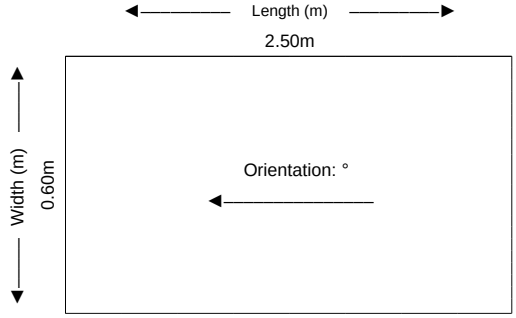
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP14
	Contract Number: CCG-C-15-8700	Date Started: 24/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274732.0	Northing: 301850.5	Ground Level: 8.59mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			8.39	0.20		Grassed dark brown silty clayey TOPSOIL		
						Brown clayey SILT		
0.60	ES			(1.20)				
0.90	B							
1.20	B							
			7.19	1.40		Grey slightly silty SAND and GRAVEL with frequent cobbles. Gravel is fine to coarse angular to round of siltstone quartz sandstone and mudstone		
1.60	B							
				(1.10)				
			6.09	2.50		End of Trial Pit at 2.50m		

1 2 3

Dimensions:

Final Depth: 2.50m



Inclination: °

General Remarks:

Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.30			0		Groundwater slowly continuing to rise from

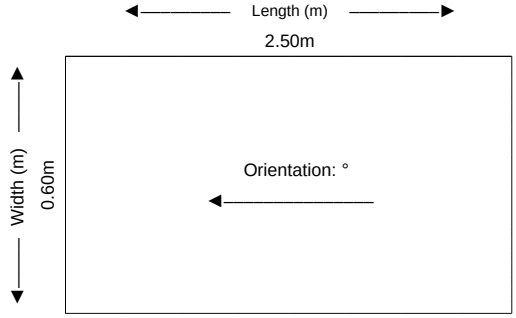
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP15
	Contract Number: CCG-C-15-8700	Date Started: 24/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274755.0	Northing: 301874.2	Ground Level: 9.64mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			9.39	0.25		Grassed dark brown clayey silty TOPSOIL		
						Brown clayey SILT		
0.60	ES			(0.85)				
0.90	B							
			8.54	1.10		Grey slightly silty SAND and GRAVEL with frequent cobbles. Gravel is fine to coarse angular to round of quartz mudstone siltstone and sandstone		
1.50	B							
1.70	EW			(1.40)				
2.00	B							
2.50	B		7.14	2.50		End of Trial Pit at 2.50m		

1 2 3

Dimensions:

Final Depth: 2.50m



Inclination: °

General Remarks:

Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.70			0		Groundwater slowly continuing to rise from

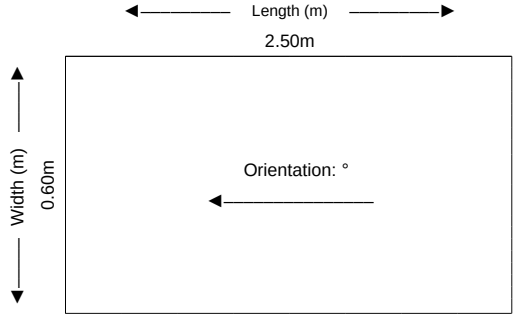
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP16
	Contract Number: CCG-C-15-8700	Date Started: 24/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274778.6	Northing: 301898.4	Ground Level: 8.92mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain		Hole Termination:		Stability: Unstable	

Samples & In Situ Testing			Strata Details					
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description	Water	Backfill
			8.72	0.20		Grassed dark brown silty clayey TOPSOIL		
0.50	ES			(0.50)		Brown clayey slightly gravelly SILT. Gravel is fine to coarse angular to subround of mudstone and siltstone		
			8.22	0.70		Grey slightly silty occasionally cobbly SAND and GRAVEL. Gravel is fine to coarse angular to subround of mudstone siltstone quartz and sandstone extending from 1.70-2.00mbgl		
1.20	B			(1.30)				
1.60	B							
			6.92	2.00		Very loose/very soft grey clayey SILT		
2.10	B	PP 2.20m, <5kPa						
				(1.00)				
		PP 2.60m, <5kPa						
2.80	B	PP 2.80m, <5kPa						
			5.92	3.00		End of Trial Pit at 3.00m		

1 2 3

Dimensions:

Final Depth: 3.00m



Inclination: °

General Remarks:

PP = Pocket Penetrometer Test. Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.90			0		Groundwater slowly continuing to rise from

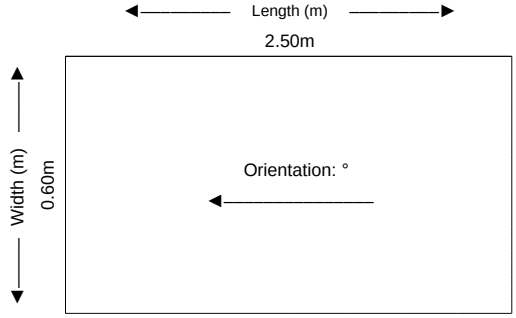
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP17
	Contract Number: CCG-C-15-8700	Date Started: 24/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274804.4	Northing: 301922.9	Ground Level: 9.30mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			9.05	0.25		Grassed dark brown silty clayey TOPSOIL		
0.50	ES					Brown becoming grey clayey SILT		
0.80	B			(1.45)				
1.10	B							
1.70	B		7.60	1.70		Grey slightly silty cobbly SAND and GRAVEL. Gravel is fine to coarse angular to round of mudstone sandstone quartz and siltstone		
2.00	B			(1.10)				
2.80	B		6.50	2.80		End of Trial Pit at 2.80m		

1 2 3

Dimensions:

Final Depth: 2.80m



Inclination: °

General Remarks:

Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.80			0		Groundwater slowly continuing to rise from

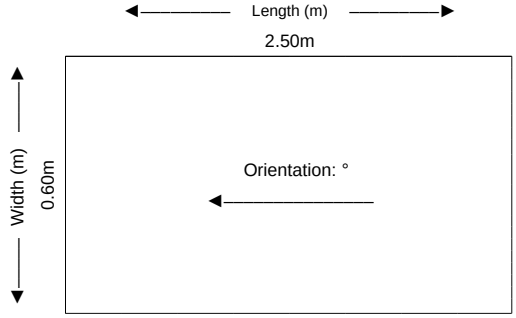
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP18
	Contract Number: CCG-C-15-8700	Date Started: 24/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274829.1	Northing: 301944.3	Ground Level: 8.24mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details					
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description	Water	Backfill
			8.09	0.15		Grassed dark brown clayey silty TOPSOIL		
0.25	ES			(0.45)		Grey slightly silty slightly cobbly SAND and GRAVEL. Gravel is fine to coarse angular to subround of mudstone quartz and siltstone		
			7.64	0.60				
0.70	B					Grey becoming brown clayey SILT		
				(1.20)				
1.30	B							
			6.44	1.80				
2.00	B					Grey slightly silty occasionally cobbly SAND and GRAVEL. Gravel is fine to coarse angular to subround of mudstone quartz sandstone and siltstone		
				(1.00)				
2.60	B							
			5.44	2.80		End of Trial Pit at 2.80m		

1 2 3

Dimensions:

Final Depth: 2.80m



Inclination: °

General Remarks:

Groundwater slowly continuing to rise from recorded level.

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.80			0		Groundwater slowly continuing to rise from

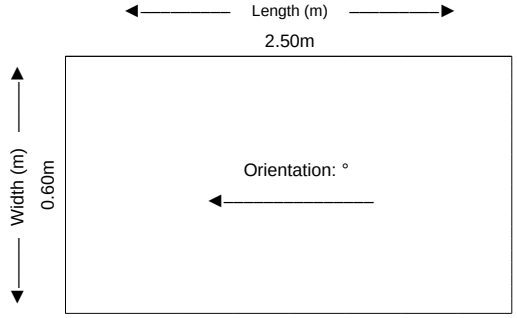
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP19
	Contract Number: CCG-C-15-8700	Date Started: 24/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274858.2	Northing: 301974.7	Ground Level: 8.44mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Rain	Hole Termination:		Stability: Unstable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			8.19	0.25		Grassed dark brown clayey silty TOPSOIL		
0.40	ES			(0.35)		Brown slightly gravelly sandy SILT		
0.70	B		7.84	0.60		Grey slightly silty occasionally cobbly SAND and GRAVEL. Gravel is fine to coarse angular to subround of mudstone siltstone sandstone and quartz		
1.00	EW							
				(1.20)				
1.60	B							
			6.64	1.80		End of Trial Pit at 1.80m		

1 2 3

Dimensions:

Final Depth: 1.80m



Inclination: °

General Remarks:

Water Strikes

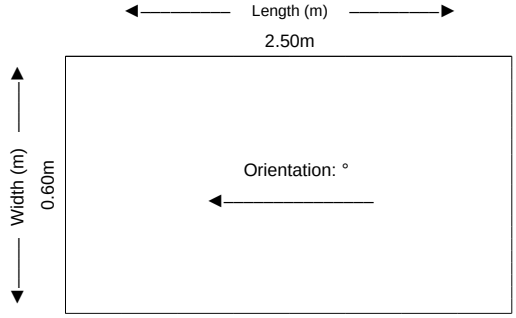
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
1.00			0		Groundwater slowly continuing to rise from

	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP20
	Contract Number: CCG-C-15-8700	Date Started: 06/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274898.1	Northing: 302027.4	Ground Level: 15.70mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Dry	Hole Termination:		Stability: Stable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			15.60	0.10		Grassed dark brown sandy clayey TOPSOIL		
0.30	ES			(0.55)		MADE GROUND comprising dark brown / grey slightly silty clayey sands and gravel with occasional fragments of wood and shards of plastic. Gravel is fine to coarse angular to subround of ceramic brick mortar glass tarmac concrete and sandstone		
			15.00	0.70		MADE GROUND comprising brown occasionally clayey sands and gravel with occasional cobbles and rare boulder. Gravel is fine to coarse angular to subround of mudstone siltstone sandstone slate ceramic glass roofing tile coal cinders glass brick and concrete		
1.40	ES							
				(2.40)				
2.50	ES							
			12.60	3.10		End of Trial Pit at 3.10m		

Dimensions:

Final Depth: 3.10m



Inclination: °

General Remarks:

No groundwater encountered

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0		TP dry

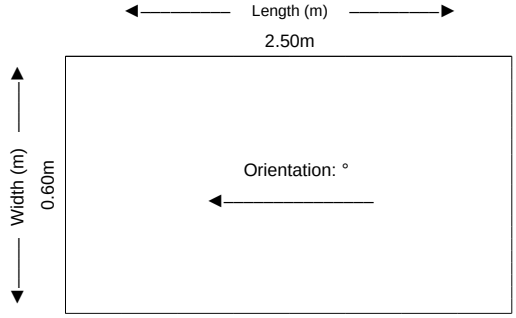
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP21
	Contract Number: CCG-C-15-8700	Date Started: 26/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274915.1	Northing: 302027.2	Ground Level: 15.48mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Dry	Hole Termination:		Stability: Stable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			15.38	0.10		Grassed dark brown clayey TOPSOIL		
0.30	ES			(0.70)		MADE GROUND comprising dark brown clayey sands and gravel with occasional fragments of wood pieces of metal and shards of plastic. Gravel is fine to coarse angular to subround of brick concrete glass and tarmac		
			14.68	0.80				
0.90	ES					MADE GROUND comprising grey occasionally red then dark brown slightly silty occasionally clayey sand and gravel with frequent cobbles and occasional boulders. Gravel is fine to coarse angular to subround of mudstone siltstone glass ceramic coal cinders mortar brick and concrete		
1.90	ES			(2.30)				
3.10	ES		12.38	3.10		End of Trial Pit at 3.10m		

1 2 3

Dimensions:

Final Depth: 3.10m



Inclination: °

General Remarks:

No groundwater encountere

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0		TP dry

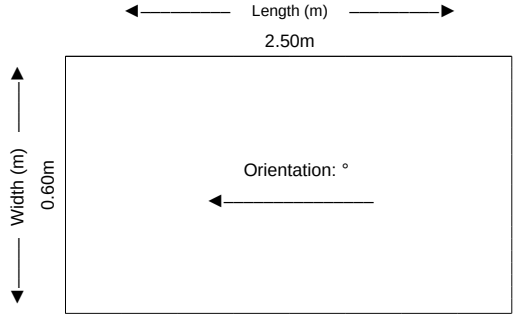
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP22
	Contract Number: CCG-C-15-8700	Date Started: 26/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274971.4	Northing: 302067.7	Ground Level: 15.04mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Wet	Hole Termination:		Stability: Stable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
0.30	ES			(0.60)		Dark brown silty gravelly SAND with occasional thin - thick roots. Gravel is fine to coarse subangular to subround of mudstone and siltstone (TOPSOIL / SUBSOIL)		
0.70	B		14.44	0.60		Dark brown becoming brown clayey SILT with occasional small - medium gravels. Gravel is fine to coarse subangular to subround of mudstone and siltstone		
1.20	B			(0.80)				
2.00	B		13.64	1.40		Brown becoming dark brown slightly silty occasionally cobbly SAND and GRAVEL. Gravel is fine to coarse angular to round of mudstone quartz siltstone and sandstone		
2.50	B			(1.50)				
			12.14	2.90		End of Trial Pit at 2.90m		

1 2 3

Dimensions:

Final Depth: 2.90m



Inclination: °

General Remarks:

No groundwater encountere

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0		TP dry

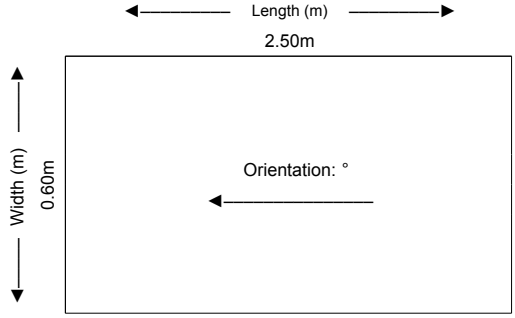
	Contract Name: A487 New Dyfi Bridge		Client: Alun Griffiths Contractors Limited		Trial Pit ID: TP24
	Contract Number: CCG-C-15-8700	Date Started: 26/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274898.0	Northing: 302075.3	Ground Level: 17.90mAOD	Plant Used: Tracked Excavator	Date Printed: 06/07/2016 — Scale: 1:25
Weather: Dry	Hole Termination:		Stability: Stable		

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			17.80	0.10		Grassed dark brown clayey TOPSOIL		
0.35	ES					Orange/red slightly sandy gravelly SILT. Gravel is fine to coarse angular to subround of mudstone and siltstone		
0.70	B			(1.10)				
0.90	B							
			16.70	1.20		Grey weathered MUDSTONE recovered a slightly silty occasionally cobbly sands and gravel		
				(0.30)				
1.50	B		16.40	1.50		Grey MUDSTONE. Bedrock recovered as very dense slightly silty cobbly sand and gravel. Unable to progress trial pit beyond 1.7mbgl in mudstone strata		
			16.20	1.70		End of Trial Pit at 1.70m		

1 2 3

Dimensions:

Final Depth: 1.70m



Inclination: °

General Remarks:

No groundwater encountered. Becoming very hard digging below 1.50mbgl

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0		TP dry

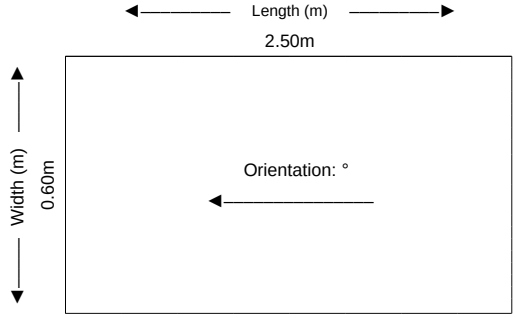
	Contract Name: A487 New Dyfi Bridge		Client: Arup / Alun Griffiths Contractors		Trial Pit ID: TP25
	Contract Number: CCG-C-15-8700	Date Started: 26/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274918.3	Northing: 302093.8	Ground Level: 19.30mAOD	Plant Used: Tracked Excavator	Date Printed: 26/02/2016 — Scale: 1:25
Weather: Dry		Hole Termination:		Stability: Stable	

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			19.20	0.10		Grassed dark brown clayey TOPSOIL		
0.25	ES			(0.70)		Brown becoming dark brown slightly sandy gravelly SILT. Gravel is fine to coarse angular to subround of mudstone and siltstone		
0.70	B		18.50	0.80		Grey weathered MUDSTONE recovered as slightly silty sands and gravel with frequent cobbles and occasional boulders		
1.10	B			(0.90)				
			17.60	1.70		Grey MUDSTONE. Bedrock recovered as very dense slightly silty cobbly sand and gravel		
1.90	B		17.40	1.90		End of Trial Pit at 1.90m		

1 2 3

Dimensions:

Final Depth: 1.90m



Inclination: °

General Remarks:

No groundwater encountered. Unable to excavate below 1.90mbgl

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0		TP dry

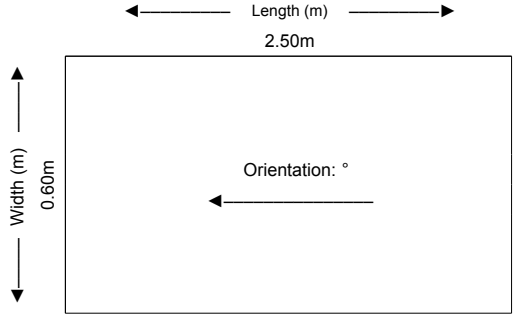
	Contract Name: A487 New Dyfi Bridge		Client: Alun Griffiths Contractors Limited		Trial Pit ID: TP25
	Contract Number: CCG-C-15-8700	Date Started: 26/11/2015	Logged By: TG	Checked By: TG/CB	Status: FINAL — Sheet 1 of 1
Trial Pit Log	Easting: 274918.3	Northing: 302093.8	Ground Level: 19.30mAOD	Plant Used: Tracked Excavator	Date Printed: 06/07/2016 — Scale: 1:25
Weather: Dry		Hole Termination:		Stability: Stable	

Samples & In Situ Testing			Strata Details				Water	Backfill
Depths	Sample ID	Test Result	Reduced Level	Depth (m) (Thickness)	Legend	Strata Description		
			19.20	0.10		Grassed dark brown clayey TOPSOIL		
0.25	ES			(0.70)		Brown becoming dark brown slightly sandy gravelly SILT. Gravel is fine to coarse angular to subround of mudstone and siltstone		
0.70	B		18.50	0.80		Grey weathered MUDSTONE recovered as slightly silty sands and gravel with frequent cobbles and occasional boulders		
1.10	B			(0.90)				
			17.60	1.70		Grey MUDSTONE. Bedrock recovered as very dense slightly silty cobbly sand and gravel. Unable to progress trial pit beyond 1.97mbgl in mudstone strata		
1.90	B		17.40	1.90		End of Trial Pit at 1.90m		

1 2 3

Dimensions:

Final Depth: 1.90m



Inclination: °

General Remarks:

No groundwater encountered. Unable to excavate below 1.90mbgl

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0		TP dry

APPENDIX 5: TRIAL PIT PHOTOGRAPHS



TP01: Soil Profile



TP01: Soil Arisings



TP02: Unspecified 200mm pipe standing at 0.6mbgl
TP02: Soil Profile





TP02: Soil Arisings



TP03: Soil Profile
TP03: Soil Arisings





TP04: Soil Profile
TP04: Soil Arisings





TP05: Soil Profile
TP05: Soil Arisings





TP06: Soil Profile
TP06: Soil Arisings





TP07: Soil Profile
TP07: Soil Arisings





TP08: Soil Profile
TP08: Soil Arisings





TP09: Soil Profile
TP09: Soil Arisings





TP10: Soil Profile
TP10: Soil Arisings





TP11: Soil Profile
TP11: Soil Arisings





TP12: Soil Profile



TP12: Soil Arisings



TP13: Soil Profile
TP13: Soil Arisings





TP14: Soil Profile
TP14: Soil Arisings





TP15: Soil Profile



TP15: Soil Arisings



TP16: Soil Profile
TP16: Soil Arisings





TP17: Soil Profile



TP17: Soil Arisings



TP18: Soil Profile
TP18: Soil Arisings





TP19: Soil Profile



TP19: Soil Arisings



TP20: Soil Profile
TP20: Soil Arisings





TP21: Soil Profile
TP21: Soil Arisings





TP22: Soil Profile
TP22: Soil Arisings





TP24: Soil Profile
TP24: Soil Arisings





TP25: Soil Profile



TP25: Soil Arisings

APPENDIX 6: SAMPLING METHODOLOGIES

SAMPLING, SAMPLE TRANSPORTATION, AND FIELD MONITORING PROTOCOLS

Soil, water and gas sampling and monitoring methodologies employed by ***CC GEOTECHNICAL LTD*** are presented hereunder.

SAMPLING OF SOIL FOR CHEMICAL ANALYSIS

Soil samples may be recovered from a variety of intrusive investigation methods including *inter alia* dynamic sampling boreholes, cable percussion boreholes, machine or manual excavation of trial pits.

All equipment which has the potential to introduce extraneous materials into soils – borehole casings, sampling drilling rods, borehole sampling tools, hand tools such as trowels and spades etc. – must be cleaned by jet washing before initial use and between sampling positions.

Cable Percussion Boreholes

In this method of investigation disturbed bulk and small disturbed samples are recovered at regular depth increments throughout the length of the borehole. Each bulk/small disturbed sample is uniquely labelled with the Project Name / Project No / Borehole No / Depth / Date. Where possible, samples are immediately scanned by PID.

Light Dynamic Sampling Boreholes

In this method of investigation samples are recovered in relatively undisturbed 1m long Perspex liners. Each liner is uniquely labelled with the Project Name / Project No / Borehole No / Depth / Date. The liner tubes are sealed by air tight caps fitted at each end, and are temporarily stored out of sunlight. Where possible, samples are immediately split, scanned by PID, logged and subsampled. In the event that splitting and logging on site is not practicable, then the liners are immediately transported to the laboratory where they are immediately split, scanned by PID, logged and subsampled

Trial Pits

Samples are to be taken from the bucket of an excavator and placed in appropriate airtight containers. Each container is uniquely labelled with the Project No / Trial Pit No / Depth / Date. The samples are then immediately placed in a cool box chilled by ice packs, and the boxes are sealed for transportation to the chemical laboratory.

Sampling Containers

Containers used to store soil samples are selected dependant on the required analysis. The testing laboratory will be consulted should there be any doubt as to the correct sampling container. Typically, a minimum of 1nr 1kg plastic tub, 1nr 500g plastic tub, 1nr 250g amber glass jar and 2nr glass vials are taken at each sample depth. Samples held on site awaiting same day courier collection are stored at $4^{O}C$ in a cool box. Only in circumstances where same day collection cannot be arranged are samples held overnight, and in this event all samples are refrigerated at $4\ ^{O}C$ either on site (if a refrigerator is available) or at CC GEOTECHNICAL soil laboratory. Courier collection is then arranged for immediate pick up the following day.

Chain of Custody records

A Chain of Custody Record (CoC) is to be sent with each batch of samples submitted to the testing laboratory. A copy of the CoC will be made available for inspection by the client, their agents, or any requesting regulatory authority.

HEADSPACE ANALYSES

Duplicate subsamples of all soil samples selected for laboratory analysis may be taken for headspace analyses.

Headspace analysis is undertaken using a MiniRae 2000 Photo Ionisation Detector (PID). In the test method, an amber glass jar is half filled with soil, and the lid is sealed with aluminium foil secured by an elastic band. The jar and contents are agitated for 30 seconds and left for a minimum of 30 minutes out of direct sunlight for the headspace to achieve equilibrium. The PID then pierces the seal and the maximum reading is recorded. Prevailing weather conditions and ambient air temperature are also recorded.

The PID headspace results are recorded on the exploratory borehole or trial pit logs.

PID headspace data is then used to inform the chemical testing schedule for volatile organic compounds analyses.

SAMPLING OF GROUNDWATER FOR CHEMICAL ANALYSIS

Groundwater is sampled from standpipes or piezometers installed during borehole drilling. On completion of the construction of the standpipe, the installation is initially developed by removing up to 10 x the internal volume of the

installation. The volume of water purged is recorded. The installation is then typically left for a week for hydraulic equilibrium to be restored.

Prior to sampling the standpipe, the depth to the water table, and the depth to the base of the installation are monitored using an electronic dipmeter. In circumstances where free phase product is suspected to be present, then an 'Interface Meter' is used to determine the free phase film thickness.

A minimum of 3 x the installation volume is then removed. The pH of the water is then monitored and the sample is taken when the change in pH between any two consecutive extracts is less than 10%. The volume of water removed is recorded.

A sample comprises of a minimum of 3 litres. Two litres are taken in amber glass bottles, and one litre in a plastic bottle.

To avoid cross-contamination one bailer is used per position.

The samples are uniquely labelled with Project Name / Project No / Borehole No / Depth / Date Sampled. They are placed in a cool box chilled by ice packs, and the containers are sealed for transportation to the laboratory.

Once the samples are received in the ***CC GEOTECHNICAL LTD*** laboratory, the samples are stored in a refrigerator and returned to the cool boxes once collected.

Water taken from the installations are taken back to the ***CC GEOTECHNICAL LTD*** laboratory and disposed.

Other data recorded in the sampling comprises:

- Volume of water removed during development of well
- Volume of water removed during purging of the well
- Results of on-site pH analyses
- Sample appearance – colour, suspended solids

MONITORING OF GAS

Prior to embarking on a gas-monitoring round, all equipment is checked for functionality and the calibration status is confirmed.

At the commencement of the monitoring round, the prevailing weather conditions, air temperature, barometric pressure and direction of movement of barometric pressure are recorded.

The flow meter is first attached to the standpipe valve, and the flow rate is measured (peak and steady flow) for 1 minute. The results are recorded in $l.hr^{-1}$. The flow meter tube is protected from the effects of wind by aligning the exhaust downwind.

Following measurement of borehole flow rate, the installation is left for a minimum of 10 minutes for the headspace to restore equilibrium.

Once the gas in the installation has regained equilibrium, the gas analyser is connected and monitoring commences. The peak and steady state readings for CH_4, CO_2, CO, H_2S and CO are recorded. The steady state is monitored for a minimum of one minute, and possibly up to a maximum of 10 minutes where fluctuations continue.

When the monitoring is complete, the depth to the water table, and the depth to the base of the well are monitored using an electronic dipmeter. In circumstances where free phase product is suspected to be present, then an 'Interface Meter' is used to determine the free phase film thickness.

APPENDIX 7: ENGINEERING DATA

ALL SOIL ENGINEERING TEST DATA HAS BEEN REPORTED IN LINE WITH EUROCODE 7: RESULTS ARE PRESENTED IN THE FOLLOWING SEQUENCE:

SOILS

- BH1 - BH5
- TP1 - TP25

SUMMARY OF LABORATORY SOIL TEST RESULTS

BH / TP / WS Number	Sample Type	Depth From (m)	Depth To (m)	Moisture Content (%)	Bulk Density (Mg/m³)	Dry Density (Mg/m³)	Shear Strength (kN/m²)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425mm (%)	Soil Classification	UKAS accredited test (Y/N)	Description / Test Method Samples described in accordance with BS EN ISO 14688-2 2004
BH1	B	1.00	1.00	44	-	-	-	44	28	16	98	MI	Y	Brown slightly sandy slightly gravelly clayey SILT. (BS1377Pt2:3.2,4.4,5)
BH1	B	5.00	5.00	-	-	-	-	-	-	-	-	-	Y	Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH1	B	14.00	14.00	-	-	-	-	-	-	-	-	-	Y	Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH1	B	22.00	22.00	-	-	-	-	-	-	-	-	-	Y	Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)

SITE: NEW DYFI BRIDGE (CCG-C-15-8700) DATE: 16.01.16

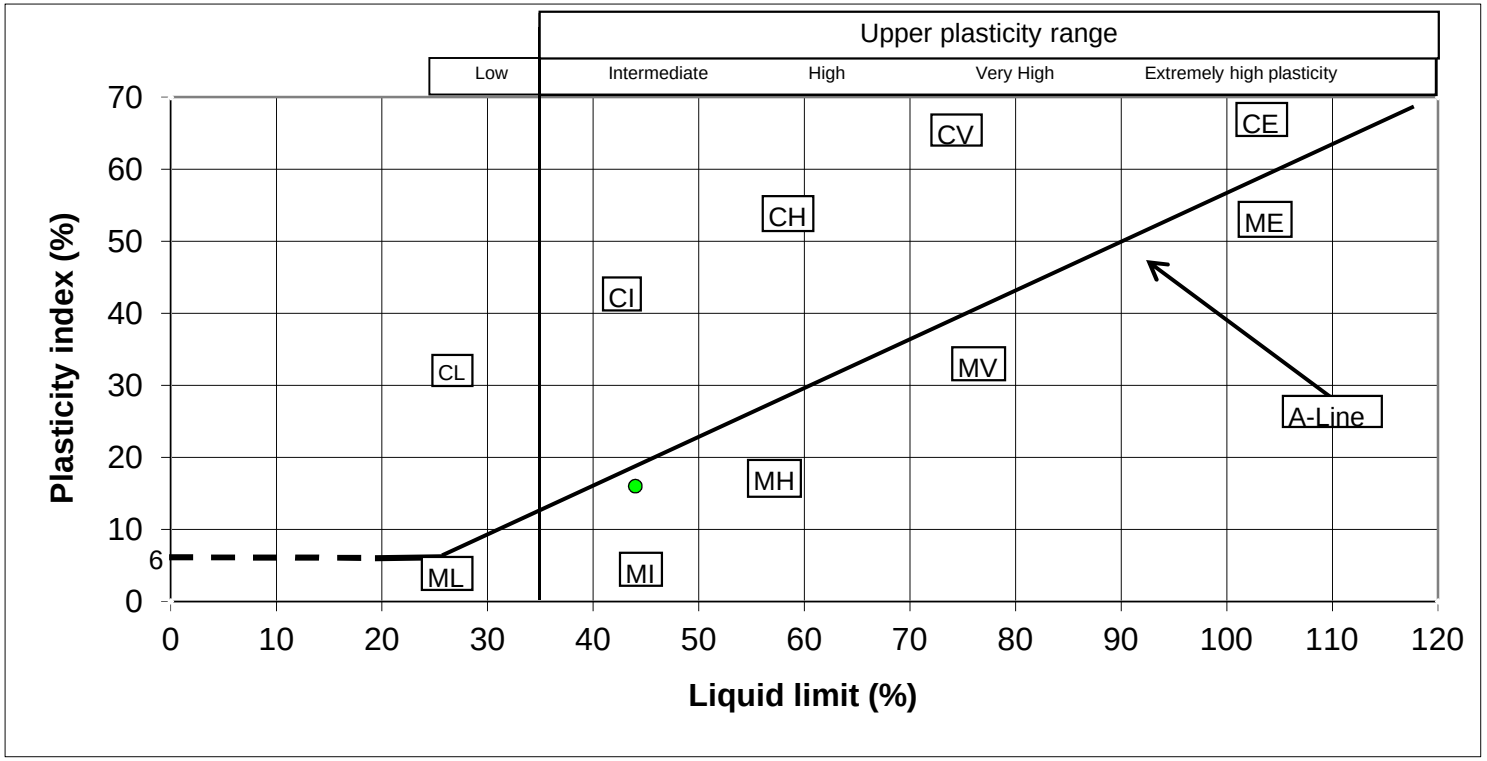
CLIENT: GROUNDSOLVE SHEET: 1 of 1

UKAS TESTING 4514

Key:- BD = Bulk Disturbed; SD = Small Disturbed; U100 = Undisturbed 100mm; WS = Window Sample
CL = Low Plasticity; CI = Intermediate; CH = High; CV = Very high; CE = Extremely high; NP = Non-plastic
(* Denotes Hand Shear Vane test result)
Sample description not accredited by UKAS

ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



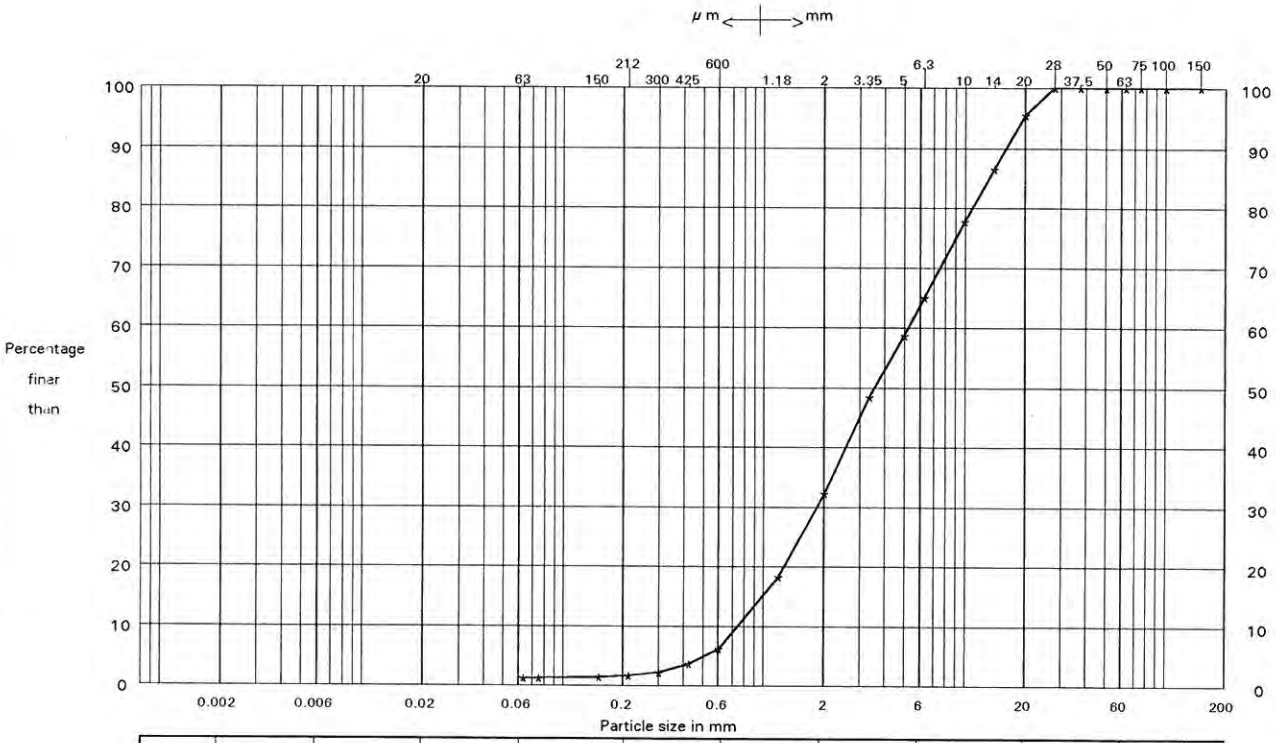
BH	Sample Depth	Liquid limit	Plasticity index
BH1	1.00	44.0	16.0

UKAS TESTING
4514

CLIENT: GROUNDSOLVE	SITE: NEW DYFI BRIDGE (CCG-C-15-8700)

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH1
CLIENT GROUNDSOLVE		SITE NEW DYFI BRIDGE	
SAMPLE DEPTH 5.00 - 5.00		SAMPLE REF 5	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	1	2	2	4	6	18	32	48	59	65	78	86	95	100	100	100	100	100	100	100

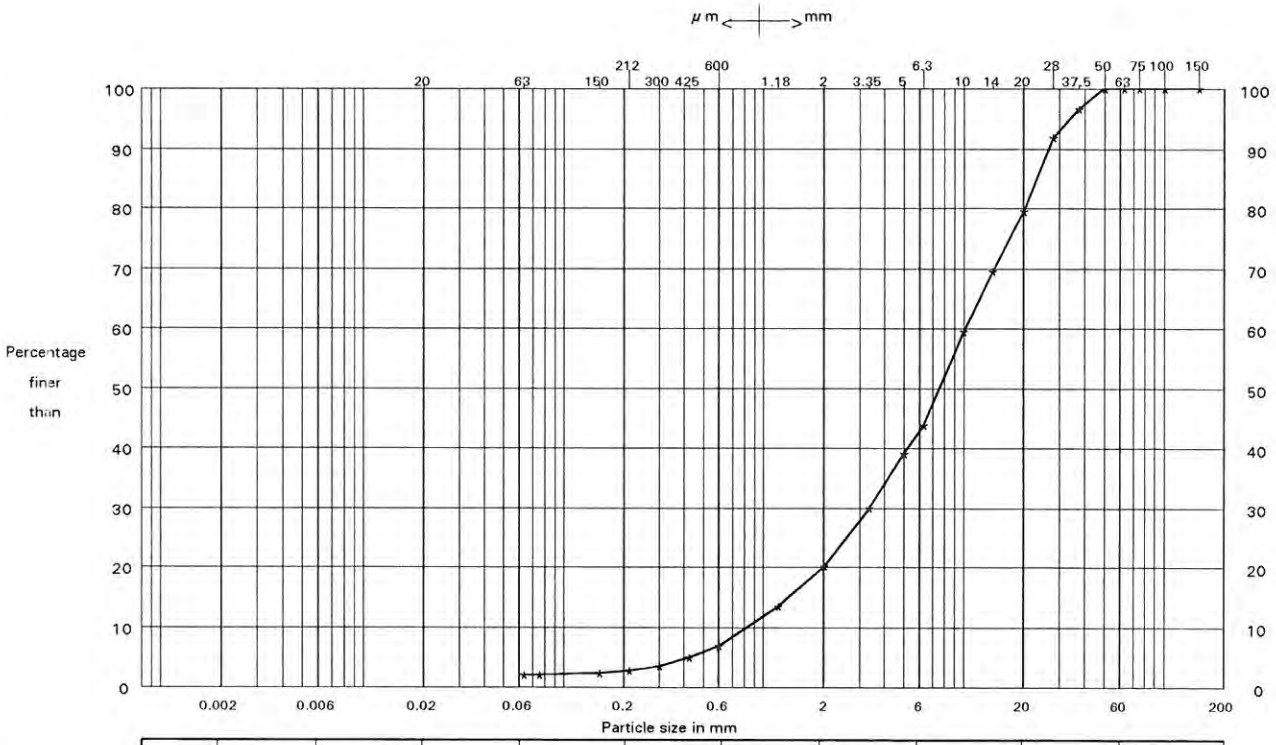


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			31			68			0

SAMPLE DESCRIPTION	REMARKS
Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH1
CLIENT GROUNDSOLVE		SITE NEW DYFI BRIDGE	
SAMPLE DEPTH 14.00 - 14.00		SAMPLE REF 14	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)															
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150	
% by Mass passing Sieve	2	2	2	3	3	5	7	13	20	30	39	44	59	69	79	92	97	100	100	100	100	100	

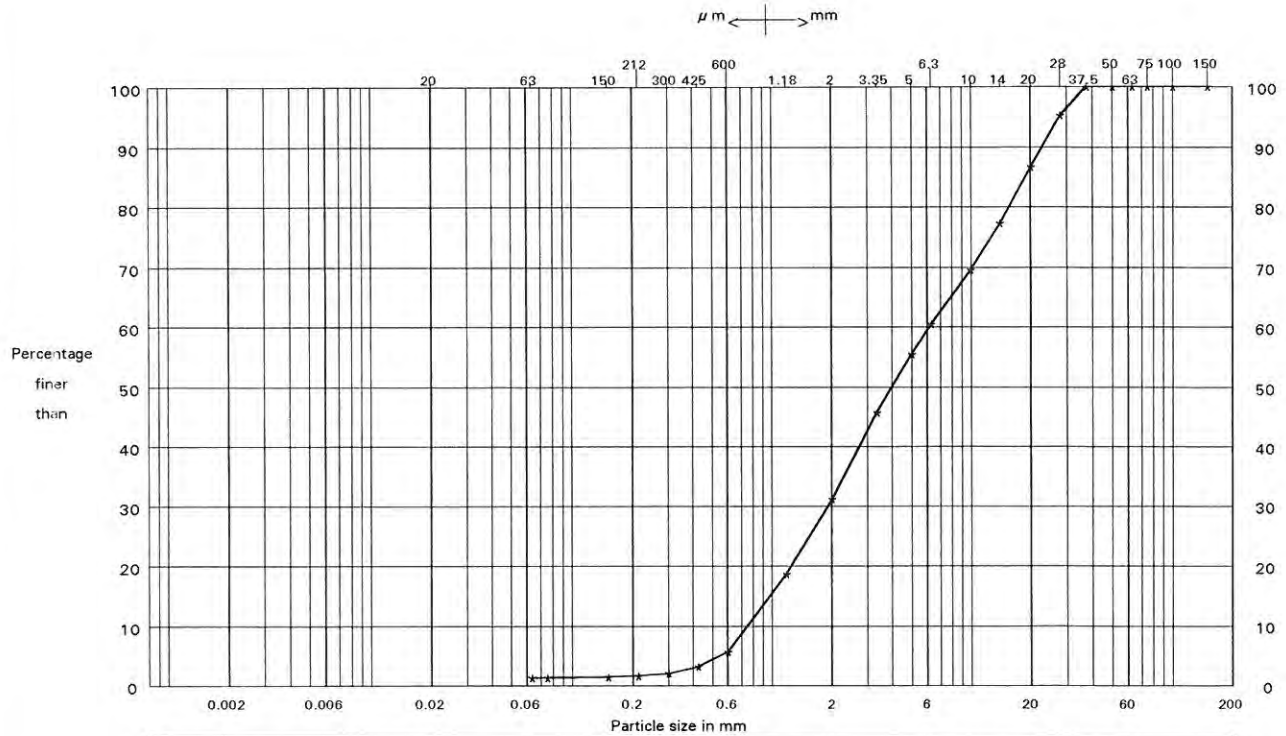


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			18			80			0

SAMPLE DESCRIPTION	REMARKS
Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH1
CLIENT GROUNDSOLVE		SITE NEW DYFI BRIDGE	
SAMPLE DEPTH 22.00 - 22.00		SAMPLE REF 22	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

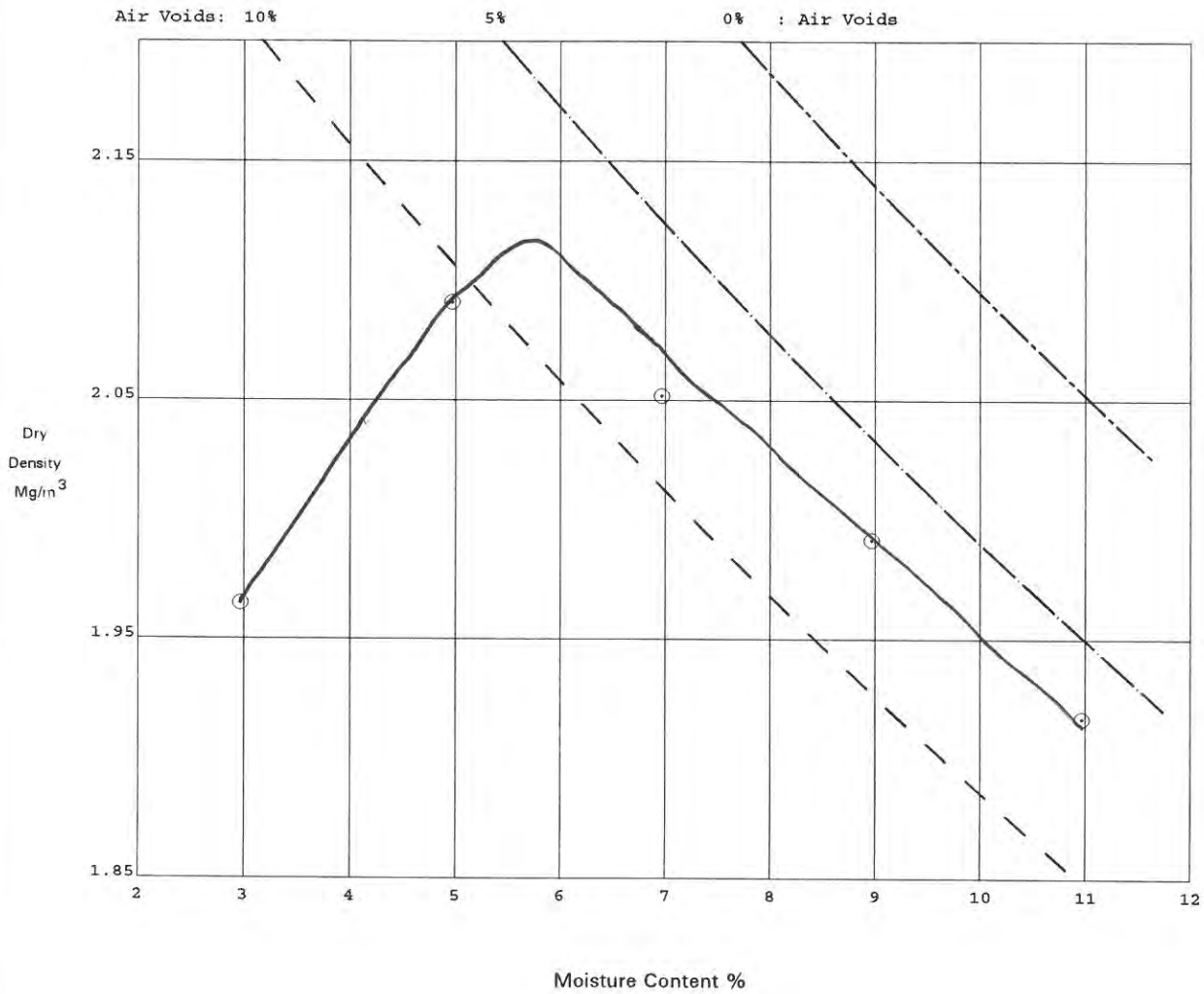
	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	1	2	2	3	6	19	31	46	55	60	70	77	87	95	100	100	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			30			69			0

SAMPLE DESCRIPTION	REMARKS
Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DRY DENSITY/MOISTURE CONTENT RELATIONSHIP	HOLE NO. BH1
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 5.00 - 5.00		SAMPLE REF 5	JOB NO. 15/8700
% MATERIAL RETAINED ON 20mm SIEVE	5.0	MAXIMUM SIZE OF COHESIVE LUMPS	20 mm
% MATERIAL RETAINED ON 37.5mm SIEVE	0.0	SINGLE OR SEPARATE SUBSAMPLES	Separate.
PARTICLE DENSITY	Assumed 2.65 Mg/m^3	TYPE OF MOULD	CBR.
METHOD OF COMPACTION 4.5 kg Rammer Method (BS 1377:Part 4:1990 3.5).		AS RECEIVED MOISTURE CONTENT	9.0 %
MAXIMUM DRY DENSITY	2.11 Mg/m^3	OPTIMUM MOISTURE CONTENT	6.0 %



SAMPLE DESCRIPTION	REMARKS
Grey very sandy slightly silty GRAVEL	

SUMMARY OF LABORATORY SOIL TEST RESULTS

BH / TP / WS Number	Sample Type	Depth From (m)	Depth To (m)	Moisture Content (%)	Bulk Density (Mg/m^3)	Dry Density (Mg/m^3)	Shear Strength (kN/m^2)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425mm (%)	Soil Classification	UKAS accredited test (Y/N)	Description / Test Method Samples described in accordance with BS EN ISO 14688-2 2004
BH2	B	1.00	1.00	48	-	-	-	38	26	12	99	MI	Y	Brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
BH2	B	4.00	4.00	-	-	-	-	-	-	-	-	-	Y	Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH2	B	8.00	8.00	-	-	-	-	-	-	-	-	-	Y	Grey slightly sandy GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH2	B	12.50	12.50	-	-	-	-	-	-	-	-	-	Y	Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH2	B	17.00	17.00	-	-	-	-	-	-	-	-	-	Y	Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH2	B	22.00	22.00	-	-	-	-	-	-	-	-	-	Y	Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH2	B	26.00	26.00	-	-	-	-	-	-	-	-	-	Y	Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH2	B	30.00	30.00	-	-	-	-	-	-	-	-	-	Y	Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)

SITE: DYFI BRIDGE (CCG-C-15-8700)
CLIENT: GROUNDSOLVE

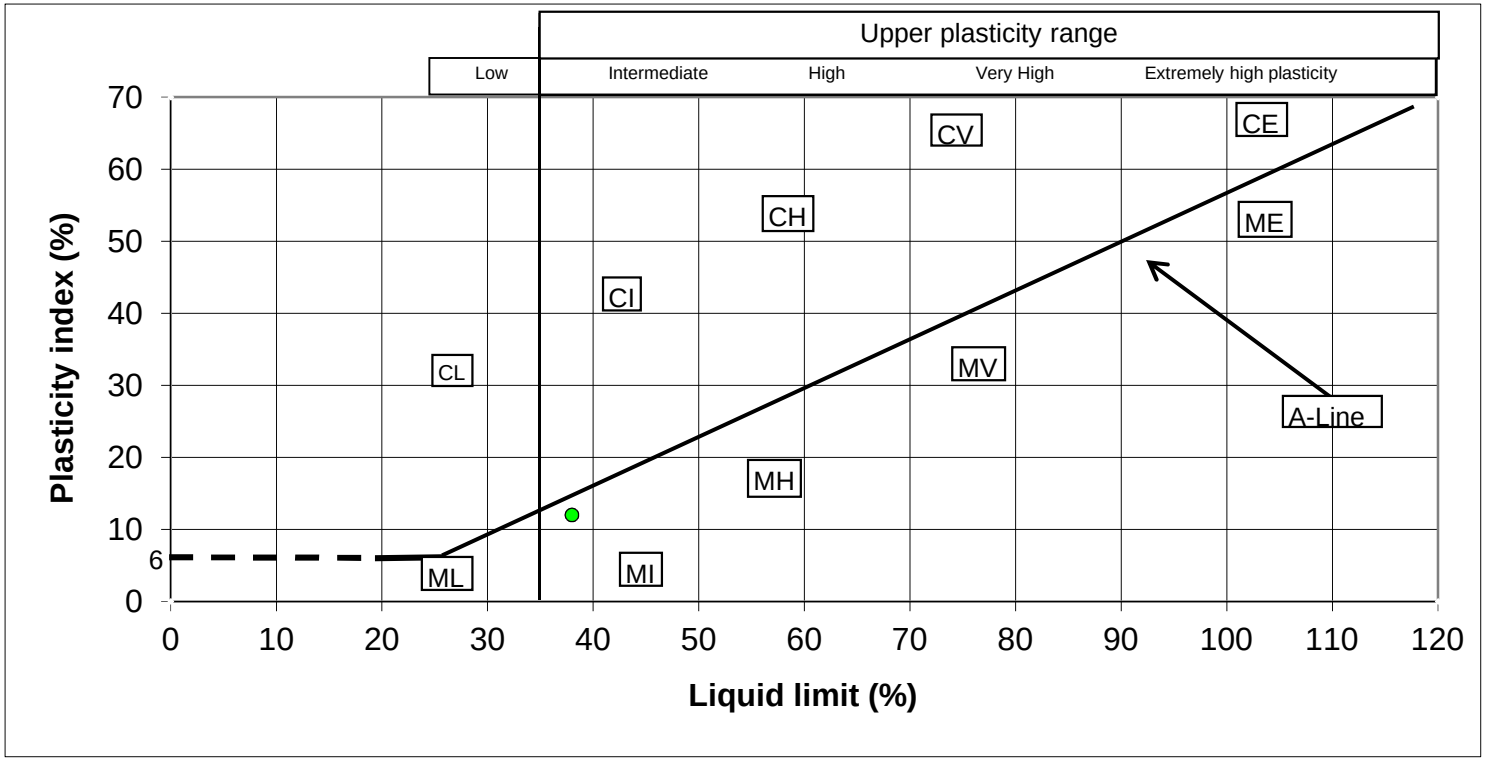
DATE: 18.01.16
SHEET: 1 of 1

UKAS TESTING 4514

Key:- BD = Bulk Disturbed; SD = Small Disturbed; U100 = Undisturbed 100mm; WS = Window Sample
CL = Low Plasticity; CI = Intermediate; CH = High; CV = Very high; CE = Extremely high; NP = Non-plastic
(* Denotes Hand Shear Vane test result)
Sample description not accredited by UKAS

ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



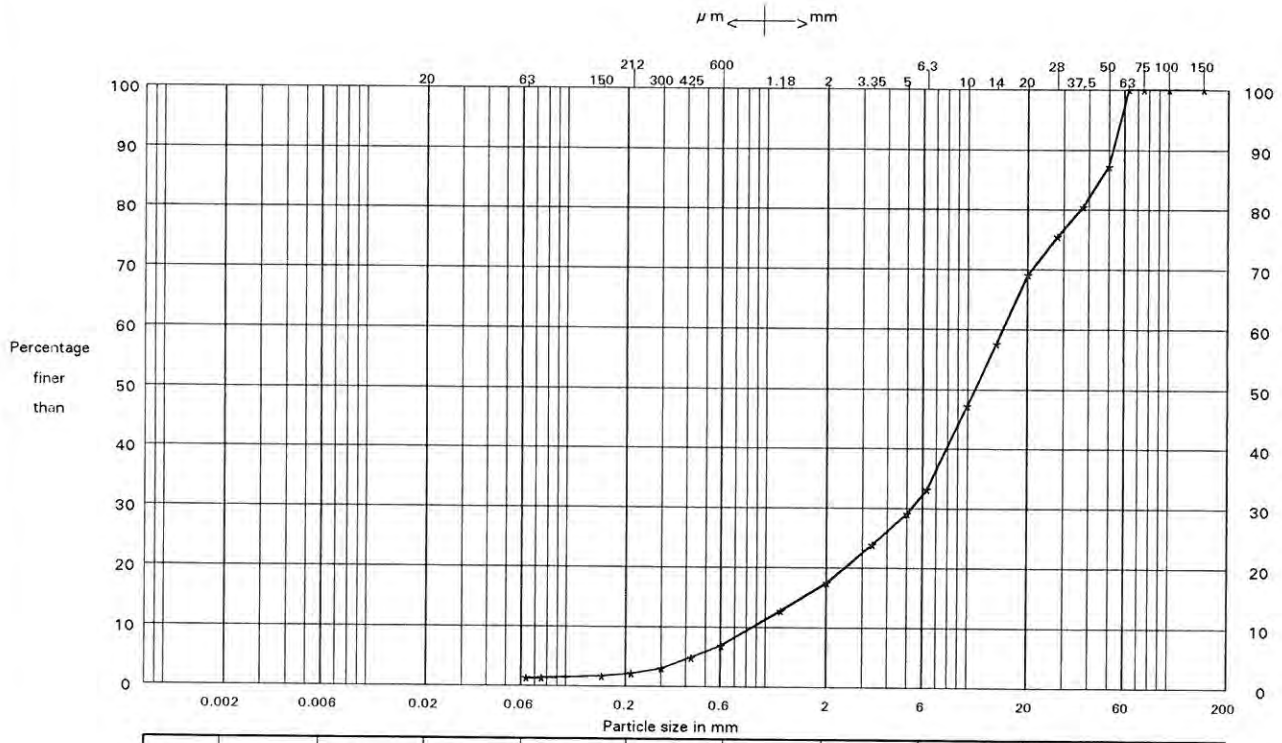
BH	Sample Depth	Liquid limit	Plasticity index
BH2	1.00	38.0	12.0

UKAS TESTING
4514

CLIENT: GROUNDSOLVE	SITE: NEW DYFI BRIDGE (CCG-C-15-8700)

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH2
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 4.00 - 4.00		SAMPLE REF 4	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	2	2	3	5	7	13	17	24	29	33	47	58	69	75	80	87	100	100	100	100

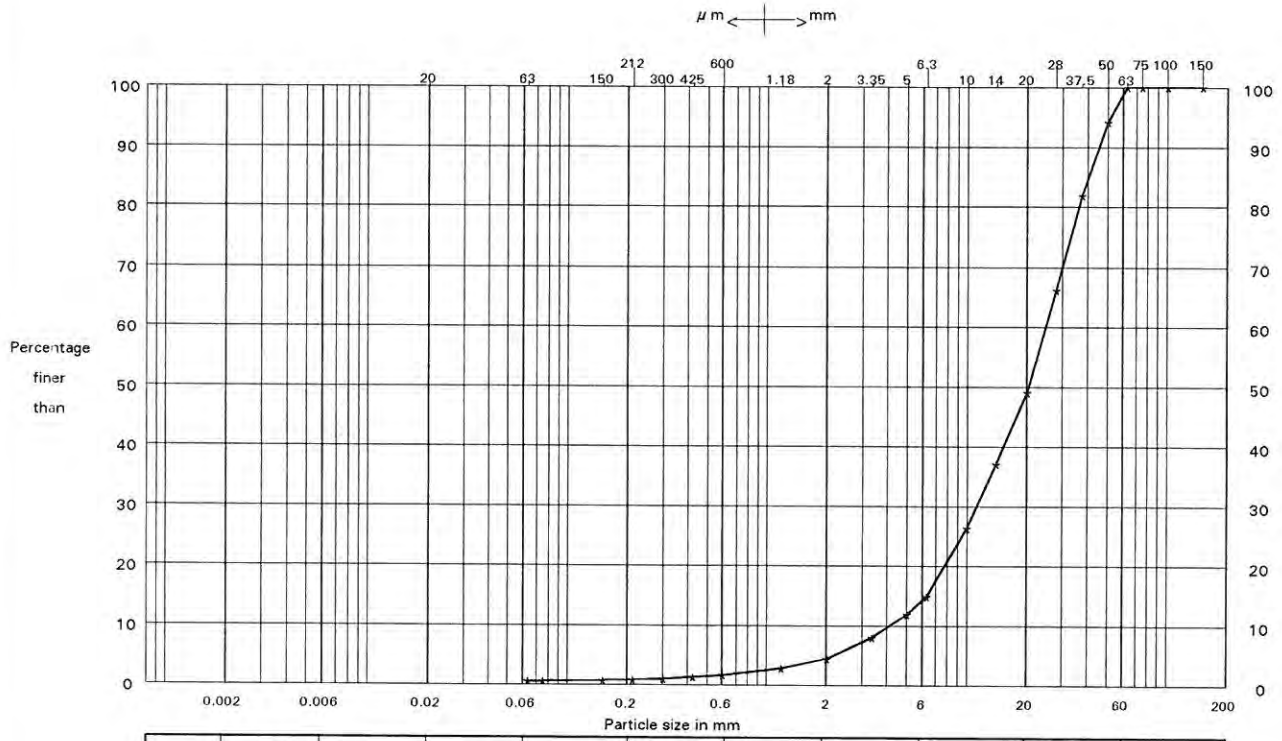


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			16			83			0

SAMPLE DESCRIPTION	REMARKS
Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH2
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 8.00 - 8.00		SAMPLE REF 8	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve			1	1	1	1	2	3	4	8	12	15	26	37	49	66	82	94	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			4			96			0

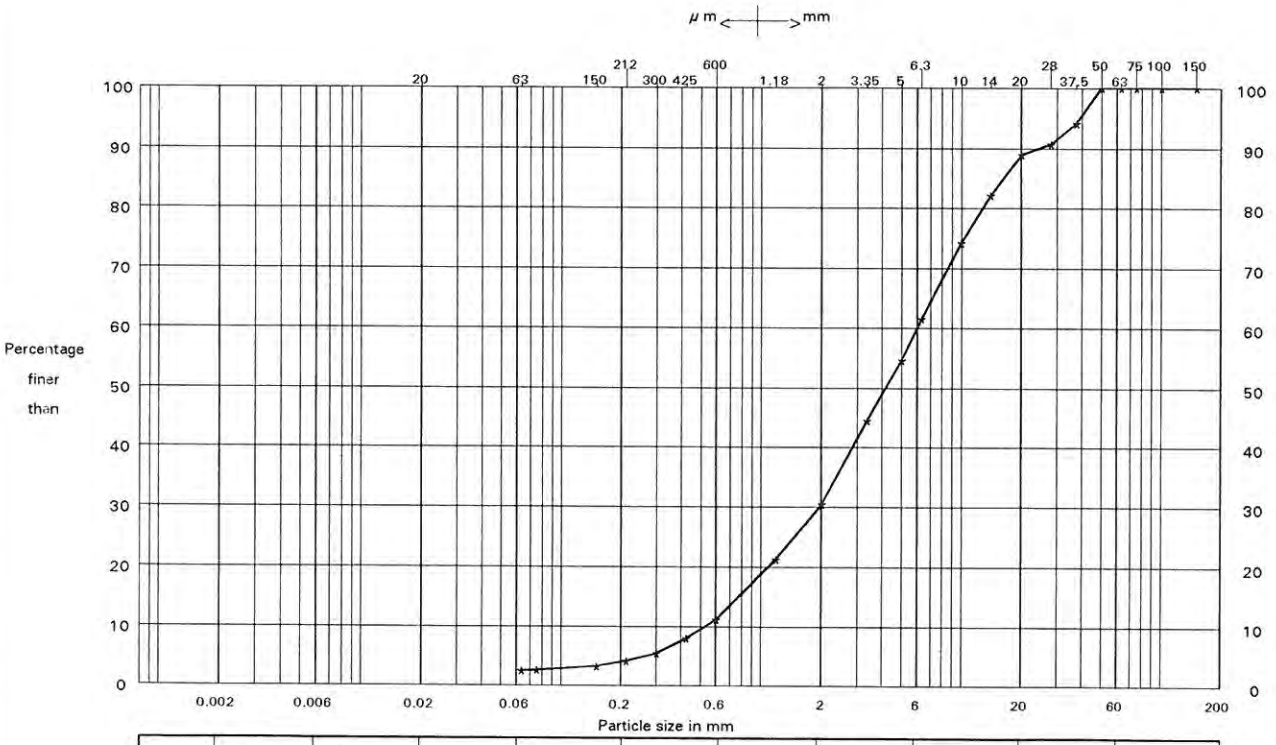
SAMPLE DESCRIPTION

Grey slightly sandy GRAVEL. Gravel is fine to coarse subangular to rounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH2
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 12.50 - 12.50		SAMPLE REF 13	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)													
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	2	2	3	4	5	8	11	21	30	44	55	61	74	82	89	91	94	100	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			28			70			0

SAMPLE DESCRIPTION

Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone

REMARKS

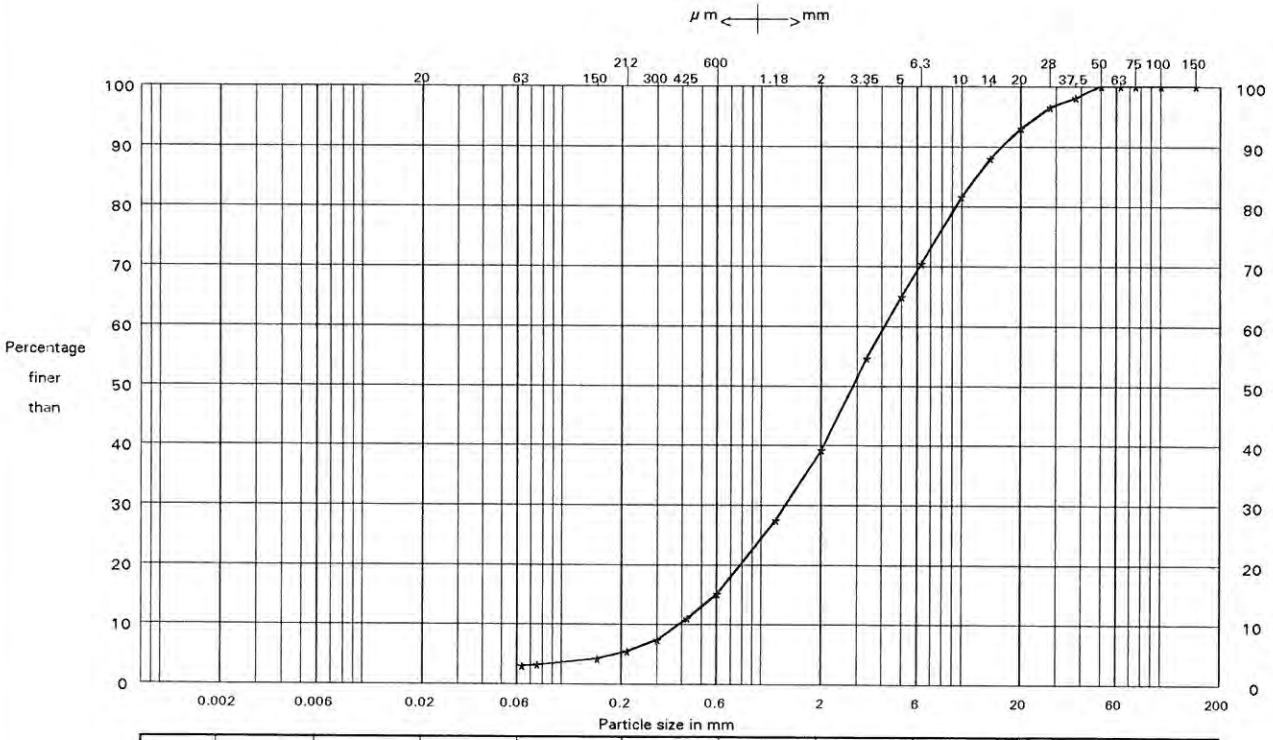
CC Geotechnical
Tel: 0151-523-0202
Fax: 0151-523-0252

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

HOLE NO. BH2

CLIENT GROUNDSOLVE	SITE DYFI BRIDGE
SAMPLE DEPTH 17.00 - 17.00	SAMPLE REF 17
JOB NO. 15/8700	
METHOD OF PRETREATMENT	METHOD OF TEST Wet Sieve

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	3	3	4	5	7	11	15	27	39	55	65	70	82	88	93	96	98	100	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			36			61			0

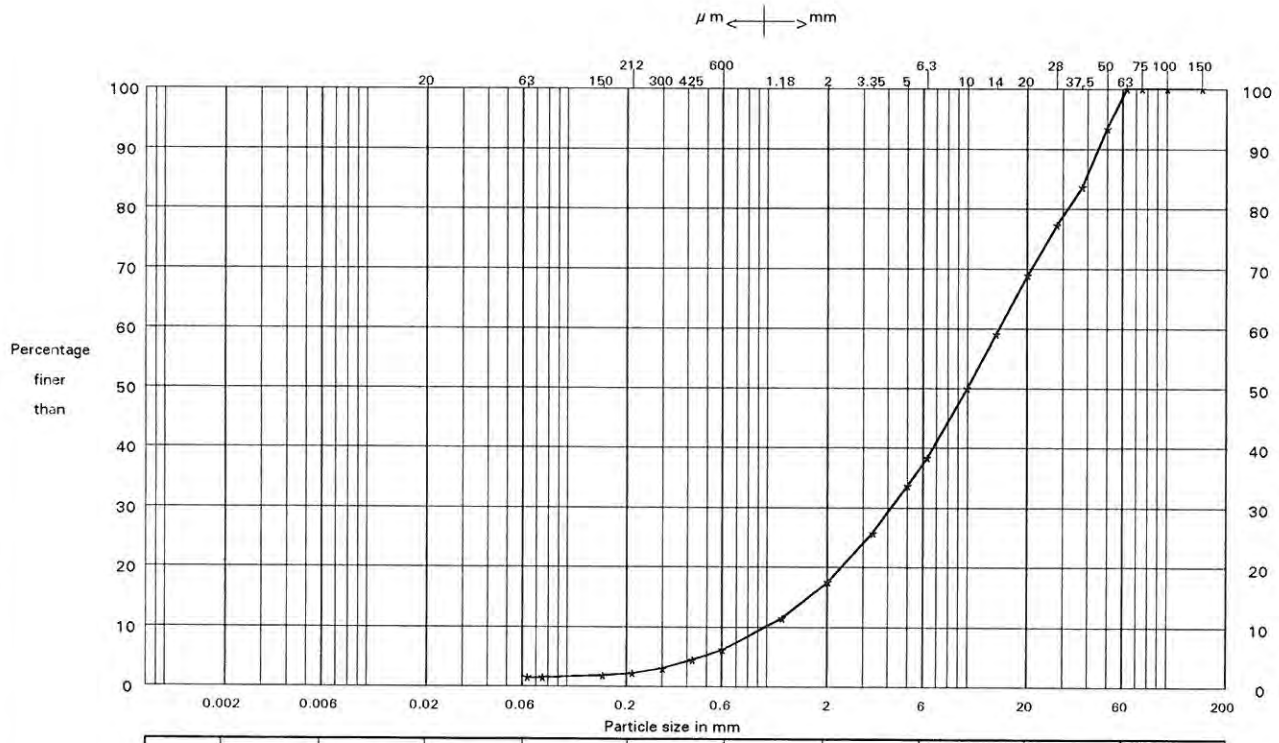
SAMPLE DESCRIPTION

Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH2
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 22.00 - 22.00		SAMPLE REF 22	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	2	2	3	4	6	11	17	26	34	38	50	59	69	77	84	93	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			16			83			0

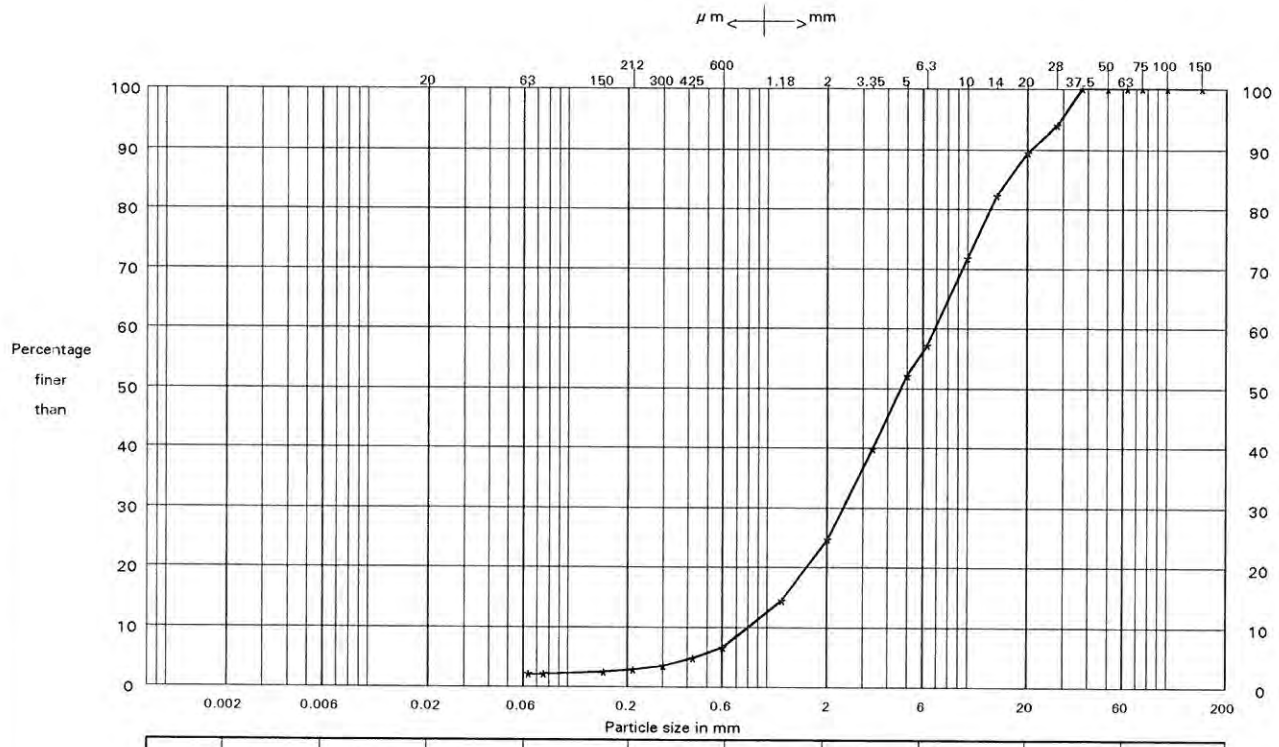
SAMPLE DESCRIPTION

Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH2
CLIENT	GROUNDSOLVE	SITE	DYFI BRIDGE
SAMPLE DEPTH	26.00 - 26.00	SAMPLE REF 26	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	2	2	2	3	3	5	7	14	25	40	52	57	72	82	89	94	100	100	100	100	100	100

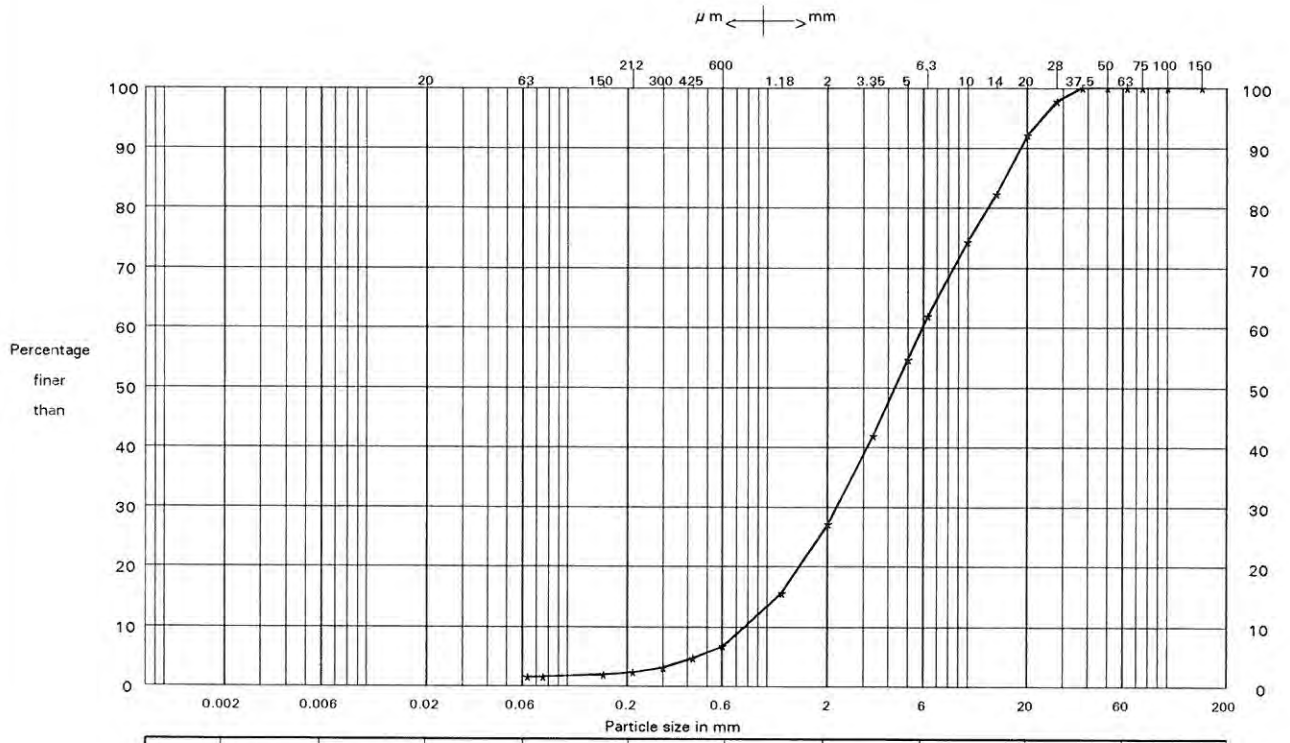


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			23			75			0

SAMPLE DESCRIPTION	REMARKS
Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH2
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 30.00 - 30.00		SAMPLE REF 30	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)													
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	2	2	3	5	7	16	27	42	55	62	74	82	92	98	100	100	100	100	100	100



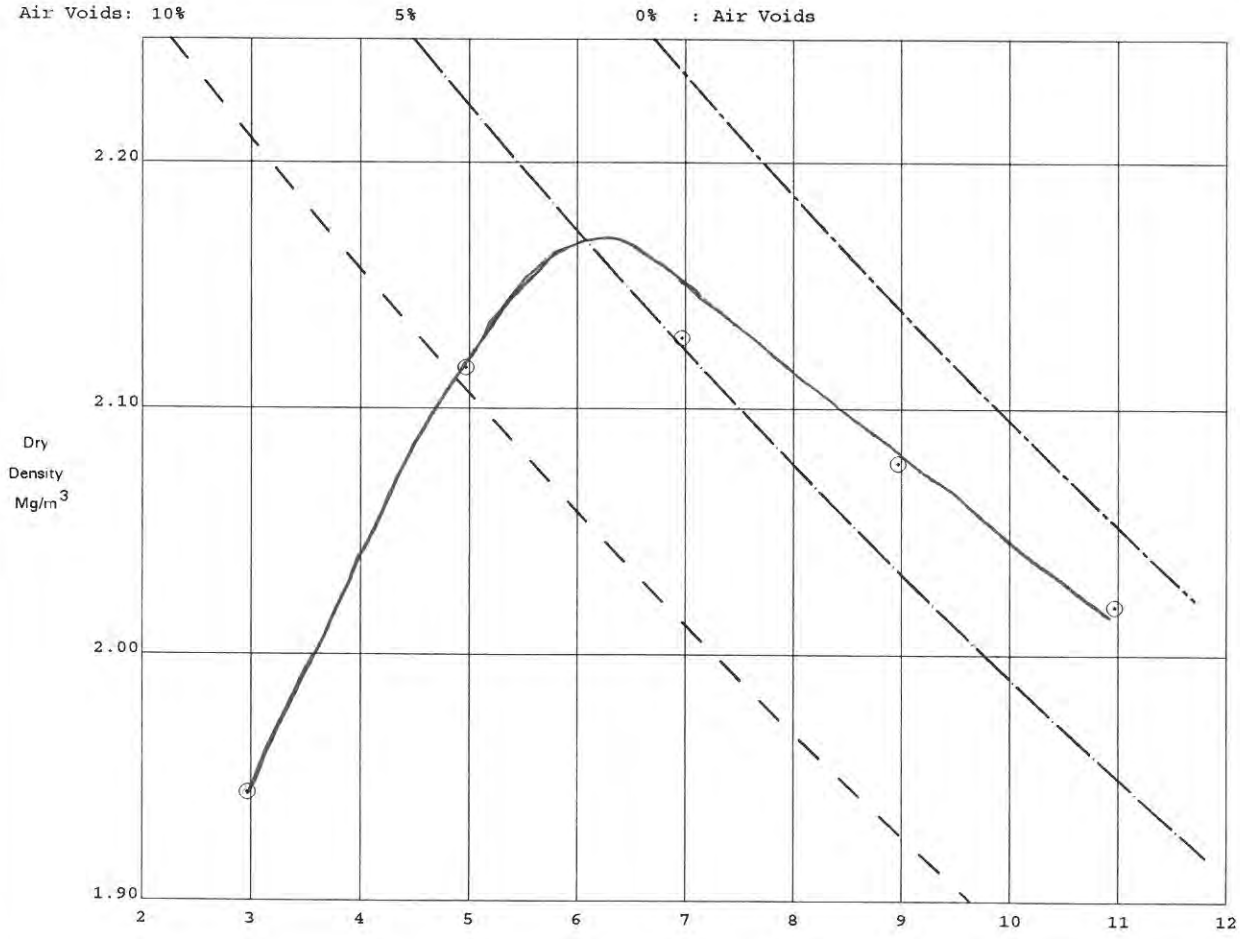
	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			26			73			0

SAMPLE DESCRIPTION

Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DRY DENSITY/MOISTURE CONTENT RELATIONSHIP	HOLE NO. BH2
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 4.00 - 4.00		SAMPLE REF 4	JOB NO. 15/8700
% MATERIAL RETAINED ON 20mm SIEVE	11	MAXIMUM SIZE OF COHESIVE LUMPS	20 mm
% MATERIAL RETAINED ON 37.5mm SIEVE	20	SINGLE OR SEPARATE SUBSAMPLES	Separate.
PARTICLE DENSITY	Assumed 2.65 Mg/m^3	TYPE OF MOULD	CBR.
METHOD OF COMPACTION 4.5 kg Rammer Method (BS 1377:Part 4:1990 3.5).		AS RECEIVED MOISTURE CONTENT	8.0 %
MAXIMUM DRY DENSITY	2.16 Mg/m^3	OPTIMUM MOISTURE CONTENT	7.0 %



SAMPLE DESCRIPTION	REMARKS
Grey sandy slightly silty GRAVEL	

SUMMARY OF LABORATORY SOIL TEST RESULTS

BH / TP / WS Number	Sample Type	Depth From (m)	Depth To (m)	Moisture Content (%)	Bulk Density (Mg/m³)	Dry Density (Mg/m³)	Shear Strength (kN/m²)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425mm (%)	Soil Classification	UKAS accredited test (Y/N)	Description / Test Method Samples described in accordance with BS EN ISO 14688-2 2004
BH3	B	0.50	0.50	52	-	-	-	59	35	24	99	MH	Y	Brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
BH3	B	6.00	6.00	-	-	-	-	-	-	-	-	-	Y	Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH3	B	9.50	9.50	-	-	-	-	-	-	-	-	-	Y	Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH3	B	15.00	15.00	-	-	-	-	-	-	-	-	-	Y	Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH3	B	20.50	20.50	-	-	-	-	-	-	-	-	-	Y	Grey sandy slightly silty GRAVEL with medium cobble content. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH3	B	25.50	25.50	-	-	-	-	-	-	-	-	-	Y	Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH3	B	29.90	29.90	-	-	-	-	-	-	-	-	-	Y	Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)

SITE: DYFI BRIDGE (CCG-C-15-8700)
CLIENT: GROUNDSOLVE

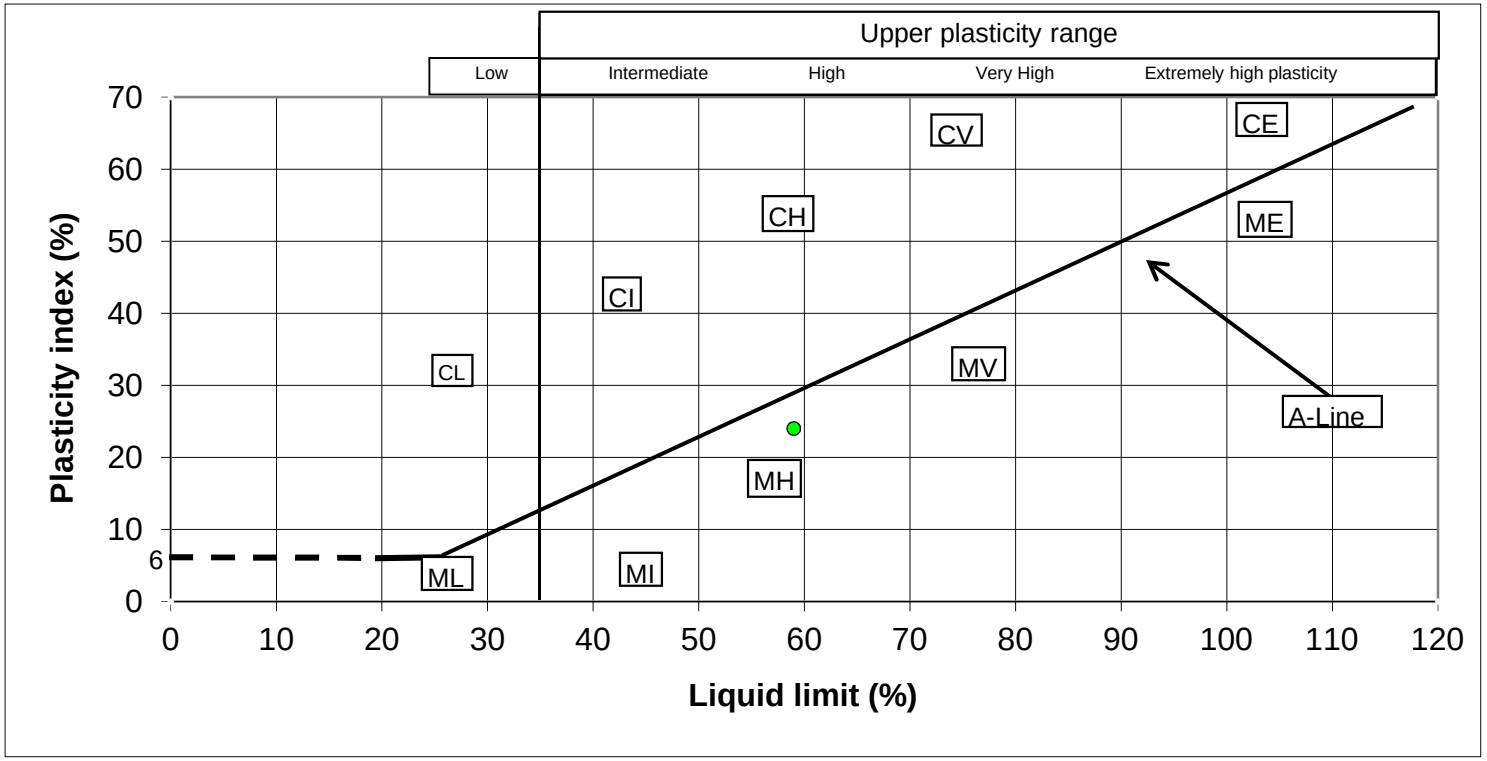
DATE: 18.01.16
SHEET: 1 of 1

UKAS TESTING 4514

Key:- BD = Bulk Disturbed; SD = Small Disturbed; U100 = Undisturbed 100mm; WS = Window Sample
CL = Low Plasticity; CI = Intermediate; CH = High; CV = Very high; CE = Extremely high; NP = Non-plastic
(* Denotes Hand Shear Vane test result)
Sample description not accredited by UKAS

ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



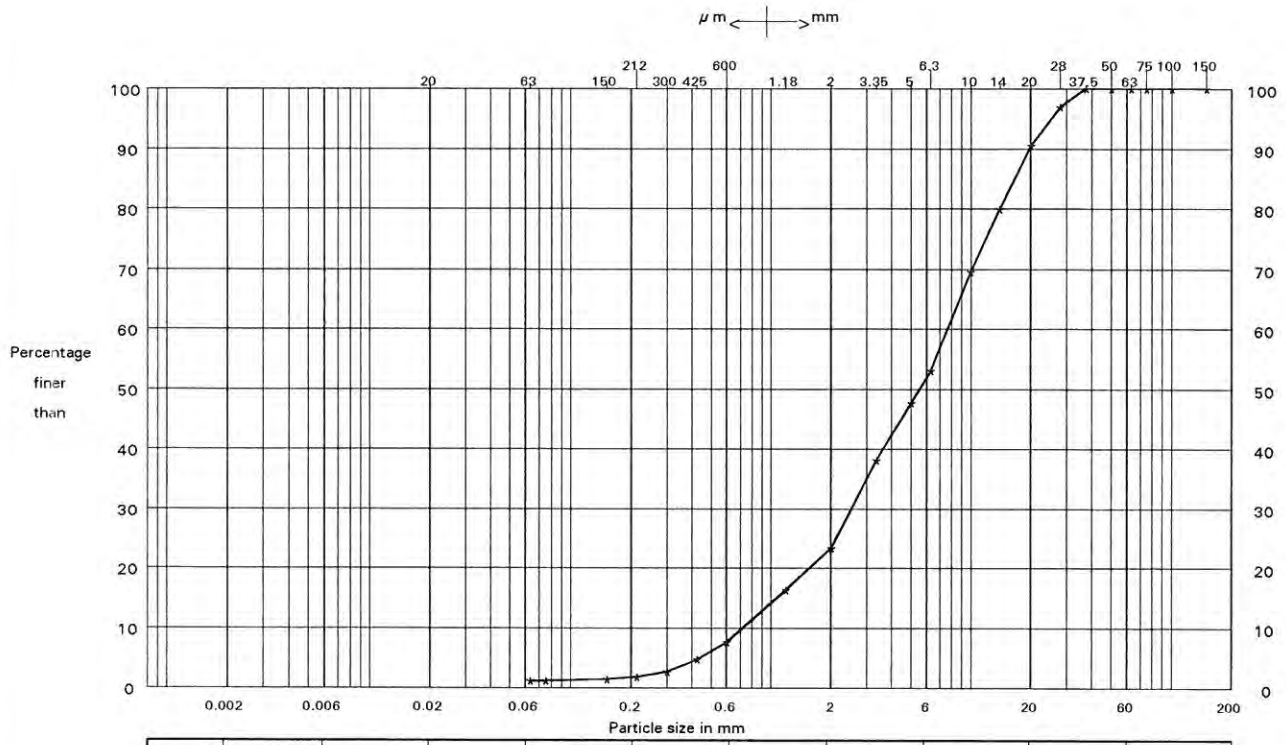
BH	Sample Depth	Liquid limit	Plasticity index
BH3	0.50	59.0	24.0

UKAS TESTING
4514

CLIENT: GROUNDSOLVE	SITE: NEW DYFI BRIDGE (CCG-C-15-8700)

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH3
CLIENT	GROUNDSOLVE	SITE	DYFI BRIDGE
SAMPLE DEPTH	6.00 - 6.00	SAMPLE REF	6
			JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	1	2	3	5	8	16	23	38	48	53	69	80	90	97	100	100	100	100	100	100

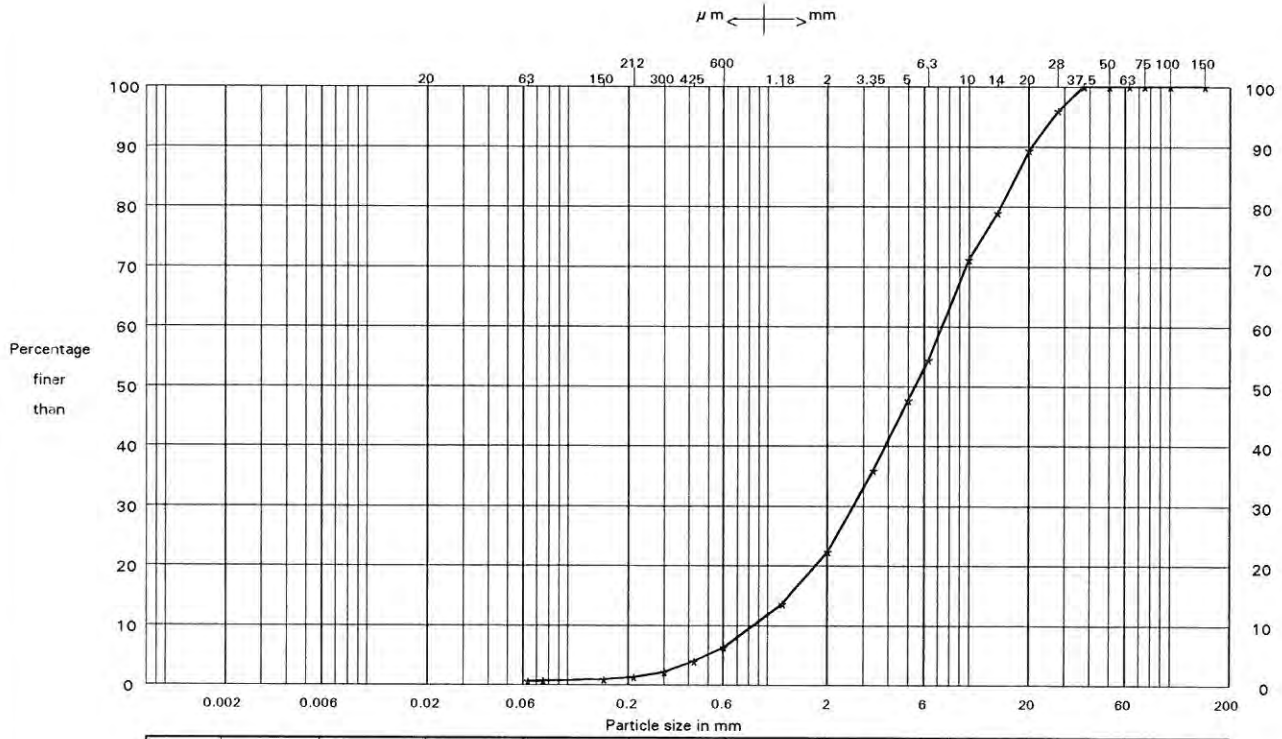


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			22			77			0

SAMPLE DESCRIPTION	REMARKS
Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH3
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 9.50 - 9.50		SAMPLE REF 10	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	1	1	2	4	6	14	22	36	48	54	71	79	89	96	100	100	100	100	100	100

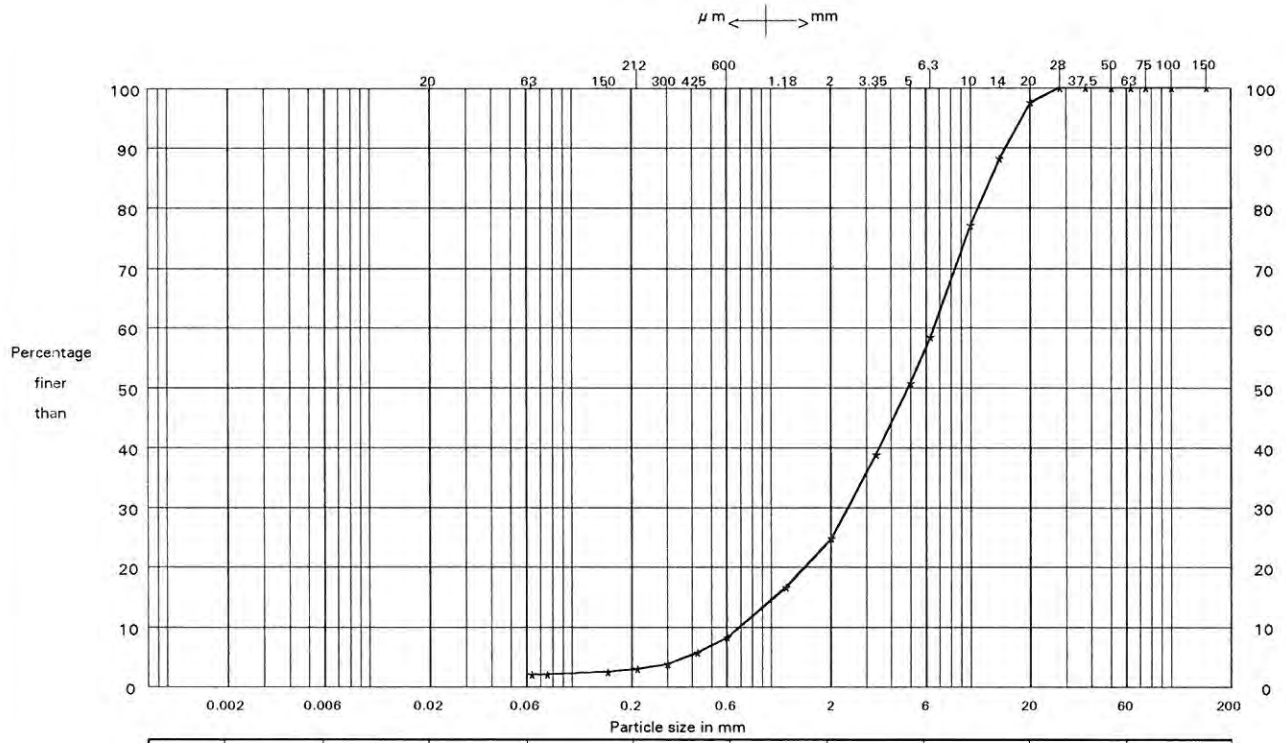


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			21			78			0

SAMPLE DESCRIPTION	REMARKS
Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH3
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 15.00 - 15.00		SAMPLE REF 15	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	2	2	2	3	4	6	8	17	25	39	51	58	77	88	98	100	100	100	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			23			75			0

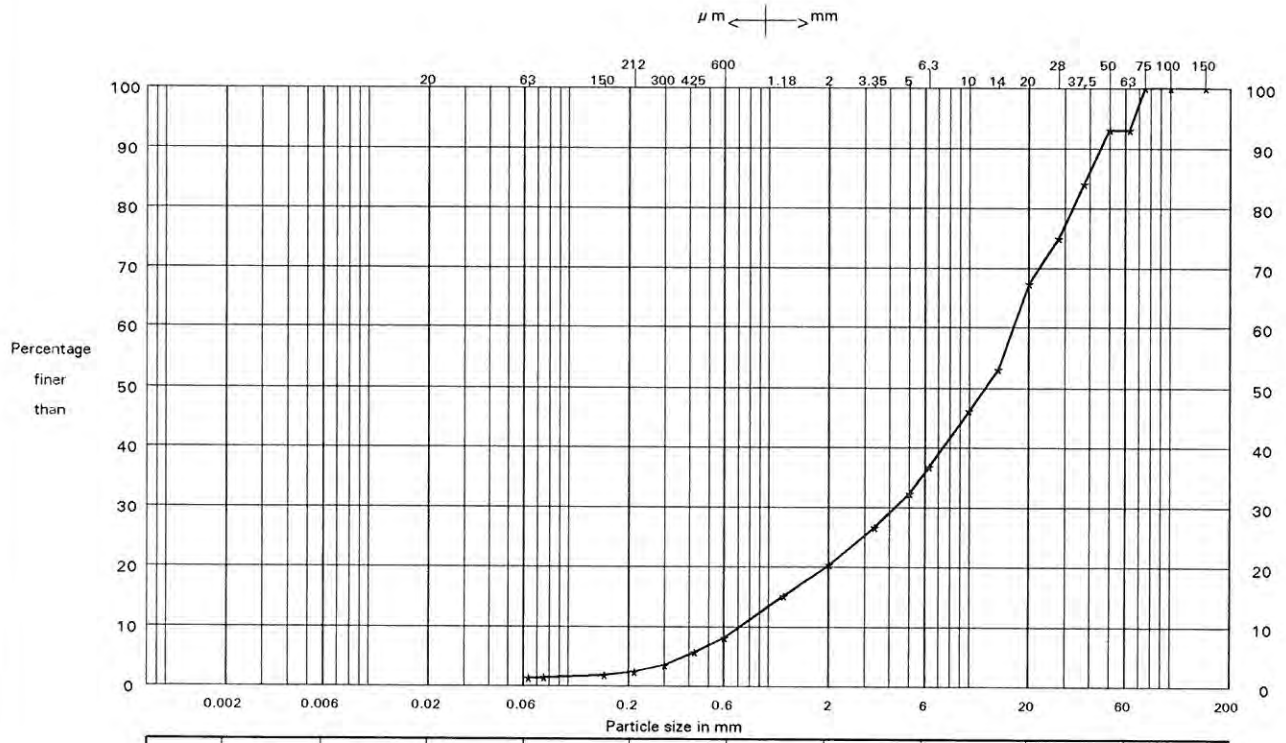
SAMPLE DESCRIPTION

Grey very sandy slightly silty GRAVEL. Gravel is fine to medium subangular to rounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH3
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 20.50 - 20.50		SAMPLE REF 21	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	2	2	3	6	8	15	20	26	32	37	46	53	67	75	84	93	93	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			19			73			7

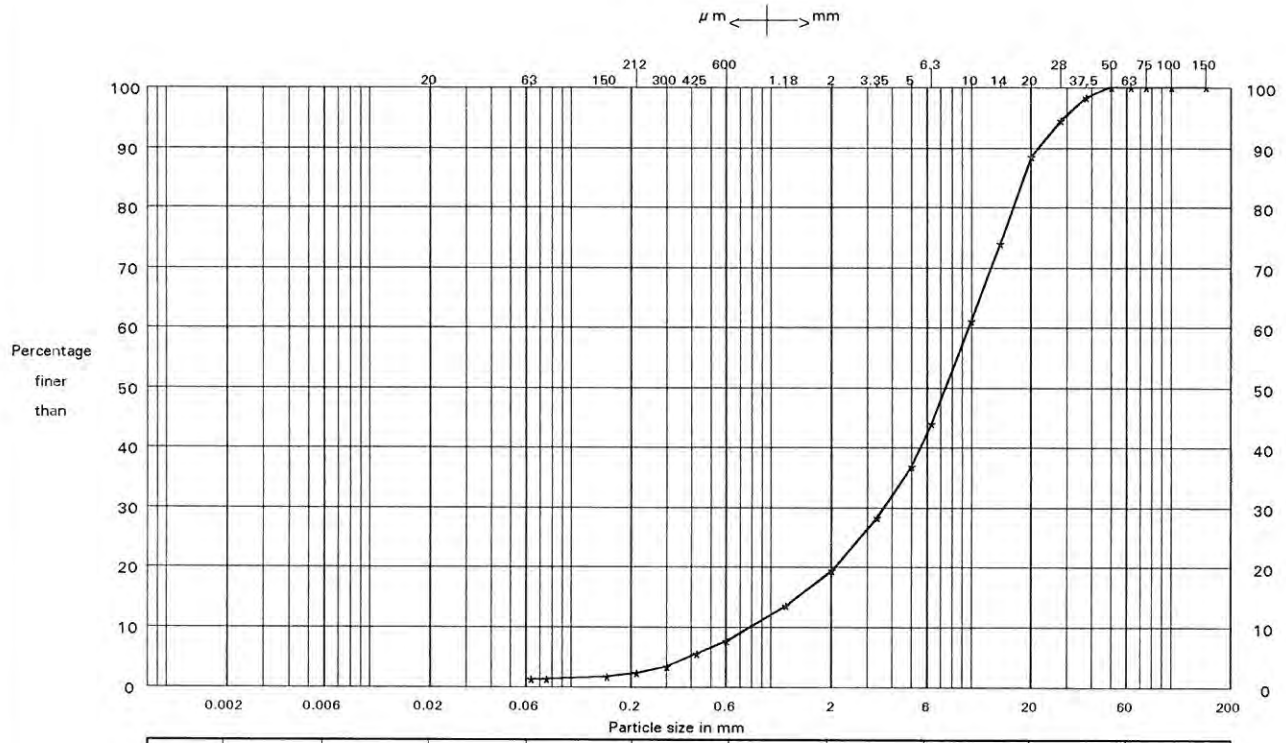
SAMPLE DESCRIPTION

Grey sandy slightly silty GRAVEL with medium cobble content. Gravel is fine to coarse subangular to rounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH3
CLIENT	GROUNDSOLVE	SITE	DYFI BRIDGE
SAMPLE DEPTH	25.50 - 25.50	SAMPLE REF 26	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	2	2	3	5	8	13	19	28	37	44	61	74	88	94	98	100	100	100	100	100

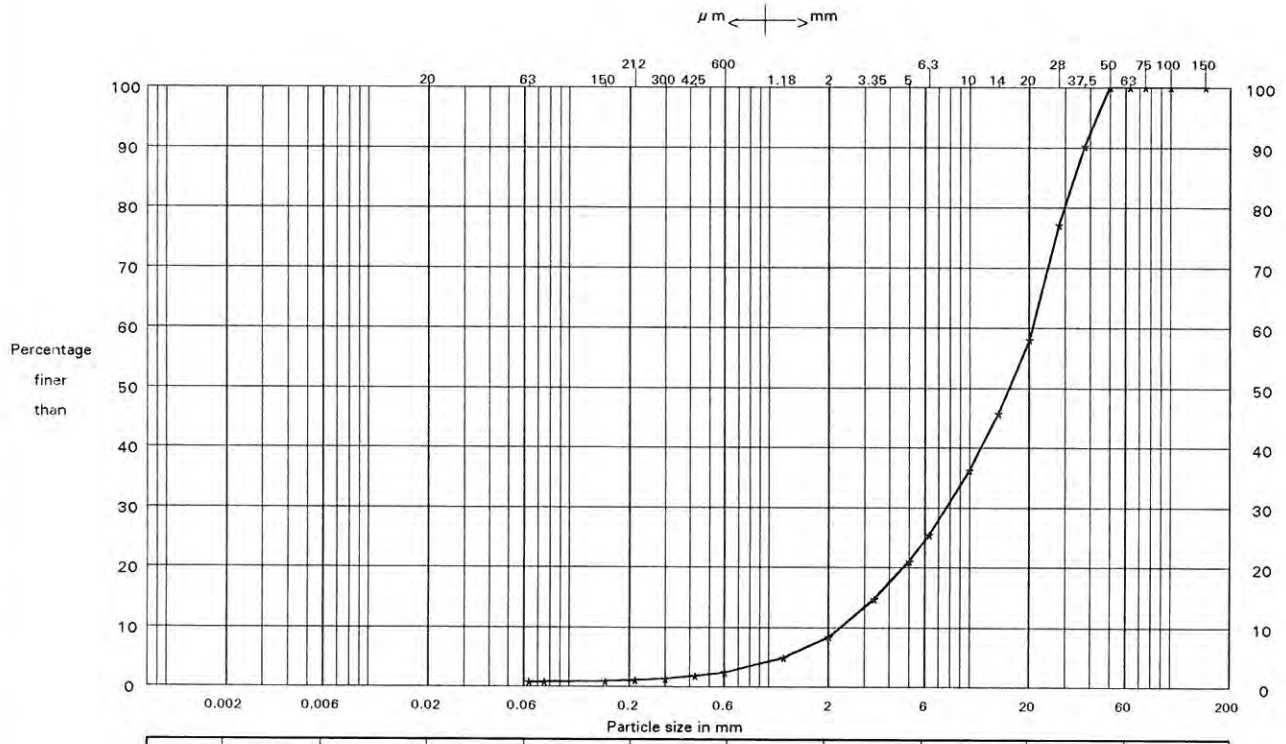


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			18			81			0

SAMPLE DESCRIPTION	REMARKS
Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH3
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 29.90 - 29.90		SAMPLE REF 30	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	1	1	1	2	2	5	8	15	21	25	36	46	58	77	90	100	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			7			92			0

SAMPLE DESCRIPTION

Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone

REMARKS

SUMMARY OF LABORATORY SOIL TEST RESULTS

BH / TP / WS Number	Sample Type	Depth From (m)	Depth To (m)	Moisture Content (%)	Bulk Density (Mg/m^3)	Dry Density (Mg/m^3)	Shear Strength (kN/m^2)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425mm (%)	Soil Classification	UKAS accredited test (Y/N)	Description / Test Method Samples described in accordance with BS EN ISO 14688-2 2004
BH4	B	1.00	1.00	50	-	-	-	46	32	14	98	MI	Y	Brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
BH4	B	6.00	6.00	-	-	-	-	-	-	-	-	-	Y	Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH4	B	10.50	10.50	-	-	-	-	-	-	-	-	-	Y	Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH4	B	15.00	15.00	-	-	-	-	-	-	-	-	-	Y	Grey sandy slightly silty GRAVEL with high cobble content. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH4	B	20.50	20.50	-	-	-	-	-	-	-	-	-	Y	Grey very sandy GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH4	B	25.50	25.50	-	-	-	-	-	-	-	-	-	Y	Grey sandy slightly silty GRAVEL with high cobble content. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH4	B	29.50	29.50	-	-	-	-	-	-	-	-	-	Y	Grey slightly sandy GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)

SITE: DYFI BRIDGE (CCG-C-15-8700)
CLIENT: GROUNDSOLVE

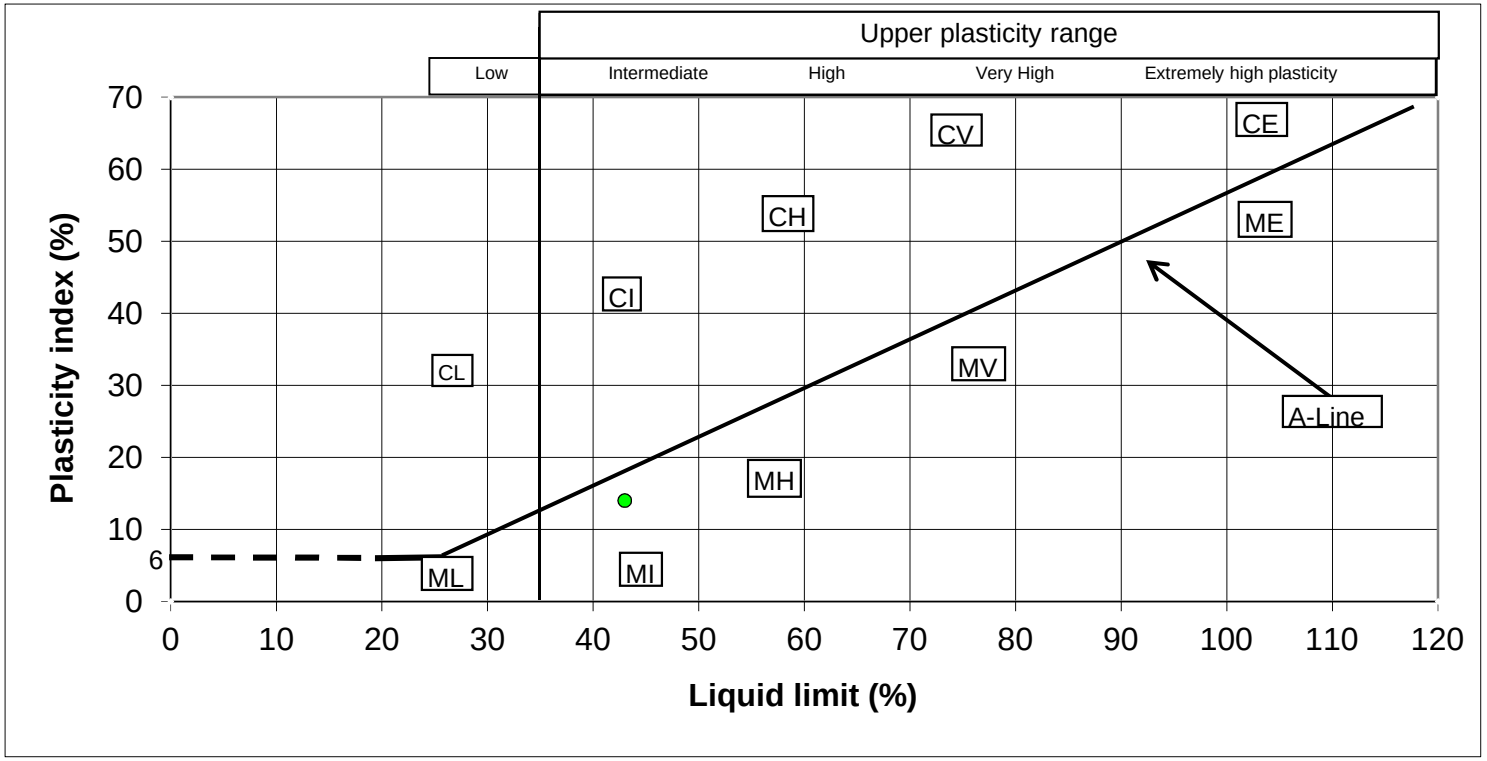
DATE: 19.01.16
SHEET: 1 of 1

UKAS TESTING 4514

Key:- BD = Bulk Disturbed; SD = Small Disturbed; U100 = Undisturbed 100mm; WS = Window Sample
CL = Low Plasticity; CI = Intermediate; CH = High; CV = Very high; CE = Extremely high; NP = Non-plastic
(* Denotes Hand Shear Vane test result)
Sample description not accredited by UKAS

ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



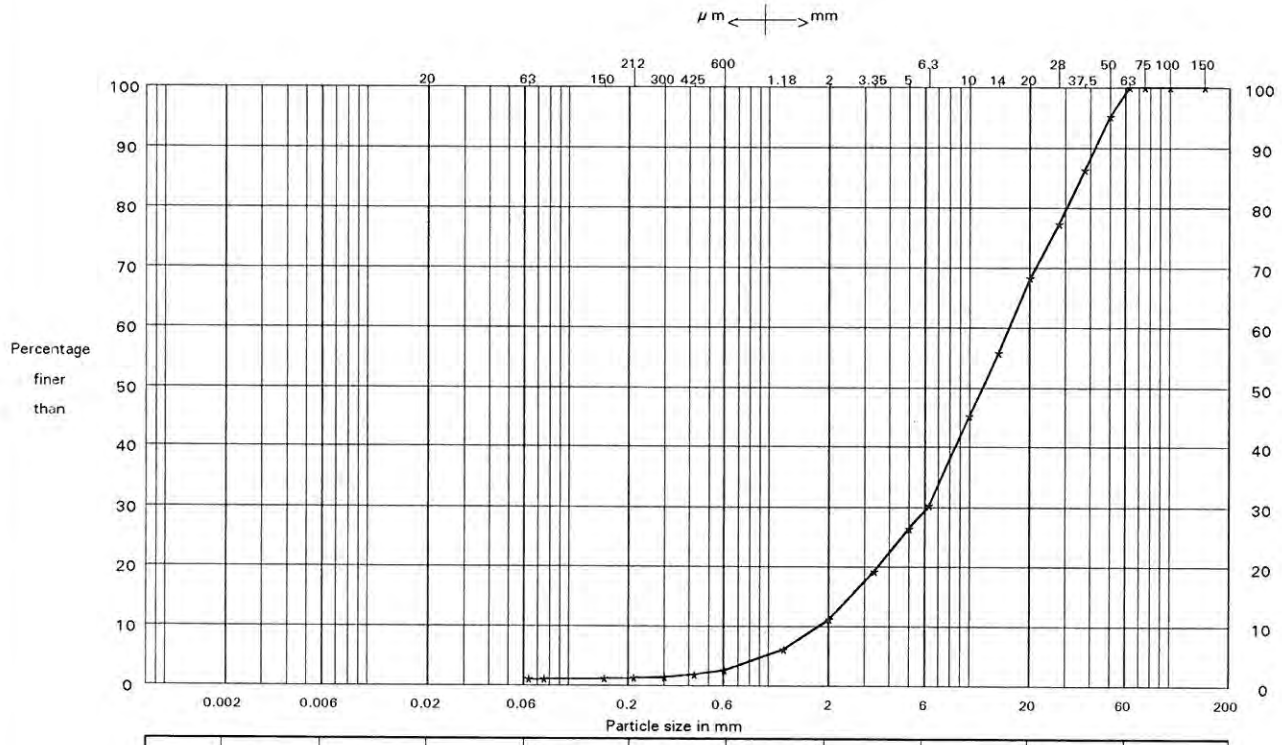
BH	Sample Depth	Liquid limit	Plasticity index
BH4	1.00	43.0	14.0

UKAS TESTING
4514

CLIENT: GROUNDSOLVE	SITE: NEW DYFI BRIDGE (CCG-C-15-8700)

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH4
CLIENT	GROUNDSOLVE	SITE	DYFI BRIDGE
SAMPLE DEPTH	6.00 - 6.00	SAMPLE REF 6	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	1	1	1	2	2	6	11	19	26	30	45	56	68	77	86	95	100	100	100	100

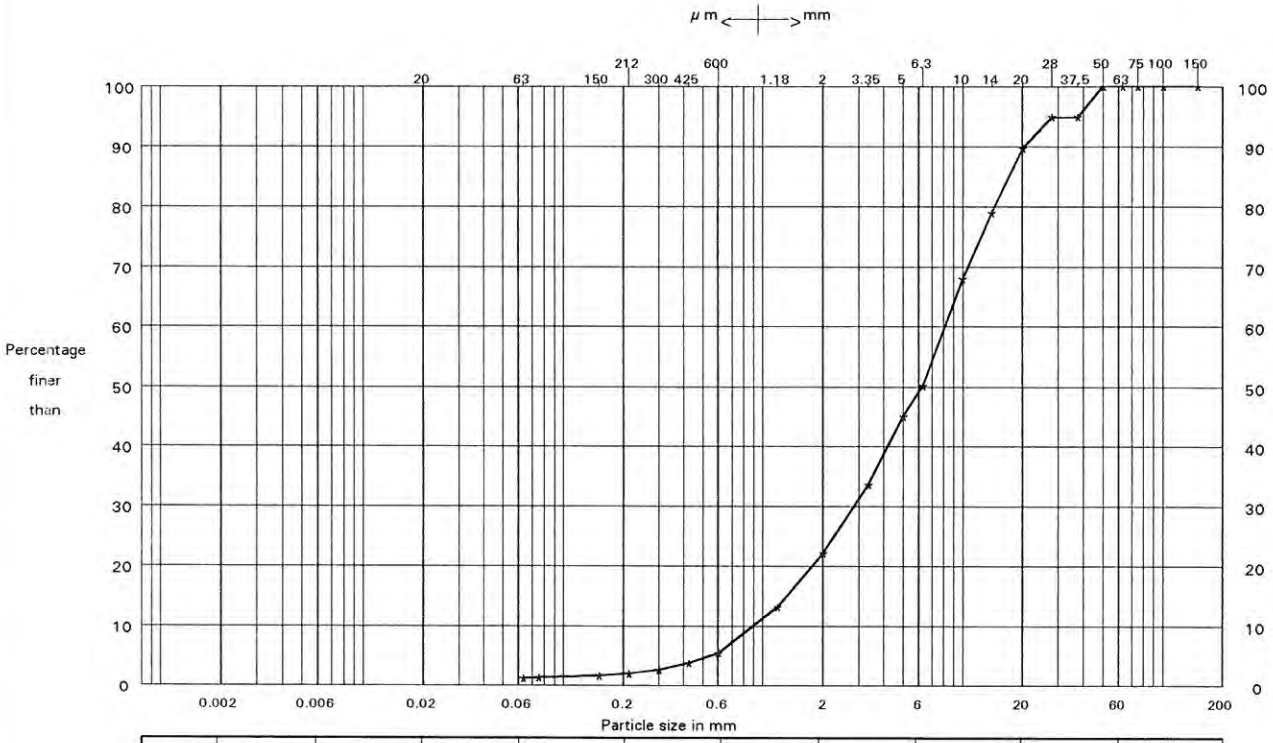


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			10			89			0

SAMPLE DESCRIPTION	REMARKS
Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH4
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 10.50 - 10.50		SAMPLE REF 11	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	2	2	2	4	5	13	22	34	45	50	68	79	90	95	95	100	100	100	100	100

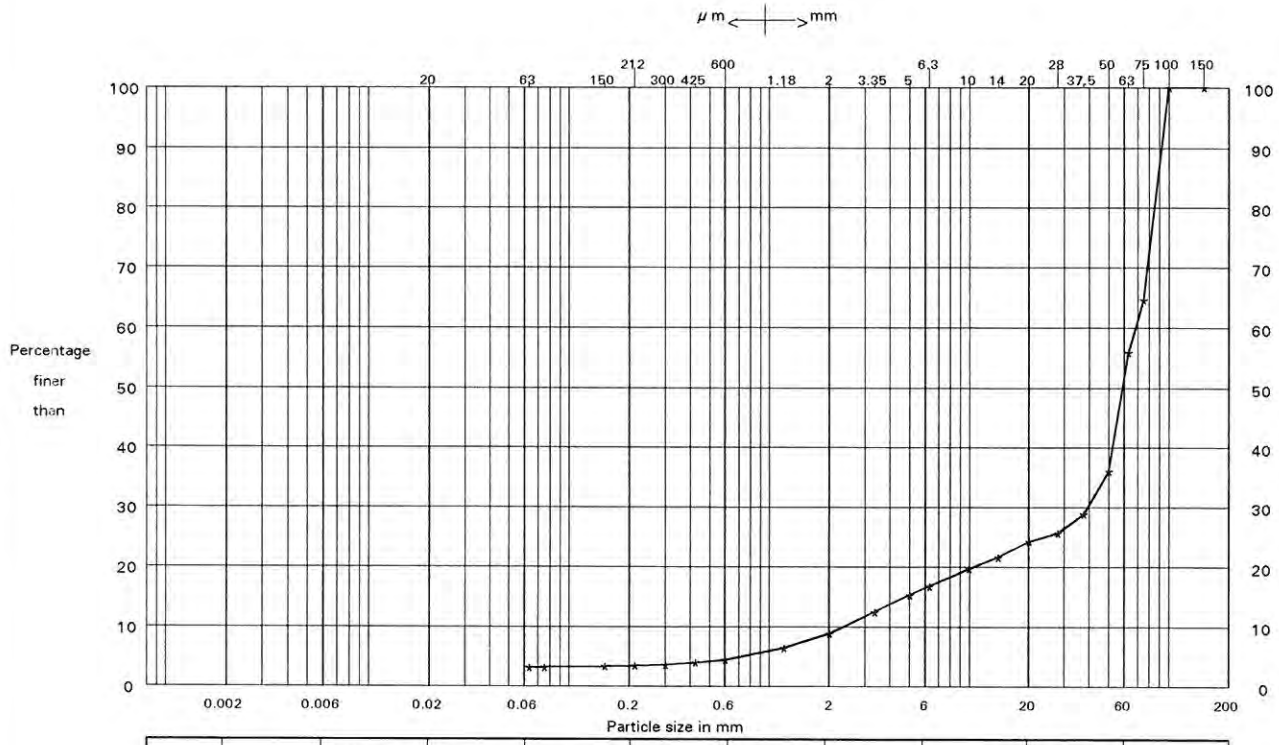


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			21			78			0

SAMPLE DESCRIPTION	REMARKS
Grey very sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH4
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 15.00 - 15.00		SAMPLE REF 15	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	3	3	3	3	3	4	4	6	9	12	15	17	20	22	24	26	29	36	56	64	100	100

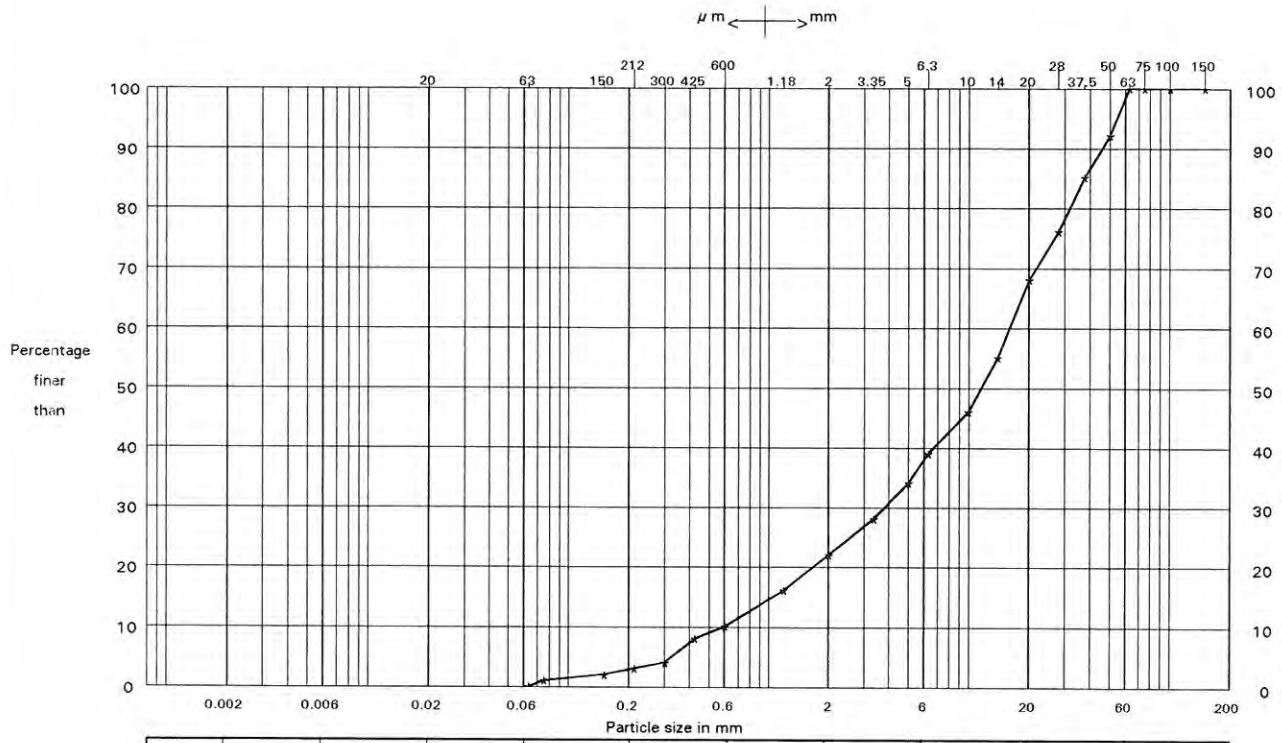


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			6			47			44

SAMPLE DESCRIPTION	REMARKS
Grey sandy slightly silty GRAVEL with high cobble content. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH4
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 20.50 - 20.50		SAMPLE REF 20	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	0	1	2	3	4	8	10	16	22	28	34	39	46	55	68	76	85	92	100	100	100	100

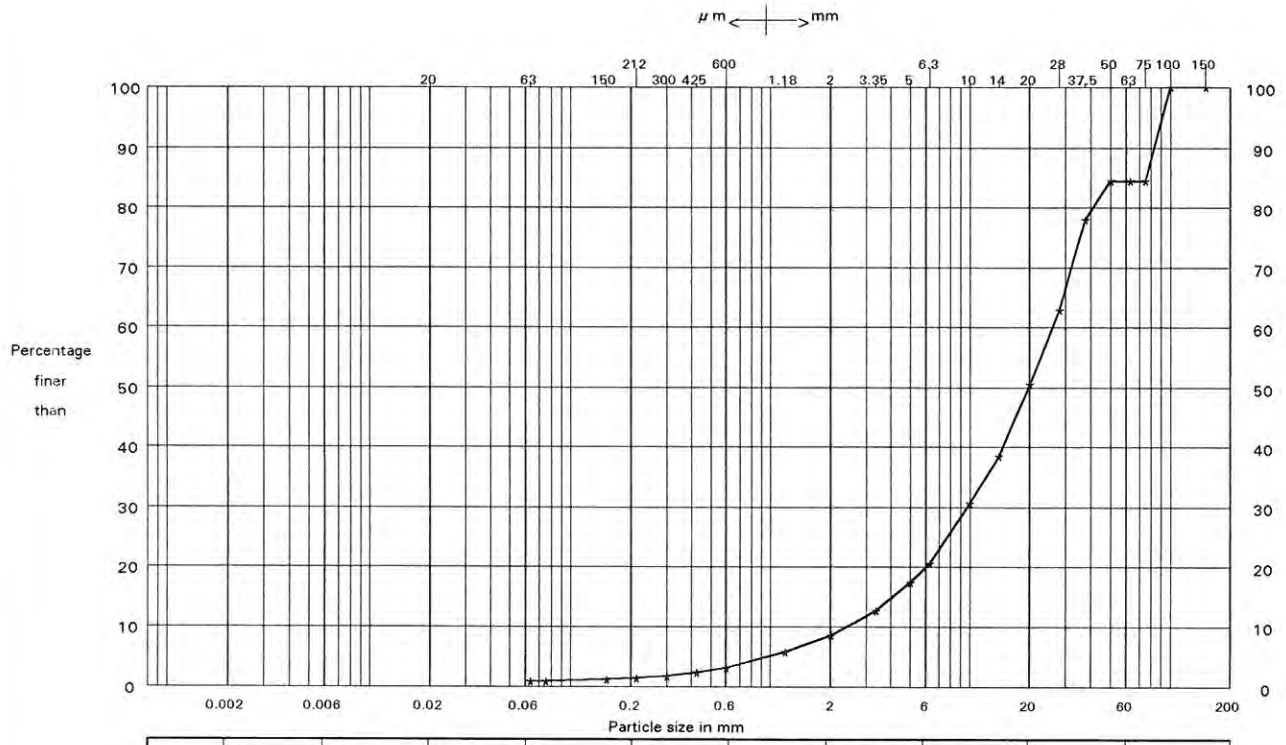


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			22			78			0

SAMPLE DESCRIPTION	REMARKS
Grey very sandy GRAVEL. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH4
CLIENT	GROUNDSOLVE	SITE	DYFI BRIDGE
SAMPLE DEPTH	25.50 - 25.50	SAMPLE REF 26	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	1	1	2	2	3	6	8	13	17	20	31	38	50	63	78	84	84	84	100	100

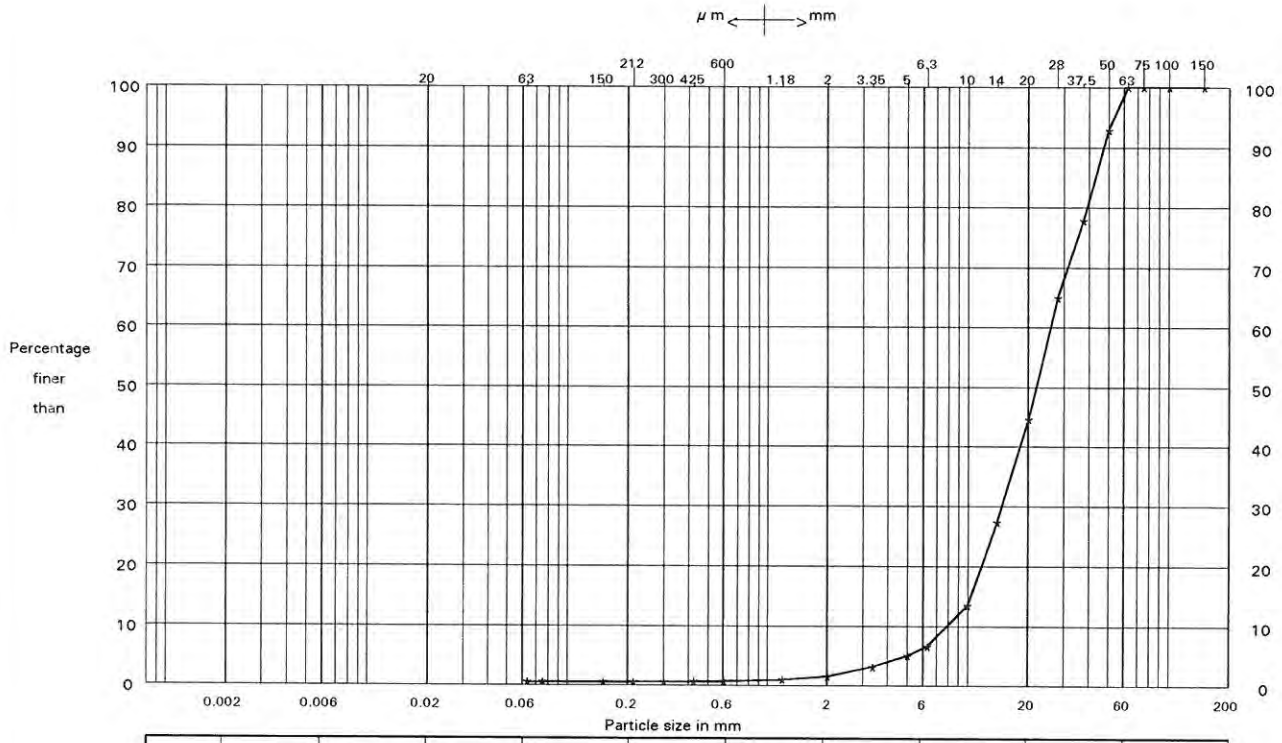


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			7			76			16

SAMPLE DESCRIPTION	REMARKS
Grey sandy slightly silty GRAVEL with high cobble content. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH4
CLIENT	GROUNDSOLVE	SITE	DYFI BRIDGE
SAMPLE DEPTH	29.50 - 29.50	SAMPLE REF 30	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve					1	1	1	1	1	3	5	7	13	27	44	65	78	93	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			1			99			0

SAMPLE DESCRIPTION	REMARKS
Grey slightly sandy GRAVL. Gravel is fine to coarse subangular to rounded mudstone	

SUMMARY OF LABORATORY SOIL TEST RESULTS

BH / TP / WS Number	Sample Type	Depth From (m)	Depth To (m)	Moisture Content (%)	Bulk Density (Mg/m³)	Dry Density (Mg/m³)	Shear Strength (kN/m²)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425mm (%)	Soil Classification	UKAS accredited test (Y/N)	Description / Test Method Samples described in accordance with BS EN ISO 14688-2 2004
BH5	B	2.00	2.00	15	-	-	-	-	-	-	31	NP	Y	Grey very sandy silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:3.2,4.4,9.2,9.5)
BH5	B	4.00	4.00	12	-	-	-	30	21	9	32	ML	Y	Grey very sandy silty slightly clayey GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:3.2,4.4,9.2,9.5)
BH5	B	6.00	6.00	1.3	-	-	-	-	-	-	-	-	Y	Grey slightly sandy GRAVEL with high cobble content. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:9.2)
BH5	B	7.50	7.50	3.6	-	-	-	-	-	-	-	-	Y	Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone. (BS1377Pt2:3.2,4.4,9.2,9.5)

SITE: DYFI BRIDGE (CCG-C-15-8700)
CLIENT: GROUNDSOLVE

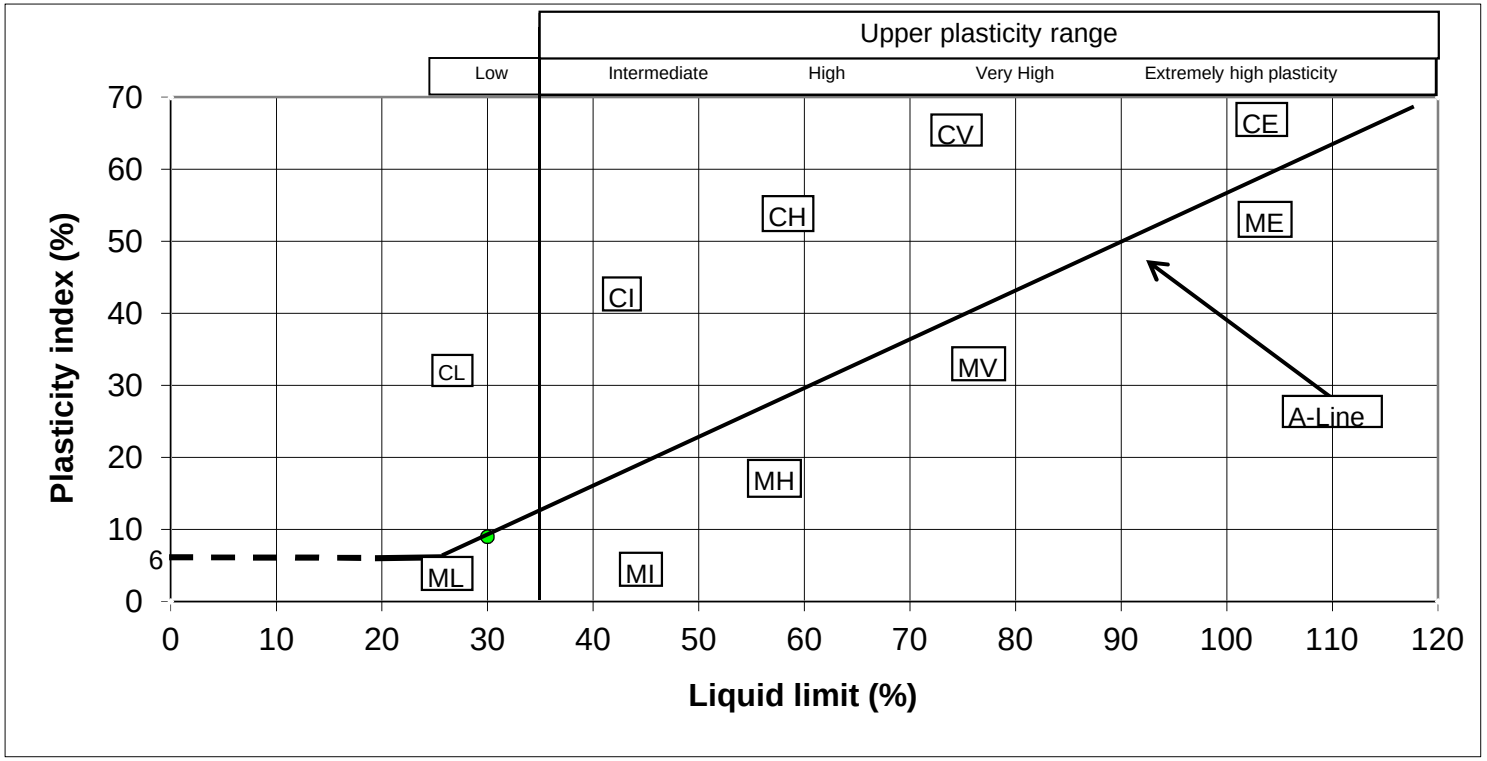
DATE: 18.01.16
SHEET: 1 of 1

UKAS TESTING 4514

Key:- BD = Bulk Disturbed; SD = Small Disturbed; U100 = Undisturbed 100mm; WS = Window Sample
CL = Low Plasticity; CI = Intermediate; CH = High; CV = Very high; CE = Extremely high; NP = Non-plastic
(* Denotes Hand Shear Vane test result)
Sample description not accredited by UKAS

ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



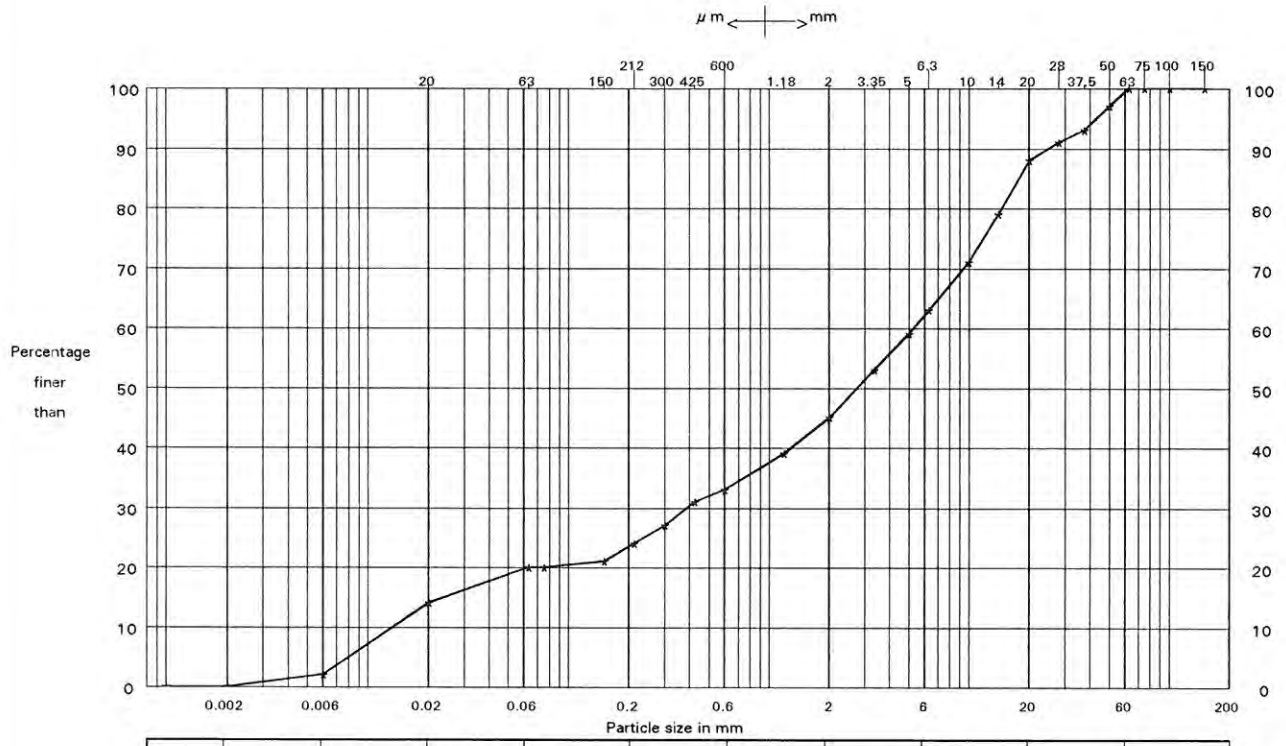
BH	Sample Depth	Liquid limit	Plasticity index
BH5	4.00	30.0	9.0

UKAS TESTING
4514

CLIENT: GROUNDSOLVE	SITE: NEW DYFI BRIDGE (CCG-C-15-8700)

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH5
CLIENT	GROUNDSOLVE	SITE	DYFI BRIDGE
SAMPLE DEPTH	2.00 - 2.00	SAMPLE REF	2
JOB NO.	15/8700		
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve + Hydrometer

	Size (microns)											Size (mm)													
Sieve Size	1	2	6	20	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve				14	20	20	21	24	27	31	33	39	45	53	59	63	71	79	88	91	93	97	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	20			25			55			0

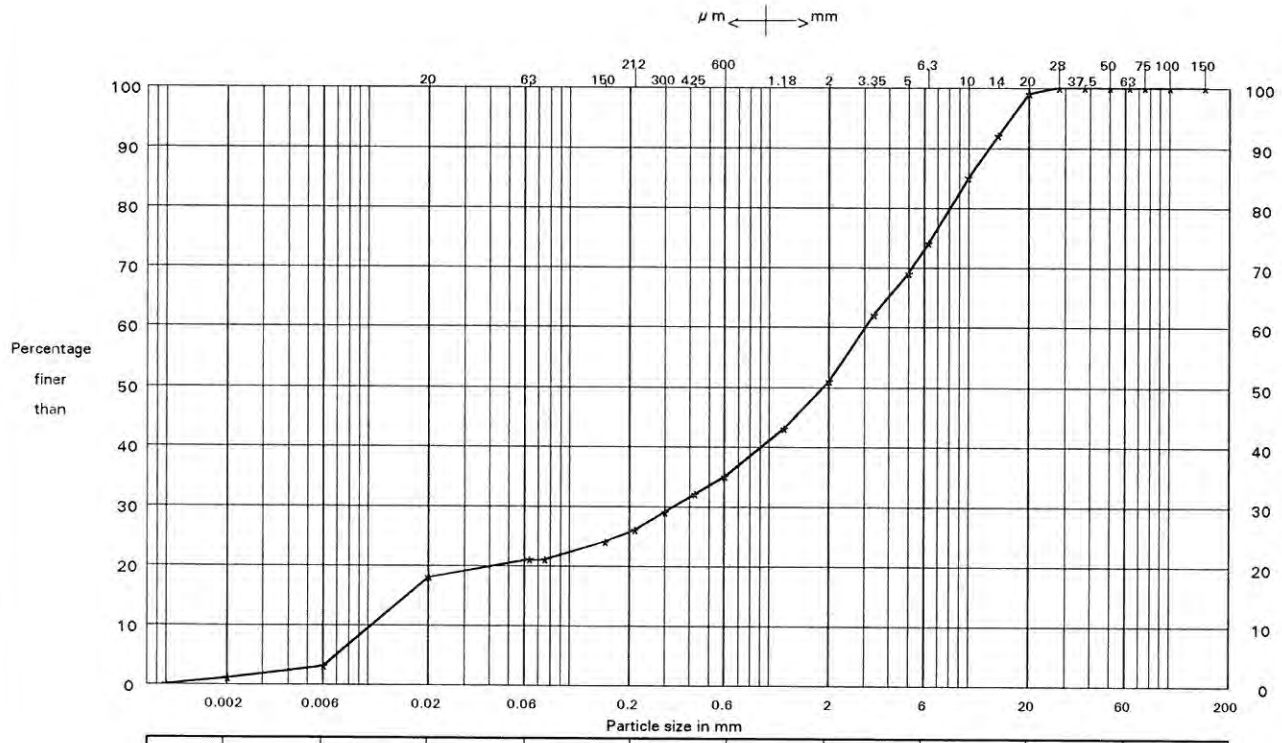
SAMPLE DESCRIPTION

Grey very sandy silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH5
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 4.00 - 4.00		SAMPLE REF 4	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve + Hydrometer	

	Size (microns)											Size (mm)													
Sieve Size	1	2	6	20	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve			18	21	21	24	26	29	32	35	43	51	62	69	74	85	92	99	100	100	100	100	100	100	100	



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	1	20			30			49			0

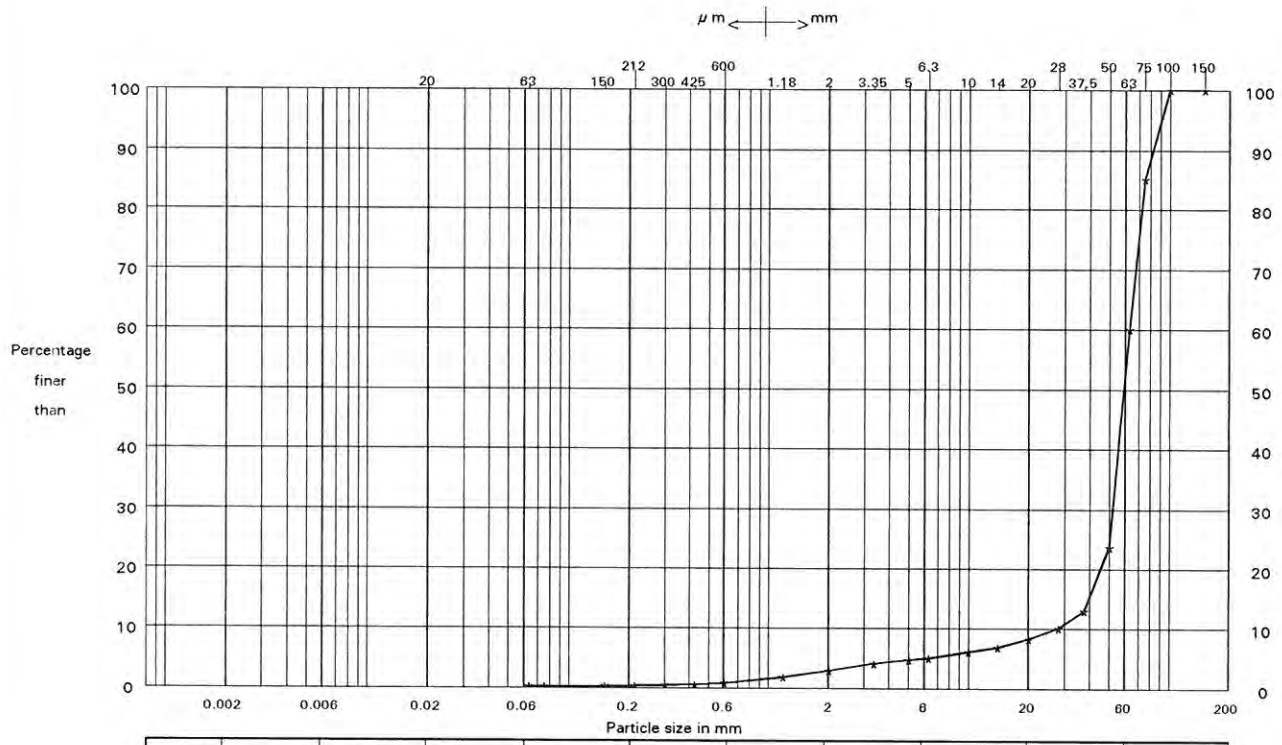
SAMPLE DESCRIPTION

Grey very sandy silty slightly clayey GRAVEL. Gravel is fine to coarse subangular to rounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH5
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 6.00 - 6.00		SAMPLE REF 6	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve						1	1	2	3	4	5	5	6	7	8	10	13	24	60	85	100	100

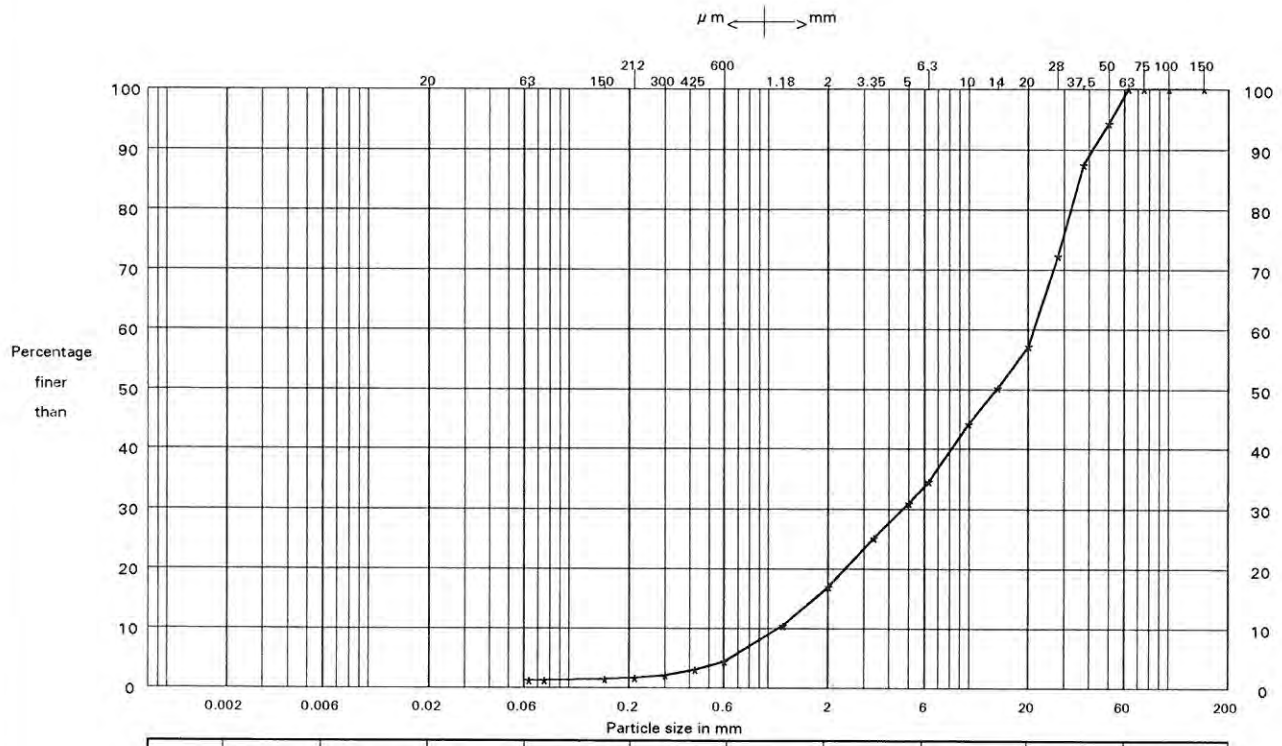


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			3			57			40

SAMPLE DESCRIPTION	REMARKS
Grey slightly sandy GRAVEL with high cobble content. Gravel is fine to coarse subangular to rounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. BH5
CLIENT GROUNDSOLVE		SITE DYFI BRIDGE	
SAMPLE DEPTH 7.50 - 7.50		SAMPLE REF 8	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	1	1	1	2	2	3	4	10	17	25	31	34	44	50	57	72	87	94	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			16			83			0

SAMPLE DESCRIPTION	REMARKS
Grey sandy slightly silty GRAVEL. Gravel is fine to coarse subangular to rounded mudstone	

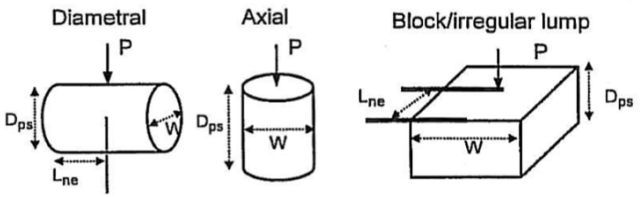
POINT LOAD TEST RESULTS

Int. J. Rock Mech. Sci. & Geomech. Abstr. Vol.22, No.2, pp. 51 - 60, 1985

PROJECT No.:- CCG-C-15-8700 SITE:- DYFI BRIDGE

Borehole Number	Depth (m)	Type of Test* a	d	i	Width (W) (mm)	Platen Separation (D) (mm)	Failure Load (P) (kN)	Equivalent Diameter (D_e) (mm)	Point Load (I_s) (MPa)	Size Factor (F)	Point Load Index ($I_{s(50)}$) (MPa)	Estimated Uniaxial Compressive Strength (MPa)	Remarks
BH5	9.50	a			85	41	4.50	67	1.01	1.14	1.15	23.08	
	10.20	a			85	46	3.50	71	0.70	1.17	0.82	16.42	
	12.35	a			85	48	3.20	72	0.62	1.18	0.73	14.52	
	13.20	a			85	43	5.10	68	1.10	1.15	1.26	25.21	
	13.90	a			85	53	6.50	76	1.13	1.21	1.37	27.32	
	15.40	a			85	36	5.00	62	1.28	1.10	1.42	28.36	
	15.95	a			85	51	5.00	74	0.91	1.20	1.08	21.65	
	16.20	a			85	50	4.80	74	0.89	1.19	1.06	21.11	
	16.90	a			85	54	6.20	76	1.06	1.21	1.28	25.68	
	17.20	a			85	33	2.00	60	0.56	1.08	0.61	12.14	

*NOTE- a = axial ; d = diametral ; i = irregular lump or blo (see diagrams, right, for details)



DIA. KEY- P = load ; Dps = platen seperation ;
W = width of shortest dimension perpendicular to load ;
Lne = length from platens to nearest free end

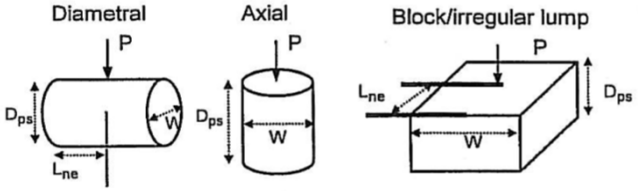
POINT LOAD TEST RESULTS

Int. J. Rock Mech. Sci. & Geomech. Abstr. Vol.22, No.2, pp. 51 - 60, 1985

PROJECT No.:- CCG-C-15-8700 SITE:- DYFI BRIDGE

Borehole Number	Depth (m)	Type of Test* a	d	i	Width (W) (mm)	Platen Separation (D) (mm)	Failure Load (P) (kN)	Equivalent Diameter (D_e) (mm)	Point Load (I_s) (MPa)	Size Factor (F)	Point Load Index ($I_{s(50)}$) (MPa)	Estimated Uniaxial Compressive Strength (MPa)	Remarks
BH5	10.30		d		201	90	>40	-	>4.94	1.30	>6.43	>128.67	
	14.00		d		190	90	18.20	-	2.25	1.30	2.93	58.54	
	15.80		d		180	90	>40	-	>4.94	1.30	>6.43	>128.67	
	16.20		d		220	90	>40	-	>4.94	1.30	>6.43	>128.67	
	17.30		d		202	90	>40	-	>4.94	1.30	>6.43	>128.67	

*NOTE- a = axial ; d = diametral ; i = irregular lump or block (see diagrams, right, for details)



DIA. KEY- P = load ; Dps = platen seperation ;
W = width of shortest dimension perpendicular to load ;
Lne = length from platens to nearest free end

0	#DIV/0!	0.00	#DIV/0!	#DIV/0!	**a**
-	#DIV/0!	0.00	#DIV/0!	#DIV/0!	**d**

TEST REPORT

UNIAXIAL COMPRESSIVE STRENGTH

In accordance with ISRM Vol 16 No 2, pp 135-140 (1979)

PROJECT:	**DYFI BRIDGE**
CLIENT:	**GROUNDSOLVE**
CCG REF:	**CCG-C-15-8700**

Sample ref:	BH5 10.7-10.9mbgl
Date of coring:	03.01.16
Sampled by:	PC
Sample description:	MUDSTONE

TEST DATA

Specimen Height (mm):	190
Specimen Diameter (mm):	85
L/D ratio:	2:1
Mode of failure:	AXIAL CLEAVAGE
Test duration:	4 mins 42 sec
Maximum load at failure (kN):	235.5
Compressive strength (N/mm2):	**41.5**

Test date:	18.01.16
Tested by:	**JE**
Report prepared by:	**JE**
Report approved by:	**DK**

TEST REPORT

UNIAXIAL COMPRESSIVE STRENGTH

In accordance with ISRM Vol 16 No 2, pp 135-140 (1979)

PROJECT:	**DYFI BRIDGE**
CLIENT:	**GROUNDSOLVE**
CCG REF:	**CCG-C-15-8700**

Sample ref:	BH5 12.1-12.3mbgl
Date of coring:	03.01.16
Sampled by:	PC
Sample description:	MUDSTONE

TEST DATA

Specimen Height (mm):	191
Specimen Diameter (mm):	85
L/D ratio:	2:1
Mode of failure:	AXIAL CLEAVAGE
Test duration:	5 mins 28 sec
Maximum load at failure (kN):	233.8
Compressive strength (N/mm2):	**41.2**

Test date:	18.01.16
Tested by:	**JE**
Report prepared by:	**JE**
Report approved by:	**DK**

TEST REPORT

UNIAXIAL COMPRESSIVE STRENGTH

In accordance with ISRM Vol 16 No 2, pp 135-140 (1979)

PROJECT:	**DYFI BRIDGE**
CLIENT:	**GROUNDSOLVE**
CCG REF:	**CCG-C-15-8700**

Sample ref:	BH5 14.2-14.4mbgl
Date of coring:	03.01.16
Sampled by:	PC
Sample description:	MUDSTONE

TEST DATA

Specimen Height (mm):	189
Specimen Diameter (mm):	85
L/D ratio:	2:1
Mode of failure:	AXIAL CLEAVAGE
Test duration:	5 mins 02 sec
Maximum load at failure (kN):	396.4
Compressive strength (N/mm2):	**69.9**

Test date:	18.01.16
Tested by:	**JE**
Report prepared by:	**JE**
Report approved by:	**DK**

TEST REPORT

UNIAXIAL COMPRESSIVE STRENGTH

In accordance with ISRM Vol 16 No 2, pp 135-140 (1979)

PROJECT:	**DYFI BRIDGE**
CLIENT:	**GROUNDSOLVE**
CCG REF:	**CCG-C-15-8700**

Sample ref:	BH5 16.0-16.2mbgl
Date of coring:	03.01.16
Sampled by:	PC
Sample description:	MUDSTONE

TEST DATA

Specimen Height (mm):	193
Specimen Diameter (mm):	85
L/D ratio:	2:1
Mode of failure:	AXIAL CLEAVAGE
Test duration:	5 mins 18 sec
Maximum load at failure (kN):	320.2
Compressive strength (N/mm2):	**56.5**

Test date:	18.01.16
Tested by:	**JE**
Report prepared by:	**JE**
Report approved by:	**DK**

TEST REPORT

UNIAXIAL COMPRESSIVE STRENGTH

In accordance with ISRM Vol 16 No 2, pp 135-140 (1979)

PROJECT:	**DYFI BRIDGE**
CLIENT:	**GROUNDSOLVE**
CCG REF:	**CCG-C-15-8700**

Sample ref:	BH5 17.0-17.2mbgl
Date of coring:	03.01.16
Sampled by:	PC
Sample description:	MUDSTONE

TEST DATA

Specimen Height (mm):	192
Specimen Diameter (mm):	85
L/D ratio:	2:1
Mode of failure:	AXIAL CLEAVAGE
Test duration:	4 mins 49 sec
Maximum load at failure (kN):	274.5
Compressive strength (N/mm2):	**48.4**

Test date:	18.01.16
Tested by:	**JE**
Report prepared by:	**JE**
Report approved by:	**DK**

SUMMARY OF LABORATORY SOIL TEST RESULTS

BH / TP / WS Number	Sample Type	Depth From (m)	Depth To (m)	Moisture Content (%)	Bulk Density (Mg/m³)	Dry Density (Mg/m³)	Shear Strength (kN/m²)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425mm (%)	Soil Classification	UKAS accredited test (Y/N)	Description / Test Method Samples described in accordance with BS EN ISO 14688-2 2004
TP1	BD	0.60	0.60	40	-	-	-	44	29	15	100	MI	Y	Greyish brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
TP1	BD	1.30	1.30	64	-	-	-	53	31	22	100	MH	Y	Brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
TP1	BD	2.10	2.10	-	-	-	-	-	-	-	-	-	Y	Grey sandy slightly gravelly SILT. (BS1377Pt2:9.2)
TP2	BD	1.40	1.40	56	-	-	-	52	31	21	100	MH	Y	Greyish brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
TP2	BD	2.70	2.70	-	-	-	-	-	-	-	-	-	Y	Greyish brown very sandy slightly silty GRAVEL. Gravel is fine to coarse subrounded mudstone. (BS1377Pt2:9.2)
TP3	BD	0.80	0.80	35	-	-	-	43	26	17	100	MI	Y	Greyish brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
TP3	BD	1.20	1.20	48	-	-	-	54	28	26	100	CH	Y	Greyish brown slightly sandy silty CLAY. (BS1377Pt2:3.2,4.4,5)
TP3	BD	2.60	2.60	-	-	-	-	-	-	-	-	-	Y	Greyish brown very gravelly silty fine to coarse grained SAND. Gravel is fine to medium subrounded mudstone. (BS1377Pt2:9.2)
TP4	BD	0.60	0.60	43	-	-	-	48	30	18	100	MI	Y	Greyish brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
TP4	BD	1.70	1.70	42	-	-	-	57	33	24	100	MH	Y	Greyish brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)

SITE: NEW DYFI BRIDGE (CCG-C-15-8700)
CLIENT: GROUNDSOLVE

DATE: 08.01.16
SHEET: 1 of 3

UKAS TESTING 4514

Key:- BD = Bulk Disturbed; SD = Small Disturbed; U100 = Undisturbed 100mm; WS = Window Sample
CL = Low Plasticity; CI = Intermediate; CH = High; CV = Very high; CE = Extremely high; NP = Non-plastic
(* Denotes Hand Shear Vane test result)
Sample description not accredited by UKAS

SUMMARY OF LABORATORY SOIL TEST RESULTS

BH / TP / WS Number	Sample Type	Depth From (m)	Depth To (m)	Moisture Content (%)	Bulk Density (Mg/m³)	Dry Density (Mg/m³)	Shear Strength (kN/m²)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425m m (%)	Soil Classification	UKAS accredited test (Y/N)	Description / Test Method Samples described in accordance with BS EN ISO 14688-2 2004
TP5	BD	1.30	1.30	40	-	-	-	46	30	16	100	MI	Y	Greyish brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
TP6	BD	0.80	0.80	43	-	-	-	42	27	15	100	MI	Y	Greyish brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
TP6	BD	2.20	2.20	41	-	-	-	43	26	17	100	MI	Y	Greyish brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
TP7	BD	1.60	1.60	39	-	-	-	42	18	14	100	MI	Y	Greyish brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
TP7	BD	2.30	2.30	42	-	-	-	45	29	16	100	MI	Y	Greyish brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
TP9	BD	1.80	1.80	-	-	-	-	-	-	-	-	-	Y	Greyish brown very sandy silty GRAVEL. Gravel is fine to coarse subrounded mudstone. (BS1377Pt2:9.2)
TP10	BD	1.90	1.90	-	-	-	-	-	-	-	-	-	Y	Greyish brown very gravelly silty fine to coarse grained SAND. Gravel is fine to medium subrounded mudstone. (BS1377Pt2:9.2)
TP11	BD	1.70	1.70	-	-	-	-	-	-	-	-	-	Y	Greyish brown very gravelly slightly silty fine to coarse grained SAND. Gravel is fine to coarse subrounded mudstone. (BS1377Pt2:9.2)
TP12	BD	1.90	1.90	-	-	-	-	-	-	-	-	-	Y	Greyish brown very sandy slightly silty GRAVEL. Gravel is fine to coarse subrounded mudstone. (BS1377Pt2:9.2)
TP13	BD	0.80	0.80	33	-	-	-	39	24	15	100	MI / CI	Y	Greyish brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)

SITE: NEW DYFI BRIDGE (CCG-C-15-8700) DATE: 08.01.16

CLIENT: GROUNDSOLVE SHEET: 2 of 3

UKAS TESTING 4514

Key:- BD = Bulk Disturbed; SD = Small Disturbed; U100 = Undisturbed 100mm; WS = Window Sample
CL = Low Plasticity; CI = Intermediate; CH = High; CV = Very high; CE = Extremely high; NP = Non-plastic
(* Denotes Hand Shear Vane test result)
Sample description not accredited by UKAS

SUMMARY OF LABORATORY SOIL TEST RESULTS

BH / TP / WS Number	Sample Type	Depth From (m)	Depth To (m)	Moisture Content (%)	Bulk Density (Mg/m³)	Dry Density (Mg/m³)	Shear Strength (kN/m²)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 0.425mm (%)	Soil Classification	UKAS accredited test (Y/N)	Description / Test Method Samples described in accordance with BS EN ISO 14688-2 2004
TP13	BD	2.30	2.30	-	-	-	-	-	-	-	-	-	Y	Greyish brown very sandy silty GRAVEL. Gravel is fine to coarse subrounded mudstone. (BS1377Pt2:9.2)
TP15	BD	2.00	2.00	-	-	-	-	-	-	-	-	-	Y	Greyish brown sandy slightly silty GRAVEL. Gravel is fine to coarse subrounded mudstone. (BS1377Pt2:9.2)
TP16	BD	1.20	1.20	-	-	-	-	-	-	-	-	-	Y	Greyish brown sandy slightly silty GRAVEL. Gravel is fine to coarse subrounded mudstone. (BS1377Pt2:9.2)
TP16	BD	2.10	2.10	40	-	-	-	50	28	22	100	MI / MH	Y	Greyish brown slightly sandy clayey SILT. (BS1377Pt2:3.2,4.4,5)
TP24	BD	0.90	0.90	12	-	-	-	-	-	-	29	NP	Y	Greyish brown very silty sandy slightly clayey GRAVEL with medium cobble content. Gravel is fine to coarse angular to subrounded mudstone. (BS1377Pt2:3.2,4.4,5,9.2,9.5)

SITE: NEW DYFI BRIDGE (CCG-C-15-8700)
CLIENT: GROUNDSOLVE

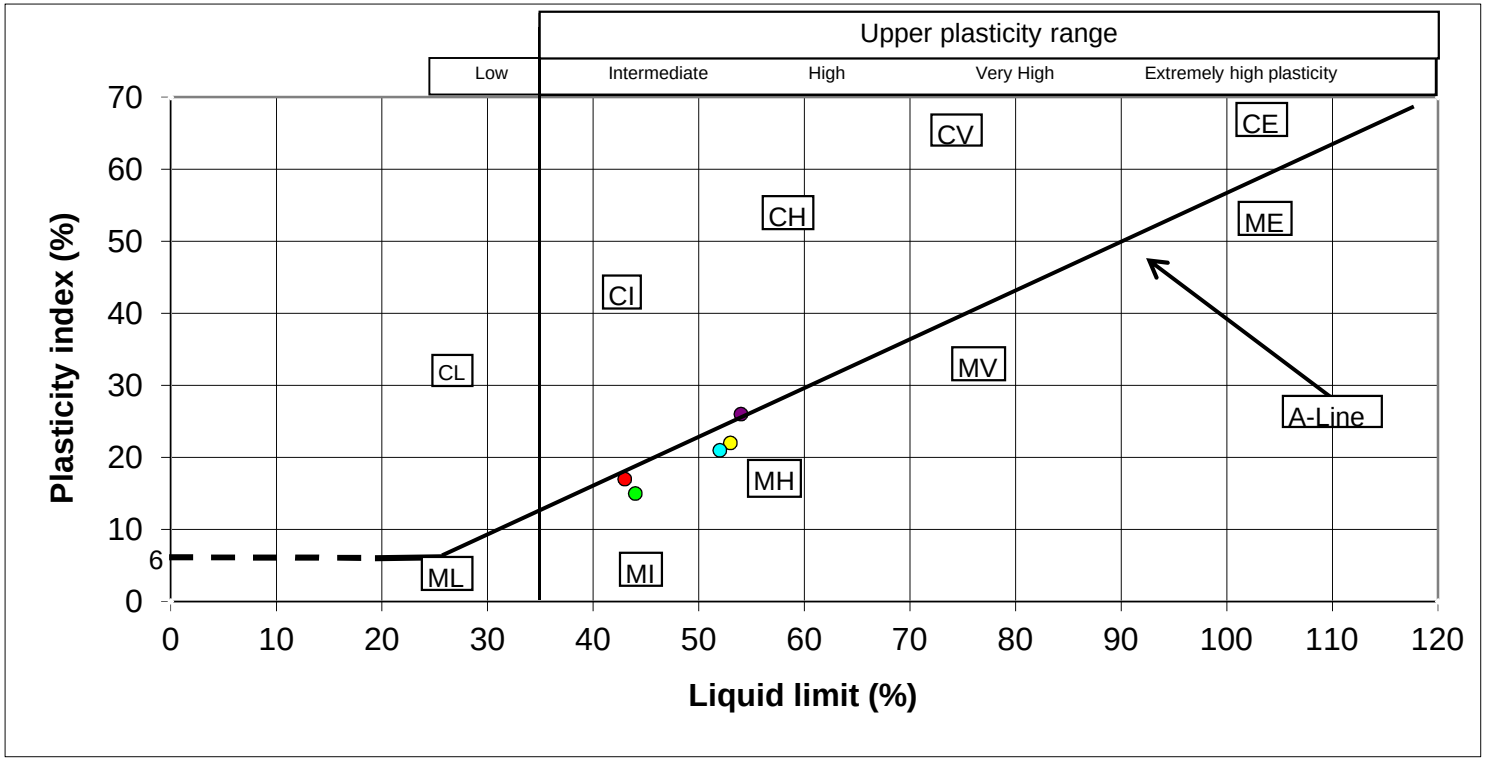
DATE: 08.01.16
SHEET: 3 of 3

UKAS TESTING 4514

Key:- BD = Bulk Disturbed; SD = Small Disturbed; U100 = Undisturbed 100mm; WS = Window Sample
CL = Low Plasticity; CI = Intermediate; CH = High; CV = Very high; CE = Extremely high; NP = Non-plastic
(* Denotes Hand Shear Vane test result)
Sample description not accredited by UKAS

ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



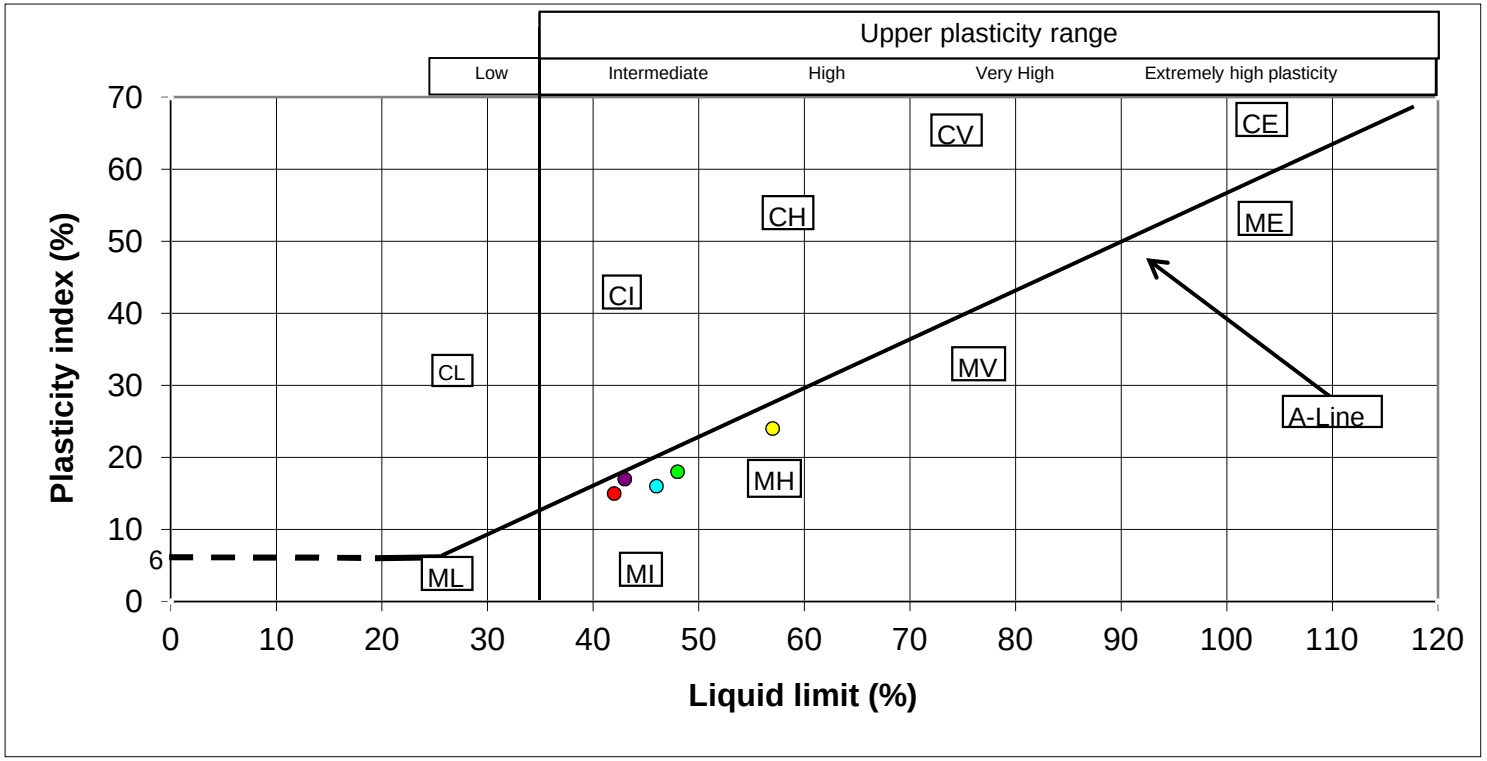
BH	Sample Depth	Liquid limit	Plasticity index
TP1	0.60	44.0	15.0
TP1	1.30	53.0	22.0
TP2	1.40	52.0	21.0
TP3	0.80	43.0	17.0
TP3	1.20	54.0	26.0

UKAS TESTING
4514

CLIENT: GROUNDSOLVE	SITE: NEW DYFI BRIDGE (CCG-C-15-8700)

ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



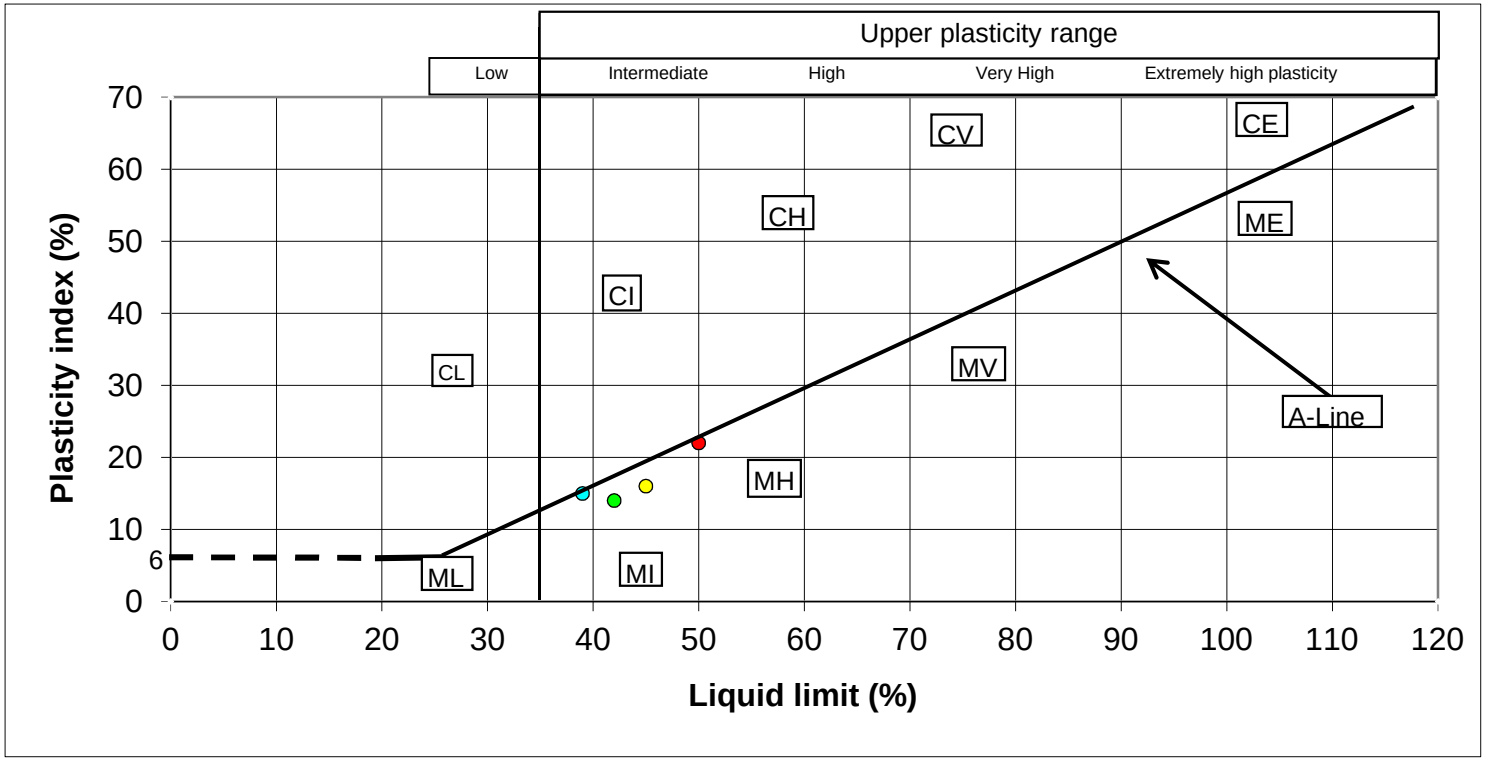
BH	Sample Depth	Liquid limit	Plasticity index
TP4	0.60	48.0	18.0
TP4	1.70	57.0	24.0
TP5	1.30	46.0	16.0
TP6	0.80	42.0	15.0
TP6	2.20	43.0	17.0

UKAS TESTING
4514

CLIENT: GROUNDSOLVE	SITE: NEW DYFI BRIDGE (CCG-C-15-8700)

ATTERBERG TEST RESULT SHEET
BS 1377:Part 2:1990:cl 4.4,5

SILT (M-SOIL), M plots below A-Line , CLAY,C, plots above A-Line, M and C may be combined as FINE SOIL, F.



BH	Sample Depth	Liquid limit	Plasticity index
TP7	1.60	42.0	14.0
TP7	2.30	45.0	16.0
TP13	0.80	39.0	15.0
TP16	2.10	50.0	22.0

UKAS TESTING
4514

CLIENT: GROUNDSOLVE	SITE: NEW DYFI BRIDGE (CCG-C-15-8700)

CC Geotechnical
Tel: 0151-523-0202
Fax: 0151-523-0252

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

HOLE NO. TP1

CLIENT GROUNDSOLVE

SITE NEW DYFI BRIDGE

SAMPLE DEPTH 2.10 - 2.10

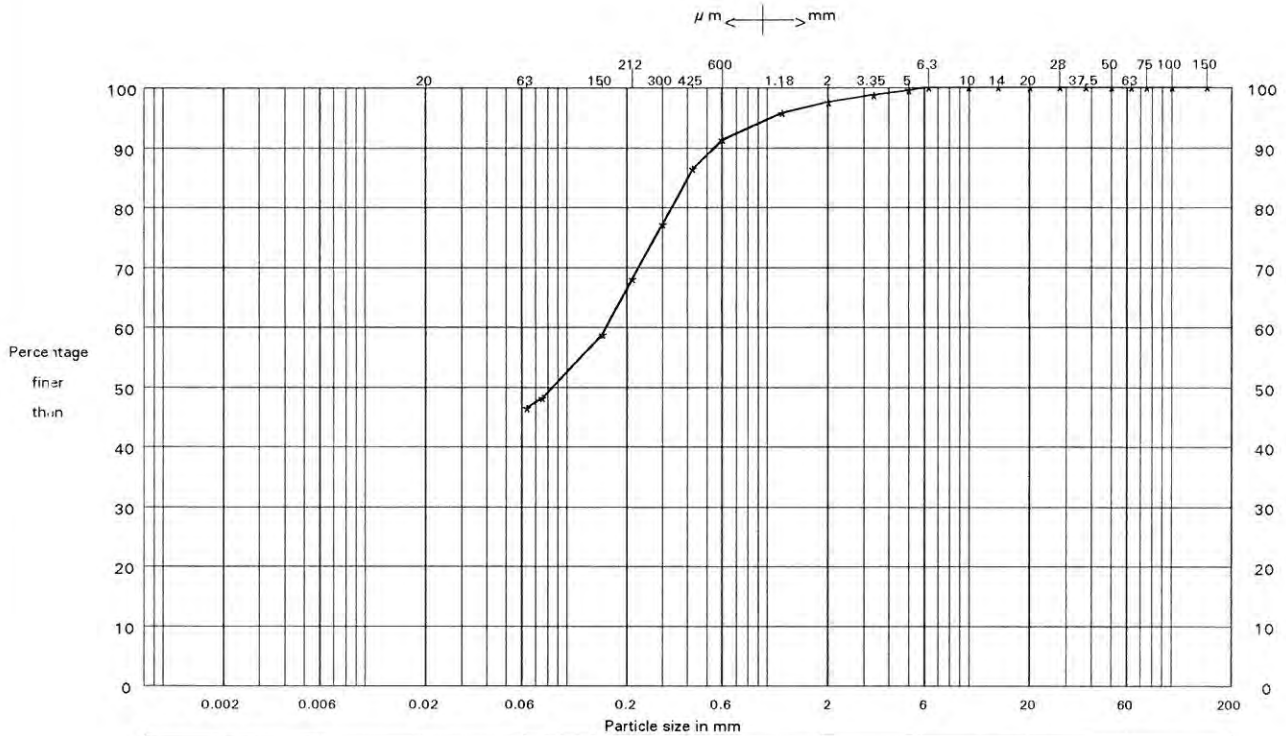
SAMPLE REF 3

JOB NO. 15/8700

METHOD OF PRETREATMENT

METHOD OF TEST Wet Sieve

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	46	48	59	68	77	86	91	96	98	99	99	100	100	100	100	100	100	100	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			52			2			0

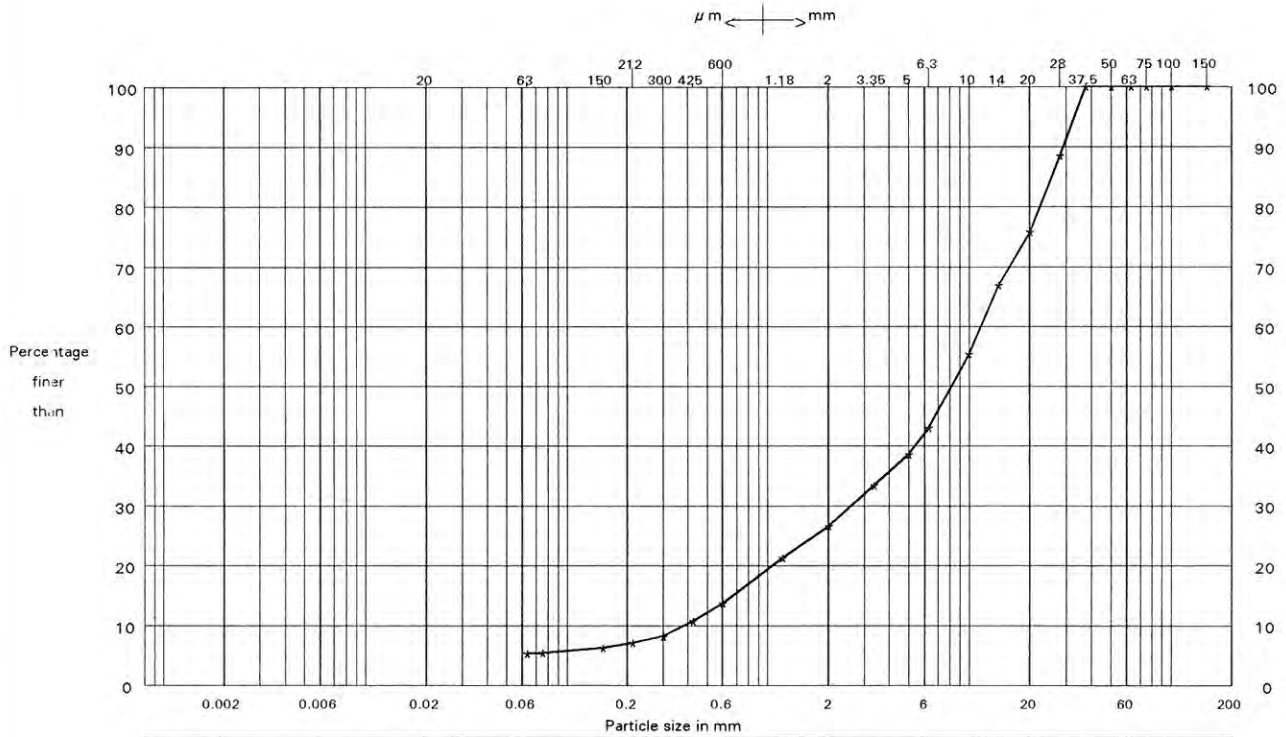
SAMPLE DESCRIPTION

Grey sandy slightly gravelly clayey SILT

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. TP2
CLIENT	GROUNDSOLVE	SITE	NEW DYFI BRIDGE
SAMPLE DEPTH	2.70 - 2.70	SAMPLE REF	2
JOB NO.	15/8700		
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	5	5	6	7	8	11	14	21	27	33	38	43	55	67	76	88	100	100	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			22			73			0

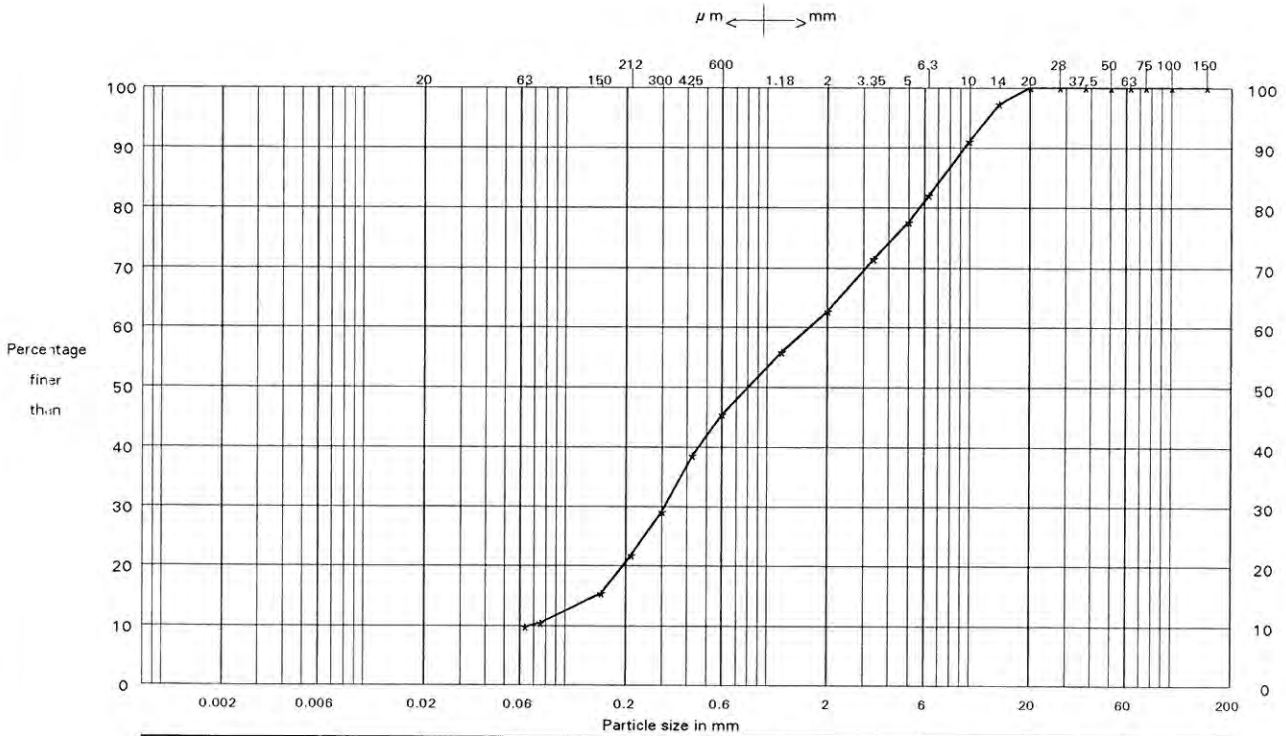
SAMPLE DESCRIPTION

Greyish brown very sandy slightly silty GRAVEL. Gravel is fine to coarse subrounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. TP3
CLIENT GROUNDSOLVE		SITE NEW DYFI BRIDGE	
SAMPLE DEPTH 2.60 - 2.60		SAMPLE REF 3	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	10	10	15	22	29	38	45	56	63	71	78	82	91	97	100	100	100	100	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			53			37			0

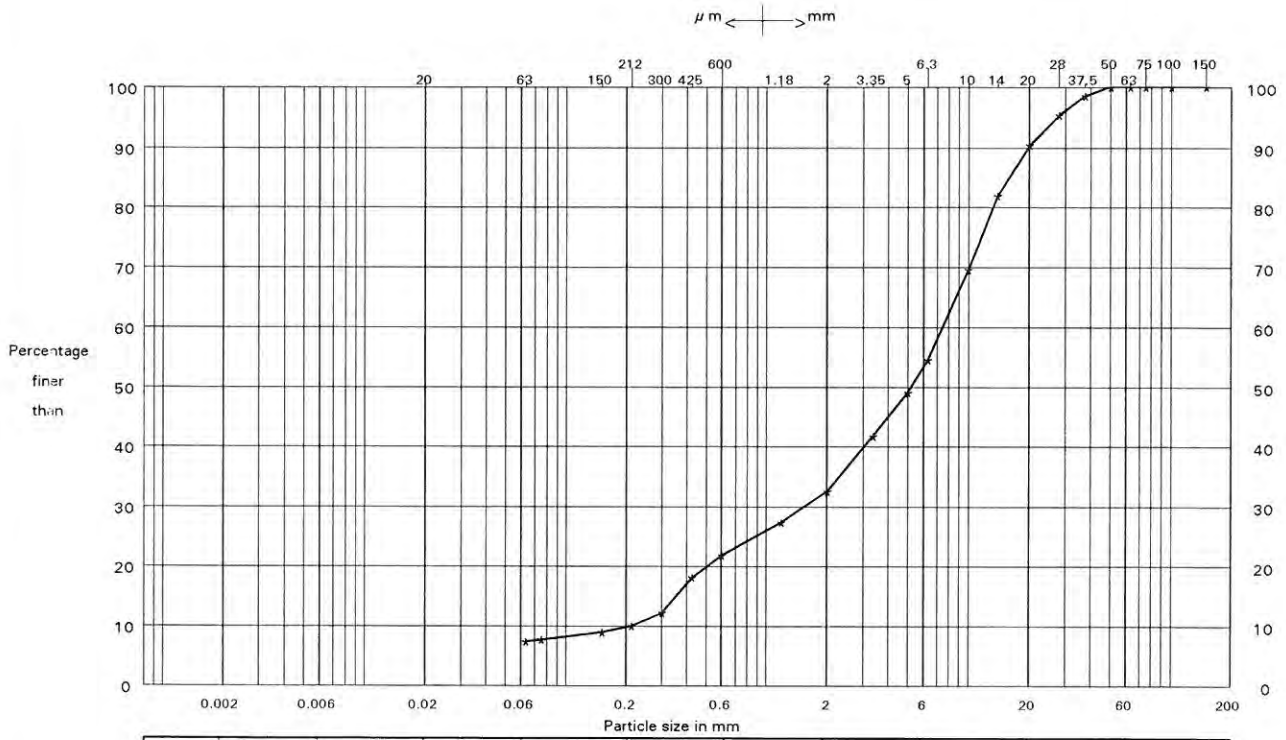
SAMPLE DESCRIPTION

Greyish brown very gravelly silty fine to coarse grained SAND Gravel is fine to medium subrounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. TP9
CLIENT	GROUNDSOLVE	SITE	NEW DYFI BRIDGE
SAMPLE DEPTH 1.80 - 1.80		SAMPLE REF 1	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	7	8	9	10	12	18	22	27	32	42	49	54	69	82	90	95	98	100	100	100	100	100

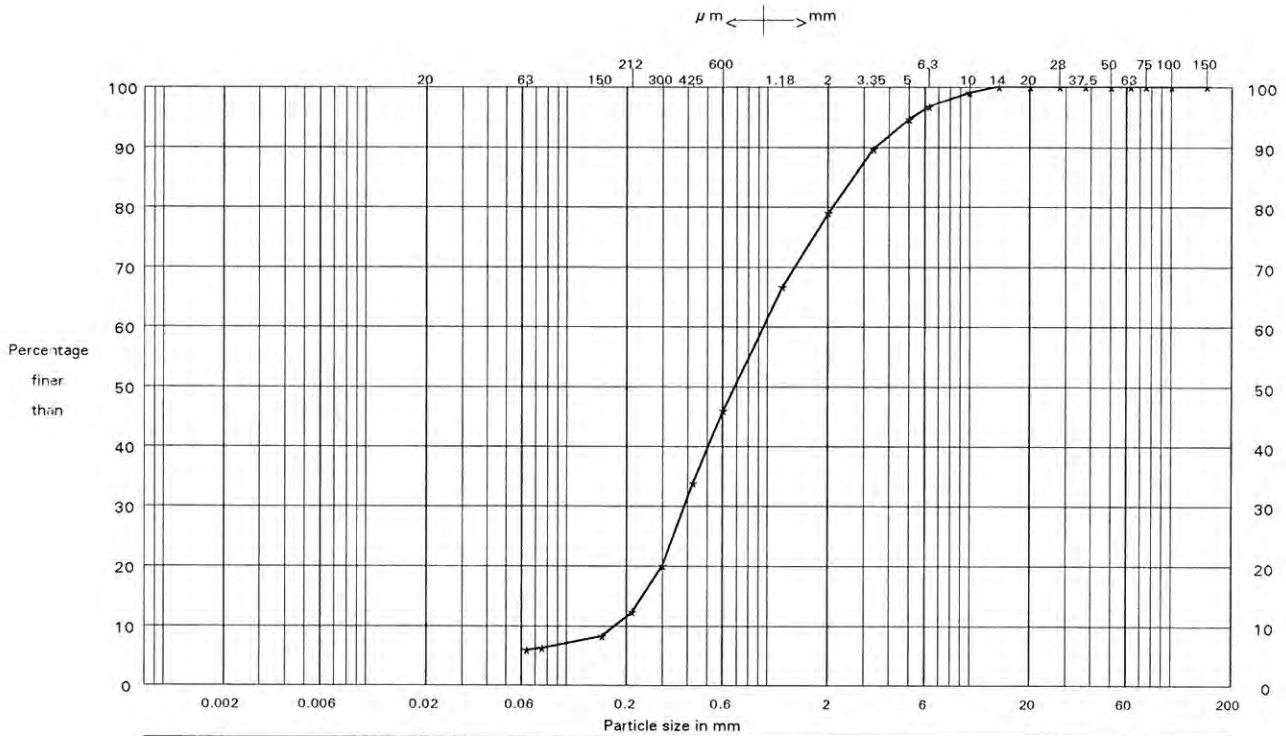


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			25			68			0

SAMPLE DESCRIPTION	REMARKS
Greyish brown very sandy silty GRAVEL. Gravel is fine to coarse subrounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. TP10
CLIENT	GROUNDSOLVE	SITE	NEW DYFI BRIDGE
SAMPLE DEPTH	1.90 - 1.90	SAMPLE REF	1
JOB NO.	15/8700		
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve

	Size (microns)							Size (mm)															
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150	
% by Mass passing Sieve	6	6	8	12	20	34	46	66	79	90	95	97	99	100	100	100	100	100	100	100	100	100	



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			73			21			0

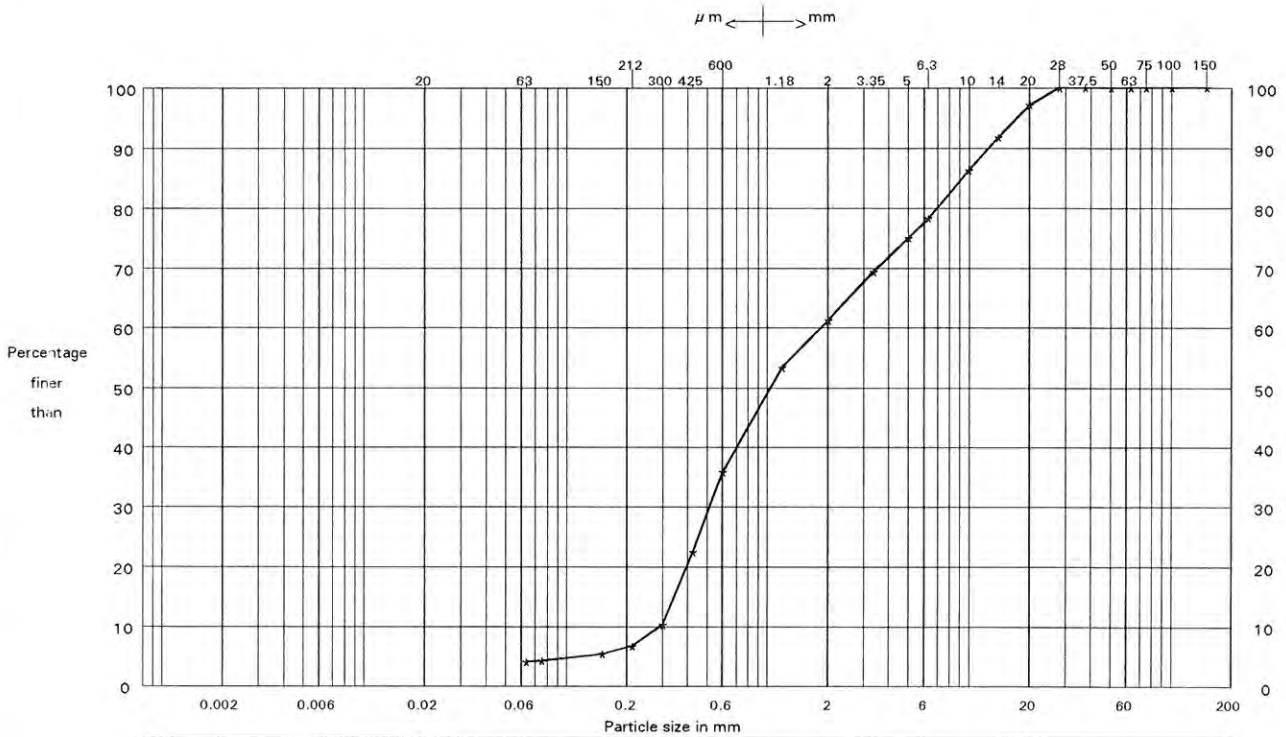
SAMPLE DESCRIPTION

Greyish brown very gravelly silty fine to coarse grained SAND. Gravel is fine to medium subrounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. TP11
CLIENT GROUNDSOLVE		SITE NEW DYFI BRIDGE	
SAMPLE DEPTH 1.70 - 1.70		SAMPLE REF 1	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	4	4	5	7	10	22	36	53	61	69	75	78	86	92	97	100	100	100	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			57			39			0

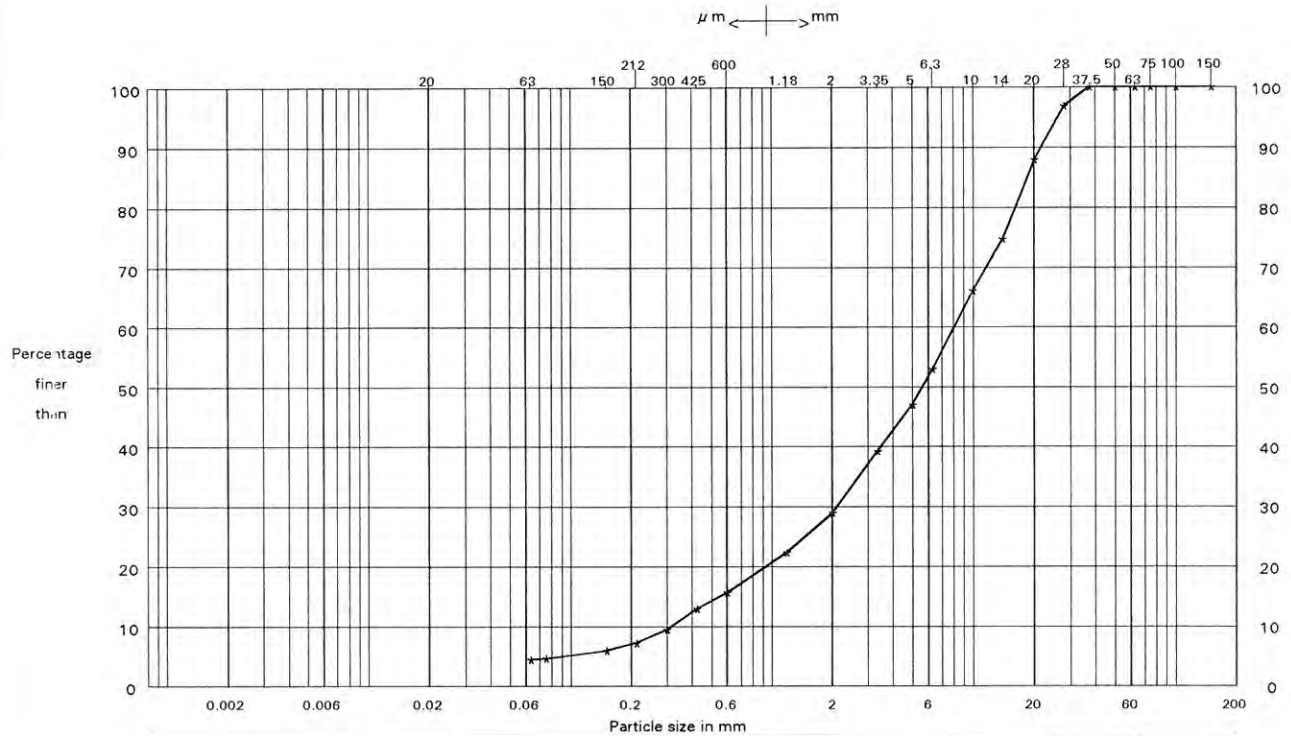
SAMPLE DESCRIPTION

Greyish brown very gravelly slightly silty fine to coarse grained SAND. Gravel is fine to coarse subrounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. TP12
CLIENT GROUNDSOLVE		SITE NEW DYFI BRIDGE	
SAMPLE DEPTH 1.90 - 1.90		SAMPLE REF 1	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	4	5	6	7	9	13	16	22	29	39	47	53	66	75	88	97	100	100	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			25			71			0

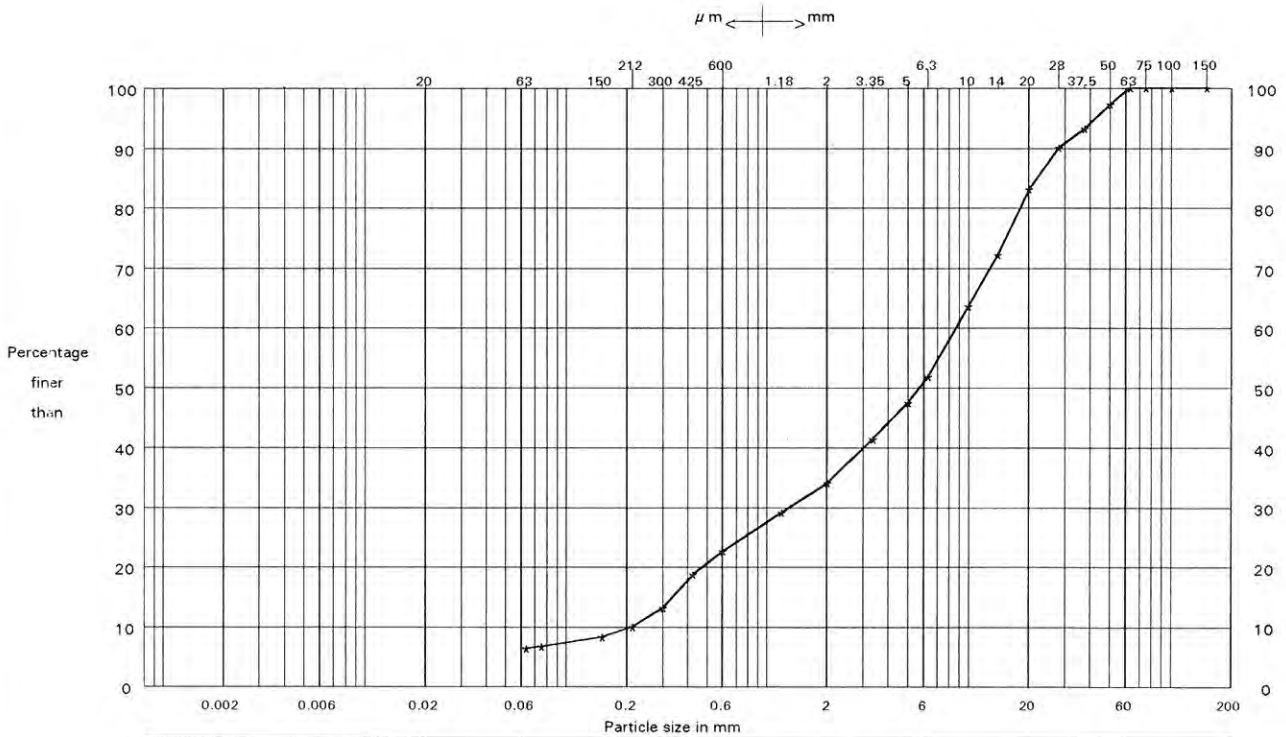
SAMPLE DESCRIPTION

Greyish brown very sandy slightly silty GRAVEL. Gravel is fine to coarse subrounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. TP13
CLIENT GROUNDSOLVE		SITE NEW DYFI BRIDGE	
SAMPLE DEPTH 2.30 - 2.30		SAMPLE REF 2	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST Wet Sieve	

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	6	7	8	10	13	19	23	29	34	41	47	52	64	72	83	90	93	97	100	100	100	100

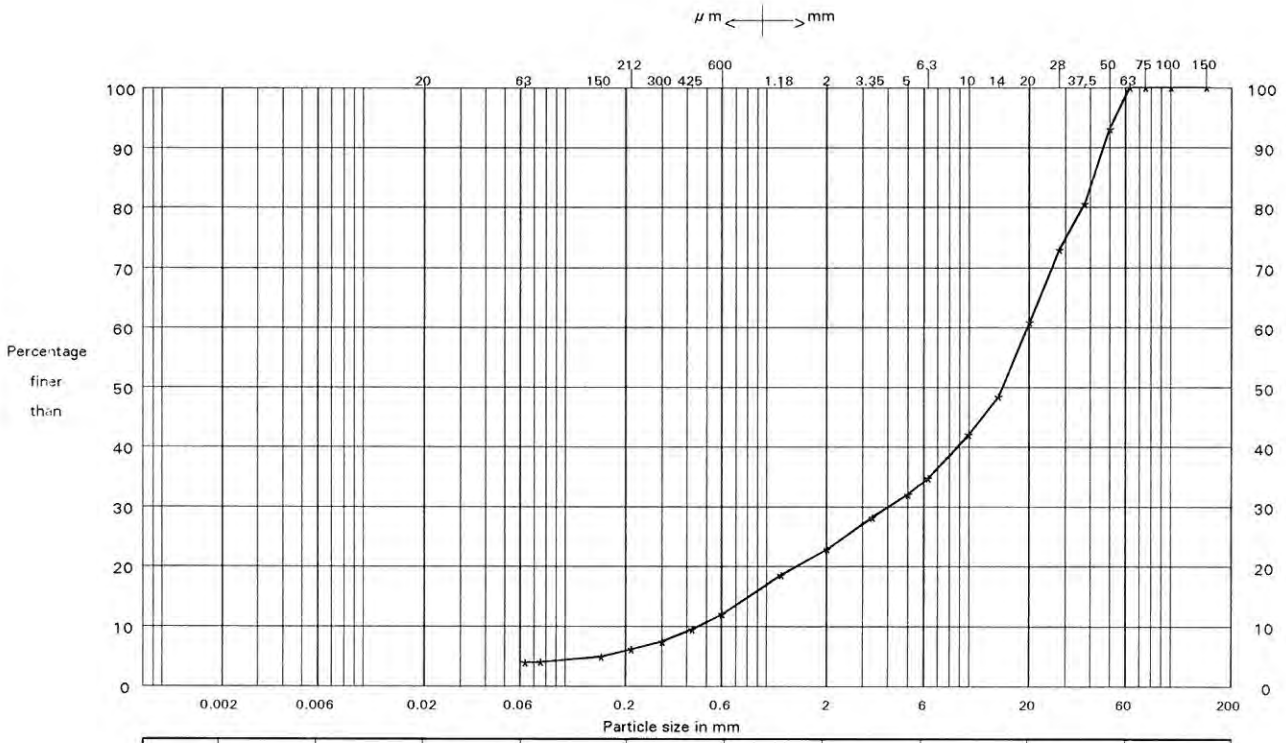


	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			28			66			0

SAMPLE DESCRIPTION	REMARKS
Greyish brown very sandy silty GRAVEL. Gravel is fine to coarse subrounded mudstone	

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. TP15
CLIENT	GROUNDSOLVE	SITE	NEW DYFI BRIDGE
SAMPLE DEPTH	2.00 - 2.00	SAMPLE REF	1
			JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve

	Size (microns)							Size (mm)													
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	4	4	5	6	7	9	12	18	23	28	32	35	42	48	61	73	81	93	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			19			77			0

SAMPLE DESCRIPTION

Greyish brown sandy slightly silty GRAVEL. Gravel is fine to coarse subrounded mudstone

REMARKS

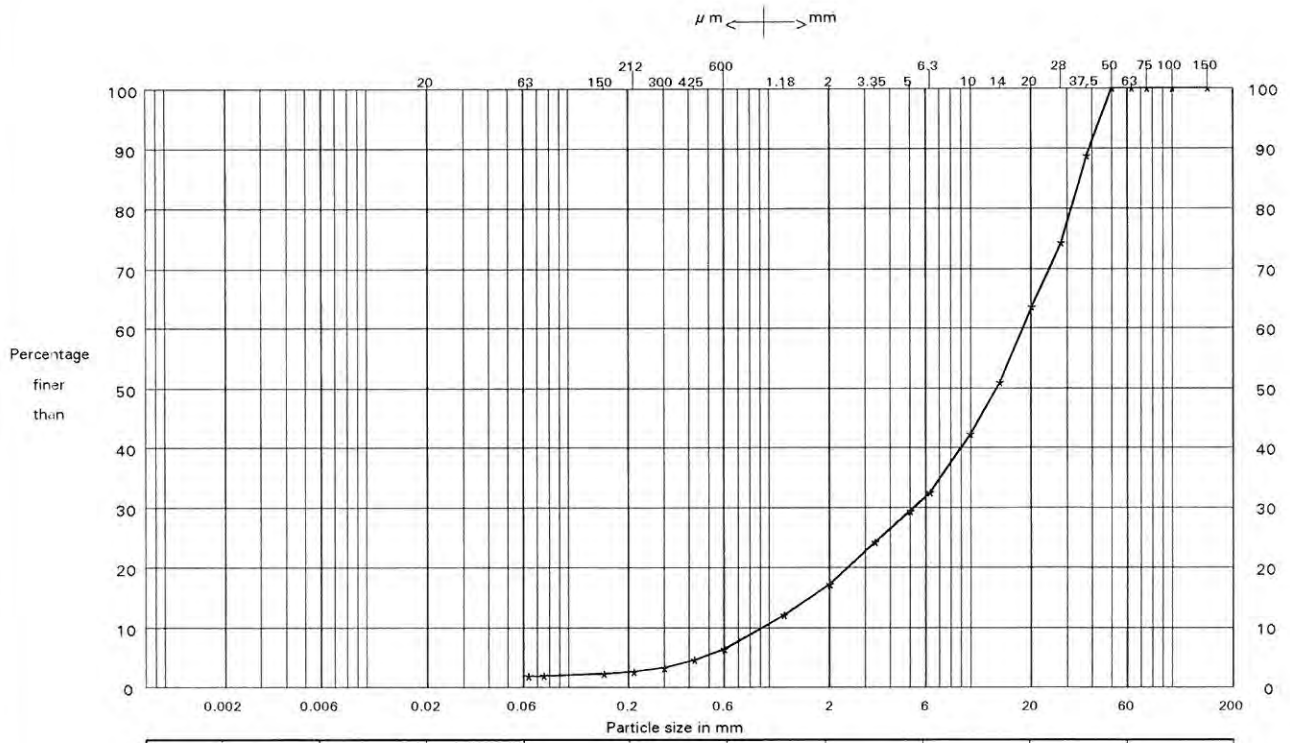
CC Geotechnical
Tel: 0151-523-0202
Fax: 0151-523-0252

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

HOLE NO. TP16

CLIENT: GROUNDSOLVE	SITE: NEW DYFI BRIDGE
SAMPLE DEPTH: 1.20 - 1.20	SAMPLE REF: 1
JOB NO.: 15/8700	
METHOD OF PRETREATMENT:	METHOD OF TEST: Wet Sieve

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	2	2	2	3	3	4	6	12	17	24	29	32	42	51	63	74	89	100	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			15			83			0

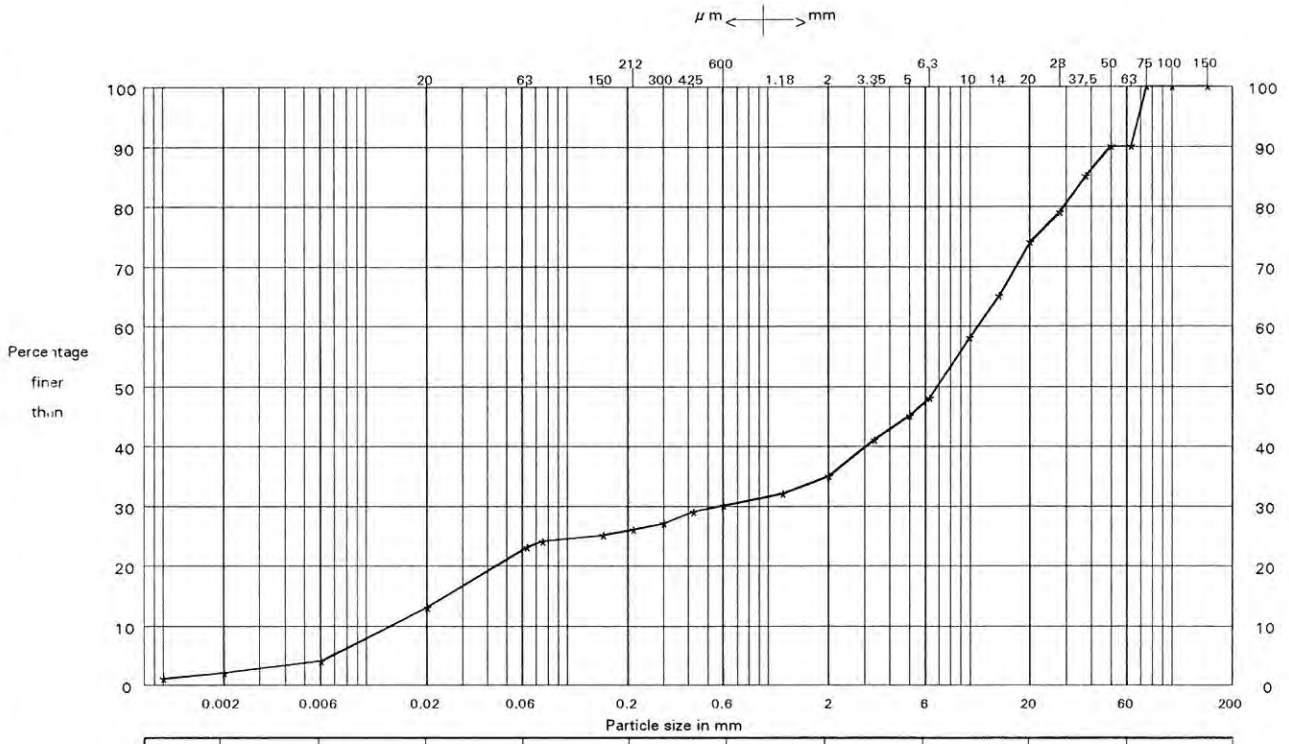
SAMPLE DESCRIPTION

Greyish brown sandy slightly silty GRAVEL. Gravel is fine to coarse subrounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. TP24
CLIENT	GROUNDSOLVE	SITE	NEW DYFI BRIDGE
SAMPLE DEPTH	0.90 - 0.90	SAMPLE REF	1
			JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve + Hydrometer

	Size (microns)											Size (mm)													
Sieve Size	1	2	6	20	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve			13	23	24	25	26	27	29	30	32	35	41	45	48	58	65	74	79	85	90	90	100	100	100	



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	2	21			12			55			10

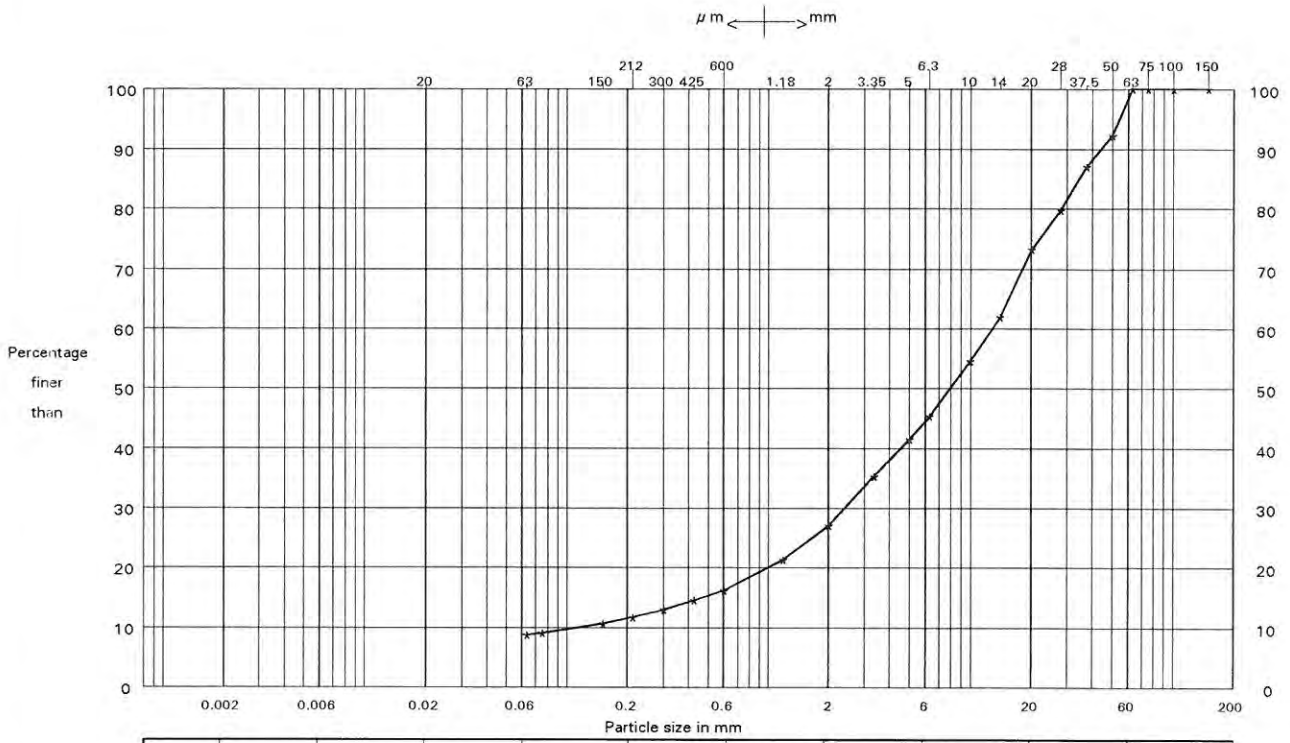
SAMPLE DESCRIPTION

Greyish brown very silty sandy slightly clayey GRAVEL with medium cobble content. Gravel is fine to coarse angular to subrounded mudstone

REMARKS

CC Geotechnical	Tel: 0151-523-0202 Fax: 0151-523-0252	DETERMINATION OF PARTICLE SIZE DISTRIBUTION	HOLE NO. TP24
CLIENT	GROUNDSOLVE	SITE	DYFI BRIDGE
SAMPLE DEPTH 1.50 - 1.50		SAMPLE REF 2	JOB NO. 15/8700
METHOD OF PRETREATMENT		METHOD OF TEST	Wet Sieve

	Size (microns)							Size (mm)														
Sieve Size	63	75	150	212	300	425	600	1.18	2	3.35	5	6.3	10	14	20	28	37.5	50	63	75	100	150
% by Mass passing Sieve	9	9	11	12	13	14	16	21	27	35	41	45	54	62	73	80	87	92	100	100	100	100



	CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES
		SILT			SAND			GRAVEL			
%	-	-			18			73			0

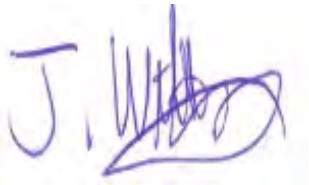
SAMPLE DESCRIPTION	REMARKS
Greyish brown silty sandy GRAVEL. Gravel is fine to coarse subrounded to subangular mudstone	

APPENDIX 8: CHEMICAL ANALYSIS CERTIFICATES

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Windmill Road
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2683

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	15-04836
Issue:	1
Date of Issue:	08/12/2015
Contact:	Tony Gerrard
Customer Details:	CC Geotechnical Ltd Unit 1 & 2 Deltic Place Deltic Way Liverpool LancashireL33 7BA
Quotation No:	Q15-00465
Order No:	Not Supplied
Customer Reference:	15-8700
Date Received:	30/11/2015
Date Approved:	08/12/2015
Details:	Dyfi Bridge, Machylleth
Approved by:	

John Wilson, Operations Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683

Sample Summary

Report No.: 15-04836

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
46901	TP7 0.30	26/11/2015	01/12/2015		
46902	TP20 0.30	26/11/2015	01/12/2015	Silty loam	
46903	TP20 1.40	26/11/2015	01/12/2015	Sandy loam	
46904	TP20 2.50	26/11/2015	01/12/2015		
46905	TP21 0.30	26/11/2015	01/12/2015		
46906	TP21 0.90	26/11/2015	01/12/2015	Sandy loam	
46907	TP21 1.90	26/11/2015	01/12/2015		
46908	TP21 3.10	26/11/2015	01/12/2015		
46909	TP22 0.30	26/11/2015	01/12/2015	Silty loam	
46910	TP24 0.35	26/11/2015	01/12/2015		
46911	TP25 0.25	26/11/2015	01/12/2015	Silty loam	
46912	TP1 0.40	25/11/2015	01/12/2015	Silty loam	
46913	TP2 0.40	25/11/2015	01/12/2015	Silty loam	
46914	TP3 0.40	25/11/2015	01/12/2015	Silty loam	
46915	TP4 0.25	25/11/2015	01/12/2015	Silty loam	
46916	TP5 0.25	25/11/2015	01/12/2015	Silty loam	
46917	TP6 0.30	25/11/2015	01/12/2015	Silty loam	
46918	TP8 0.30	25/11/2015	01/12/2015	Silty loam	
46919	TP9 0.50	24/11/2015	01/12/2015	Silty loam	
46920	TP10 0.50	24/11/2015	01/12/2015	Silty loam	
46921	TP11 0.50	24/11/2015	01/12/2015	Silty loam	
46922	TP12 0.60	24/11/2015	01/12/2015	Silty loam	
46923	TP13 0.60	24/11/2015	01/12/2015	Silty loam	
46924	TP14 0.60	24/11/2015	01/12/2015	Silty loam	
46925	TP15 0.60	24/11/2015	01/12/2015	Silty loam	
46926	TP16 0.50	24/11/2015	01/12/2015	Silty loam	c
46927	TP17 0.50	24/11/2015	01/12/2015	Silty loam	
46928	TP18 0.25	24/11/2015	01/12/2015	Silty loam	
46929	TP19 0.40	24/11/2015	01/12/2015	Sandy silty loam	
46930	TP15 0.40	24/11/2015	01/12/2015		
46931	TP19 0.40	24/11/2015	01/12/2015		
46932	TP1 0.40	25/11/2015	01/12/2015		
46933	TP3 0.40	25/11/2015	01/12/2015		
46934	TP5 0.40	25/11/2015	01/12/2015		
46935	TP8 0.40	25/11/2015	01/12/2015		
46936	TP7 0.40	26/11/2015	01/12/2015		

Results Summary

Report No.: 15-04836

			ELAB Reference	46902	46903	46906	46909	46911	46912
			Customer Reference						
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	TP20	TP20	TP21	TP22	TP25	TP1
			Sample Depth (m)	0.30	1.40	0.90	0.30	0.25	0.40
			Sampling Date	26/11/2015	26/11/2015	26/11/2015	26/11/2015	26/11/2015	25/11/2015
Determinand	**Codes**	**Units**	**LOD**						
Metals									
Antimony	N	mg/kg	2.5	< 2.5	n/t	< 2.5	< 2.5	< 2.5	< 2.5
Arsenic	M	mg/kg	1	9.9	n/t	9.6	11.7	11.9	13.2
Beryllium	U	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium	M	mg/kg	0.5	< 0.5	n/t	< 0.5	< 0.5	< 0.5	0.6
Chromium	M	mg/kg	5	27.5	n/t	24.7	34.8	30.8	35.9
Copper	M	mg/kg	5	30.1	n/t	26.7	32.2	32.7	63.9
Lead	M	mg/kg	5	46.1	n/t	98.0	73.1	34.2	227
Mercury	M	mg/kg	0.5	< 0.5	n/t	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	22.3	n/t	27.9	37.5	25.3	39.5
Selenium	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium	M	mg/kg	5	42.6	n/t	22.7	28.0	29.0	33.0
Zinc	M	mg/kg	5	103	n/t	114	116	87.0	206
Anions									
Water Soluble Sulphate	M	g/l	0.02	n/t	0.09	0.02	n/t	n/t	n/t
Inorganics									
Total Sulphide	N	mg/kg	2	n/t	< 2	< 2	n/t	n/t	n/t
Total Cyanide	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	< 1.0	< 1.0
Acid Soluble Sulphate (SO4)	U	%SO4	0.02	n/t	0.17	0.02	n/t	n/t	n/t
Water Soluble Boron	N	mg/kg	0.5	< 0.5	n/t	< 0.5	0.5	0.6	0.6
Miscellaneous									
pH	M	pH units	0.1	7.9	11.2	8.5	6.3	6.0	5.6
Total Organic Carbon	N	%	0.01	0.88	n/t	0.21	0.80	1.0	3.9
Organics									
>C8-C10 BCB	N	mg/kg	1	n/t	n/t	n/t	< 1.0	< 1.0	n/t
>C10-C12 BCB	N	mg/kg	1	n/t	n/t	n/t	< 1.0	< 1.0	n/t
>C12-C16 BCB	N	mg/kg	1	n/t	n/t	n/t	< 1.0	< 1.0	n/t
>C16-C21 BCB	N	mg/kg	1	n/t	n/t	n/t	< 1.0	< 1.0	n/t
Diesel Range Organics (>C8-C21)	N	mg/kg	1	n/t	n/t	n/t	< 1	< 1	n/t
Petrol Range Organics (>C6-C10)	N	mg/kg	0.01	n/t	n/t	n/t	< 0.01	< 0.01	n/t
Phenols									
Total Phenols	N	mg/kg	6	< 6	n/t	< 6	< 6	< 6	< 6
Polyaromatic hydrocarbons									
Naphthalene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.01	< 0.01	0.04
Acenaphthylene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.03	< 0.01	0.07
Acenaphthene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	< 0.01	< 0.01	0.02
Fluorene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	< 0.01	< 0.01	0.04
Phenanthrene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.05	< 0.01	0.27
Anthracene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.01	< 0.01	0.11
Fluoranthene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.11	0.01	0.87
Pyrene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.11	< 0.01	0.79
Benzo(a)anthracene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.06	< 0.01	0.60
Chrysene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.10	< 0.01	0.74
Benzo (b) fluoranthene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.06	< 0.01	0.36
Benzo(k)fluoranthene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.11	< 0.01	0.78
Benzo (a) pyrene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.08	< 0.01	0.66
Indeno (1,2,3-cd) pyrene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.03	< 0.01	0.28
Dibenzo(a,h)anthracene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.02	< 0.01	0.11
Benzo(g,h,i)perylene GCMS	N	mg/kg	0.01	n/t	n/t	n/t	0.04	< 0.01	0.35
Total PAH(16) GCMS	N	mg/kg	0.04	n/t	n/t	n/t	0.83	0.06	6.08

Tests marked N are not UKAS accredited.

Results Summary

Report No.: 15-04836

				ELAB Reference	46902	46903	46906	46909	46911	46912
				Customer Reference						
				Sample ID						
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sample Location	TP20	TP20	TP21	TP22	TP25	TP1
				Sample Depth (m)	0.30	1.40	0.90	0.30	0.25	0.40
				Sampling Date	26/11/2015	26/11/2015	26/11/2015	26/11/2015	26/11/2015	25/11/2015
Determinand	**Codes**	**Units**	**LOD**							
BTEX										
Benzene	M	ug/kg	10	n/t	n/t	n/t	< 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10	n/t	n/t	n/t	< 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	n/t	n/t	n/t	< 10.0	< 10.0	< 10.0
Xylenes	M	ug/kg	10	n/t	n/t	n/t	< 10.0	< 10.0	< 10.0
TPH CWG										
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	n/t	< 1.0	n/t	n/t	< 1.0
>C10-C12 Aliphatic	N	mg/kg	1	< 1.0	n/t	< 1.0	n/t	n/t	< 1.0
>C12-C16 Aliphatic	N	mg/kg	1	6.9	n/t	< 1.0	n/t	n/t	< 1.0
>C16-C21 Aliphatic	N	mg/kg	1	7.8	n/t	< 1.0	n/t	n/t	< 1.0
>C21-C35 Aliphatic	N	mg/kg	1	132	n/t	2.5	n/t	n/t	17.6
>C35-C40 Aliphatic	N	mg/kg	1	63.0	n/t	1.7	n/t	n/t	14.5
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	< 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	< 0.01
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	n/t	< 1.0	n/t	n/t	< 1.0
>C10-C12 Aromatic	N	mg/kg	1	< 1.0	n/t	< 1.0	n/t	n/t	< 1.0
>C12-C16 Aromatic	N	mg/kg	1	1.2	n/t	< 1.0	n/t	n/t	< 1.0
>C16-C21 Aromatic	N	mg/kg	1	3.5	n/t	< 1.0	n/t	n/t	< 1.0
>C21-C35 Aromatic	N	mg/kg	1	85.2	n/t	< 1.0	n/t	n/t	9.1
>C35-C40 Aromatic	N	mg/kg	1	42.7	n/t	< 1.0	n/t	n/t	2.5
Total (>C5-C40) Ali/Aro	N	mg/kg	1	343	n/t	4.2	n/t	n/t	43.7
Total Petroleum Hydrocarbons										
Mineral Oil	U	mg/kg	5	n/t	n/t	n/t	< 5	10	n/t
Total TPH (>C8-C40)	M	mg/kg	5	n/t	n/t	n/t	< 5	10	n/t
PCB (WHO 12 Congeners)										
PCB 81	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	n/t
PCB 77	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	n/t
PCB 123	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	n/t
PCB 118	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	n/t
PCB 114	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	n/t
PCB 105	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	n/t
PCB 126	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	n/t
PCB 167	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	n/t
PCB 156	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	n/t
PCB 157	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	n/t
PCB 169	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	n/t
PCB 189	N	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	n/t	n/t

Results Summary

Report No.: 15-04836

			ELAB Reference	46913	46914	46915	46916	46917	46918
			Customer Reference						
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	TP2	TP3	TP4	TP5	TP6	TP8
			Sample Depth (m)	0.40	0.40	0.25	0.25	0.30	0.30
			Sampling Date	25/11/2015	25/11/2015	25/11/2015	25/11/2015	25/11/2015	25/11/2015
Determinand	**Codes**	**Units**	**LOD**						
Metals									
Antimony	N	mg/kg	2.5	< 2.5	< 2.5	n/t	< 2.5	< 2.5	< 2.5
Arsenic	M	mg/kg	1	12.5	21.3	n/t	16.4	15.7	9.4
Beryllium	U	mg/kg	1	1.2	1.0	n/t	< 1.0	1.1	< 1.0
Cadmium	M	mg/kg	0.5	0.5	0.6	n/t	0.6	0.7	0.7
Chromium	M	mg/kg	5	41.4	32.4	n/t	38.3	41.4	41.0
Copper	M	mg/kg	5	50.5	56.6	n/t	128	110	46.8
Lead	M	mg/kg	5	201	299	n/t	348	432	258
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	n/t	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	47.5	40.1	n/t	46.3	48.6	45.1
Selenium	M	mg/kg	1	< 1.0	< 1.0	n/t	< 1.0	< 1.0	< 1.0
Vanadium	M	mg/kg	5	34.0	28.2	n/t	33.8	32.7	34.1
Zinc	M	mg/kg	5	202	186	n/t	233	258	220
Anions									
Water Soluble Sulphate	M	g/l	0.02	< 0.02	n/t	< 0.02	n/t	n/t	n/t
Inorganics									
Total Sulphide	N	mg/kg	2	< 2	n/t	< 2	n/t	n/t	n/t
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	n/t	< 1.0	< 1.0	< 1.0
Acid Soluble Sulphate (SO4)	U	%SO4	0.02	0.05	n/t	0.06	n/t	n/t	n/t
Water Soluble Boron	N	mg/kg	0.5	0.8	< 0.5	n/t	0.7	0.6	0.6
Miscellaneous									
pH	M	pH units	0.1	5.7	5.6	5.7	5.5	5.7	5.7
Total Organic Carbon	N	%	0.01	1.7	3.8	n/t	1.9	1.2	1.4
Organics									
>C8-C10 BCB	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	< 1.0	< 1.0
>C10-C12 BCB	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	< 1.0	< 1.0
>C12-C16 BCB	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	< 1.0	< 1.0
>C16-C21 BCB	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	< 1.0	< 1.0
Diesel Range Organics (>C8-C21)	N	mg/kg	1	n/t	< 1	n/t	< 1	< 1	< 1
Petrol Range Organics (>C6-C10)	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	< 0.01	< 0.01
Phenols									
Total Phenols	N	mg/kg	6	< 6	< 6	n/t	< 6	< 6	< 6
Polyaromatic hydrocarbons									
Naphthalene GCMS	N	mg/kg	0.01	< 0.01	0.04	n/t	0.03	< 0.01	< 0.01
Acenaphthylene GCMS	N	mg/kg	0.01	< 0.01	< 0.01	n/t	< 0.01	< 0.01	< 0.01
Acenaphthene GCMS	N	mg/kg	0.01	< 0.01	< 0.01	n/t	< 0.01	< 0.01	< 0.01
Fluorene GCMS	N	mg/kg	0.01	< 0.01	0.03	n/t	< 0.01	< 0.01	< 0.01
Phenanthrene GCMS	N	mg/kg	0.01	0.01	0.33	n/t	0.07	0.02	0.03
Anthracene GCMS	N	mg/kg	0.01	< 0.01	0.02	n/t	< 0.01	< 0.01	< 0.01
Fluoranthene GCMS	N	mg/kg	0.01	0.02	0.14	n/t	0.03	0.02	0.15
Pyrene GCMS	N	mg/kg	0.01	0.02	0.13	n/t	0.03	0.01	0.14
Benzo(a)anthracene GCMS	N	mg/kg	0.01	0.01	0.07	n/t	0.01	< 0.01	0.06
Chrysene GCMS	N	mg/kg	0.01	0.02	0.18	n/t	0.03	0.01	0.09
Benzo (b) fluoranthene GCMS	N	mg/kg	0.01	< 0.01	0.05	n/t	0.01	< 0.01	0.05
Benzo(k)fluoranthene GCMS	N	mg/kg	0.01	0.01	0.07	n/t	0.01	< 0.01	0.09
Benzo (a) pyrene GCMS	N	mg/kg	0.01	< 0.01	0.07	n/t	0.01	< 0.01	0.07
Indeno (1,2,3-cd) pyrene GCMS	N	mg/kg	0.01	< 0.01	0.02	n/t	< 0.01	< 0.01	0.03
Dibenzo(a,h)anthracene GCMS	N	mg/kg	0.01	< 0.01	0.02	n/t	< 0.01	< 0.01	0.01
Benzo(g,h,i)perylene GCMS	N	mg/kg	0.01	< 0.01	0.03	n/t	< 0.01	< 0.01	0.04
Total PAH(16) GCMS	N	mg/kg	0.04	0.14	1.22	n/t	0.27	0.10	0.77

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Results Summary

Report No.: 15-04836

				ELAB Reference	46913	46914	46915	46916	46917	46918
				Customer Reference						
				Sample ID						
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sample Location	TP2	TP3	TP4	TP5	TP6	TP8
				Sample Depth (m)	0.40	0.40	0.25	0.25	0.30	0.30
				Sampling Date	25/11/2015	25/11/2015	25/11/2015	25/11/2015	25/11/2015	25/11/2015
Determinand	**Codes**	**Units**	**LOD**							
BTEX										
Benzene	M	ug/kg	10		< 10.0	< 10.0	n/t	< 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10		< 10.0	< 10.0	n/t	< 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10		< 10.0	< 10.0	n/t	< 10.0	< 10.0	< 10.0
Xylenes	M	ug/kg	10		< 10.0	< 10.0	n/t	< 10.0	< 10.0	< 10.0
TPH CWG										
>C5-C6 Aliphatic	N	mg/kg	0.01		< 0.01	n/t	n/t	n/t	n/t	n/t
>C6-C8 Aliphatic	N	mg/kg	0.01		< 0.01	n/t	n/t	n/t	n/t	n/t
>C8-C10 Aliphatic	N	mg/kg	1		< 1.0	n/t	n/t	n/t	n/t	n/t
>C10-C12 Aliphatic	N	mg/kg	1		< 1.0	n/t	n/t	n/t	n/t	n/t
>C12-C16 Aliphatic	N	mg/kg	1		< 1.0	n/t	n/t	n/t	n/t	n/t
>C16-C21 Aliphatic	N	mg/kg	1		< 1.0	n/t	n/t	n/t	n/t	n/t
>C21-C35 Aliphatic	N	mg/kg	1		4.8	n/t	n/t	n/t	n/t	n/t
>C35-C40 Aliphatic	N	mg/kg	1		2.9	n/t	n/t	n/t	n/t	n/t
>C5-C7 Aromatic	N	mg/kg	0.01		< 0.01	n/t	n/t	n/t	n/t	n/t
>C7-C8 Aromatic	N	mg/kg	0.01		< 0.01	n/t	n/t	n/t	n/t	n/t
>C8-C10 Aromatic	N	mg/kg	1		< 1.0	n/t	n/t	n/t	n/t	n/t
>C10-C12 Aromatic	N	mg/kg	1		< 1.0	n/t	n/t	n/t	n/t	n/t
>C12-C16 Aromatic	N	mg/kg	1		< 1.0	n/t	n/t	n/t	n/t	n/t
>C16-C21 Aromatic	N	mg/kg	1		< 1.0	n/t	n/t	n/t	n/t	n/t
>C21-C35 Aromatic	N	mg/kg	1		< 1.0	n/t	n/t	n/t	n/t	n/t
>C35-C40 Aromatic	N	mg/kg	1		< 1.0	n/t	n/t	n/t	n/t	n/t
Total (>C5-C40) Ali/Aro	N	mg/kg	1		7.7	n/t	n/t	n/t	n/t	n/t
Total Petroleum Hydrocarbons										
Mineral Oil	U	mg/kg	5		n/t	< 5	n/t	< 5	< 5	< 5
Total TPH (>C8-C40)	M	mg/kg	5		n/t	< 5	n/t	< 5	< 5	< 5
PCB (WHO 12 Congeners)										
PCB 81	N	mg/kg	0.01		n/t	n/t	n/t	n/t	n/t	n/t
PCB 77	N	mg/kg	0.01		n/t	n/t	n/t	n/t	n/t	n/t
PCB 123	N	mg/kg	0.01		n/t	n/t	n/t	n/t	n/t	n/t
PCB 118	N	mg/kg	0.01		n/t	n/t	n/t	n/t	n/t	n/t
PCB 114	N	mg/kg	0.01		n/t	n/t	n/t	n/t	n/t	n/t
PCB 105	N	mg/kg	0.01		n/t	n/t	n/t	n/t	n/t	n/t
PCB 126	N	mg/kg	0.01		n/t	n/t	n/t	n/t	n/t	n/t
PCB 167	N	mg/kg	0.01		n/t	n/t	n/t	n/t	n/t	n/t
PCB 156	N	mg/kg	0.01		n/t	n/t	n/t	n/t	n/t	n/t
PCB 157	N	mg/kg	0.01		n/t	n/t	n/t	n/t	n/t	n/t
PCB 169	N	mg/kg	0.01		n/t	n/t	n/t	n/t	n/t	n/t
PCB 189	N	mg/kg	0.01		n/t	n/t	n/t	n/t	n/t	n/t

Results Summary

Report No.: 15-04836

				ELAB Reference	46919	46920	46921	46922	46923	46924
				Customer Reference						
				Sample ID						
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sample Location	TP9	TP10	TP11	TP12	TP13	TP14
				Sample Depth (m)	0.50	0.50	0.50	0.60	0.60	0.60
				Sampling Date	24/11/2015	24/11/2015	24/11/2015	24/11/2015	24/11/2015	24/11/2015
Determinand	**Codes**	**Units**	**LOD**							
Metals										
Antimony	N	mg/kg	2.5	n/t	< 2.5	n/t	< 2.5	n/t	2.8
Arsenic	M	mg/kg	1	n/t	11.9	n/t	13.4	n/t	15.7
Beryllium	U	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	< 1.0
Cadmium	M	mg/kg	0.5	n/t	< 0.5	n/t	< 0.5	n/t	0.9
Chromium	M	mg/kg	5	n/t	34.8	n/t	41.6	n/t	36.0
Copper	M	mg/kg	5	n/t	33.6	n/t	51.2	n/t	60.0
Lead	M	mg/kg	5	n/t	153	n/t	85.8	n/t	718
Mercury	M	mg/kg	0.5	n/t	< 0.5	n/t	< 0.5	n/t	< 0.5
Nickel	M	mg/kg	5	n/t	39.6	n/t	47.7	n/t	42.8
Selenium	M	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	< 1.0
Vanadium	M	mg/kg	5	n/t	27.0	n/t	31.6	n/t	27.5
Zinc	M	mg/kg	5	n/t	155	n/t	147	n/t	250
Anions										
Water Soluble Sulphate	M	g/l	0.02	< 0.02	n/t	< 0.02	n/t	< 0.02	n/t
Inorganics										
Total Sulphide	N	mg/kg	2	< 2	n/t	< 2	n/t	< 2	n/t
Total Cyanide	M	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	< 1.0
Acid Soluble Sulphate (SO4)	U	%SO4	0.02	0.04	n/t	0.04	n/t	0.04	n/t
Water Soluble Boron	N	mg/kg	0.5	n/t	< 0.5	n/t	< 0.5	n/t	0.5
Miscellaneous										
pH	M	pH units	0.1	5.7	6.0	5.8	6.0	6.0	5.5
Total Organic Carbon	N	%	0.01	n/t	0.73	n/t	0.52	n/t	0.69
Organics										
>C8-C10 BCB	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	< 1.0
>C10-C12 BCB	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	< 1.0
>C12-C16 BCB	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	< 1.0
>C16-C21 BCB	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	< 1.0
Diesel Range Organics (>C8-C21)	N	mg/kg	1	n/t	< 1	n/t	< 1	n/t	< 1
Petrol Range Organics (>C6-C10)	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	< 0.01
Phenols										
Total Phenols	N	mg/kg	6	n/t	< 6	n/t	< 6	n/t	< 6
Polyaromatic hydrocarbons										
Naphthalene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	< 0.01
Acenaphthylene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	< 0.01
Acenaphthene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	< 0.01
Fluorene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	< 0.01
Phenanthrene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	0.03	n/t	< 0.01
Anthracene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	< 0.01
Fluoranthene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	0.08	n/t	< 0.01
Pyrene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	0.07	n/t	< 0.01
Benzo(a)anthracene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	0.03	n/t	< 0.01
Chrysene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	0.04	n/t	< 0.01
Benzo (b) fluoranthene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	0.02	n/t	< 0.01
Benzo(k)fluoranthene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	0.03	n/t	< 0.01
Benzo (a) pyrene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	0.02	n/t	< 0.01
Indeno (1,2,3-cd) pyrene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	< 0.01
Dibenzo(a,h)anthracene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	< 0.01
Benzo(g,h,i)perylene GCMS	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	< 0.01
Total PAH(16) GCMS	N	mg/kg	0.04	n/t	< 0.04	n/t	0.35	n/t	< 0.04

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Results Summary

Report No.: 15-04836

			ELAB Reference	46919	46920	46921	46922	46923	46924
			Customer Reference						
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	TP9	TP10	TP11	TP12	TP13	TP14
			Sample Depth (m)	0.50	0.50	0.50	0.60	0.60	0.60
			Sampling Date	24/11/2015	24/11/2015	24/11/2015	24/11/2015	24/11/2015	24/11/2015
Determinand	**Codes**	**Units**	**LOD**						
BTEX									
Benzene	M	ug/kg	10	n/t	< 10.0	n/t	< 10.0	n/t	< 10.0
Toluene	M	ug/kg	10	n/t	< 10.0	n/t	< 10.0	n/t	< 10.0
Ethylbenzene	M	ug/kg	10	n/t	< 10.0	n/t	< 10.0	n/t	< 10.0
Xylenes	M	ug/kg	10	n/t	< 10.0	n/t	< 10.0	n/t	< 10.0
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
>C6-C8 Aliphatic	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
>C8-C10 Aliphatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C10-C12 Aliphatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C12-C16 Aliphatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C16-C21 Aliphatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C21-C35 Aliphatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C35-C40 Aliphatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C5-C7 Aromatic	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
>C7-C8 Aromatic	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
>C8-C10 Aromatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C10-C12 Aromatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C12-C16 Aromatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C16-C21 Aromatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C21-C35 Aromatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
>C35-C40 Aromatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
Total (>C5-C40) Ali/Aro	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t	n/t
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	< 5	n/t	< 5	n/t	< 5
Total TPH (>C8-C40)	M	mg/kg	5	n/t	< 5	n/t	< 5	n/t	< 5
PCB (WHO 12 Congeners)									
PCB 81	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 77	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 123	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 118	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 114	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 105	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 126	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 167	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 156	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 157	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 169	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 189	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t

Results Summary

Report No.: 15-04836

				ELAB Reference	46925	46926	46927	46928	46929
				Customer Reference					
				Sample ID					
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
				Sample Location	TP15	TP16	TP17	TP18	TP19
				Sample Depth (m)	0.60	0.50	0.50	0.25	0.40
				Sampling Date	24/11/2015	24/11/2015	24/11/2015	24/11/2015	24/11/2015
Determinand	**Codes**	**Units**	**LOD**						
Metals									
Antimony	N	mg/kg	2.5	n/t	< 2.5	n/t	< 2.5	< 2.5
Arsenic	M	mg/kg	1	n/t	10.2	n/t	9.4	14.9
Beryllium	U	mg/kg	1	n/t	< 1.0	n/t	< 1.0	1.0
Cadmium	M	mg/kg	0.5	n/t	0.6	n/t	< 0.5	0.7
Chromium	M	mg/kg	5	n/t	32.5	n/t	30.3	43.1
Copper	M	mg/kg	5	n/t	42.8	n/t	32.1	48.3
Lead	M	mg/kg	5	n/t	315	n/t	228	319
Mercury	M	mg/kg	0.5	n/t	< 0.5	n/t	< 0.5	< 0.5
Nickel	M	mg/kg	5	n/t	39.3	n/t	34.5	52.0
Selenium	M	mg/kg	1	n/t	< 1.0	n/t	< 1.0	< 1.0
Vanadium	M	mg/kg	5	n/t	25.0	n/t	21.8	33.7
Zinc	M	mg/kg	5	n/t	175	n/t	145	223
Anions									
Water Soluble Sulphate	M	g/l	0.02	< 0.02	n/t	0.02	n/t	n/t
Inorganics									
Total Sulphide	N	mg/kg	2	< 2	n/t	< 2	n/t	n/t
Total Cyanide	M	mg/kg	1	n/t	< 1.0	n/t	< 1.0	< 1.0
Acid Soluble Sulphate (SO4)	U	%SO4	0.02	0.05	n/t	0.04	n/t	n/t
Water Soluble Boron	N	mg/kg	0.5	n/t	< 0.5	n/t	0.5	0.5
Miscellaneous									
pH	M	pH units	0.1	5.4	5.7	5.5	6.0	6.0
Total Organic Carbon	N	%	0.01	n/t	0.50	n/t	0.99	0.49
Organics									
>C8-C10 BCB	N	mg/kg	1	n/t	c < 1.0	n/t	< 1.0	< 1.0
>C10-C12 BCB	N	mg/kg	1	n/t	c < 1.0	n/t	< 1.0	< 1.0
>C12-C16 BCB	N	mg/kg	1	n/t	c < 1.0	n/t	< 1.0	< 1.0
>C16-C21 BCB	N	mg/kg	1	n/t	c < 1.0	n/t	< 1.0	< 1.0
Diesel Range Organics (>C8-C21)	N	mg/kg	1	n/t	c < 1	n/t	< 1	< 1
Petrol Range Organics (>C6-C10)	N	mg/kg	0.01	n/t	c < 0.01	n/t	< 0.01	< 0.01
Phenols									
Total Phenols	N	mg/kg	6	n/t	c < 6	n/t	< 6	< 6
Polyaromatic hydrocarbons									
Naphthalene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	< 0.01	< 0.01
Acenaphthylene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	< 0.01	< 0.01
Acenaphthene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	< 0.01	0.01
Fluorene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	< 0.01	< 0.01
Phenanthrene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	0.01	0.14
Anthracene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	< 0.01	0.03
Fluoranthene GCMS	N	mg/kg	0.01	n/t	c 0.02	n/t	0.04	0.32
Pyrene GCMS	N	mg/kg	0.01	n/t	c 0.02	n/t	0.03	0.25
Benzo(a)anthracene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	0.01	0.09
Chrysene GCMS	N	mg/kg	0.01	n/t	c 0.01	n/t	0.02	0.12
Benzo (b) fluoranthene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	0.01	0.04
Benzo(k)fluoranthene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	0.02	0.09
Benzo (a) pyrene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	0.01	0.07
Indeno (1,2,3-cd) pyrene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	< 0.01	0.02
Dibenzo(a,h)anthracene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	< 0.01	< 0.01
Benzo(g,h,i)perylene GCMS	N	mg/kg	0.01	n/t	c < 0.01	n/t	< 0.01	0.03
Total PAH(16) GCMS	N	mg/kg	0.04	n/t	c 0.10	n/t	0.18	1.25

Tests marked N are not UKAS accredited.

Results Summary

Report No.: 15-04836

				ELAB Reference	46925	46926	46927	46928	46929
				Customer Reference					
				Sample ID					
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
				Sample Location	TP15	TP16	TP17	TP18	TP19
				Sample Depth (m)	0.60	0.50	0.50	0.25	0.40
				Sampling Date	24/11/2015	24/11/2015	24/11/2015	24/11/2015	24/11/2015
Determinand	**Codes**	**Units**	**LOD**						
BTEX									
Benzene	M	ug/kg	10	n/t	c < 10.0	n/t	< 10.0	< 10.0
Toluene	M	ug/kg	10	n/t	c < 10.0	n/t	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	n/t	c < 10.0	n/t	< 10.0	< 10.0
Xylenes	M	ug/kg	10	n/t	c < 10.0	n/t	< 10.0	< 10.0
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
>C6-C8 Aliphatic	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
>C8-C10 Aliphatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
>C10-C12 Aliphatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
>C12-C16 Aliphatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
>C16-C21 Aliphatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
>C21-C35 Aliphatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
>C35-C40 Aliphatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
>C5-C7 Aromatic	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
>C7-C8 Aromatic	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
>C8-C10 Aromatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
>C10-C12 Aromatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
>C12-C16 Aromatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
>C16-C21 Aromatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
>C21-C35 Aromatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
>C35-C40 Aromatic	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
Total (>C5-C40) Ali/Aro	N	mg/kg	1	n/t	n/t	n/t	n/t	n/t
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	c < 5	n/t	< 5	< 5
Total TPH (>C8-C40)	M	mg/kg	5	n/t	c < 5	n/t	< 5	< 5
PCB (WHO 12 Congeners)									
PCB 81	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
PCB 77	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
PCB 123	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
PCB 118	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
PCB 114	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
PCB 105	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
PCB 126	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
PCB 167	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
PCB 156	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
PCB 157	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
PCB 169	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t
PCB 189	N	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t

Results Summary

Report No.: 15-04836

ELAB Reference	46902	46906
Customer Reference		
Sample ID		
Sample Type	SOIL	SOIL
Sample Location	TP20	TP21
Sample Depth (m)	0.30	0.90
Sampling Date	26/11/2015	26/11/2015

Determinand	Codes	Units	LOD		
VOC					
Heptane	N	ug/kg	10	< 10.0	< 10.0
Octane	N	ug/kg	10	< 10.0	< 10.0
Nonane	N	ug/kg	10	< 10.0	< 10.0
Benzene	M	ug/kg	10	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	< 10.0
m+p-xylene	M	ug/kg	10	< 10.0	< 10.0
o-xylene	M	ug/kg	10	< 10.0	< 10.0
cis-1,2-dichloroethene	M	ug/kg	10	< 10.0	< 10.0
1,1-Dichloroethane	M	ug/kg	10	< 10.0	< 10.0
Chloroform	M	ug/kg	10	< 10.0	< 10.0
Tetrachloromethane	M	ug/kg	10	< 10.0	< 10.0
1,1,1-Trichloroethane	M	ug/kg	10	< 10.0	< 10.0
Trichloroethylene	M	ug/kg	10	< 10.0	< 10.0
Tetrachloroethylene	M	ug/kg	10	< 10.0	< 10.0
1,1,1,2-Tetrachloroethane	M	ug/kg	10	< 10.0	< 10.0
1,1,2,2-Tetrachloroetha	M	ug/kg	10	< 10.0	< 10.0
Chlorobenzene	M	ug/kg	10	< 10.0	< 10.0
Bromobenzene	M	ug/kg	10	< 10.0	< 10.0
Bromodichloromethane	M	ug/kg	10	< 10.0	< 10.0
Methylethylbenzene	M	ug/kg	10	< 10.0	< 10.0
1,1-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0
Trans - 1-2 -dichloroethylene	N	ug/kg	10	< 10.0	< 10.0
2,2-Dichloropropane	N	ug/kg	10	< 10.0	< 10.0
Bromochloromethane	N	ug/kg	10	< 10.0	< 10.0
1,2-Dichloroethane	N	ug/kg	10	< 10.0	< 10.0
Dibromomethane	M	ug/kg	10	< 10.0	< 10.0
1,2-Dichloropropane	M	ug/kg	10	< 10.0	< 10.0
cis-1,3-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0
trans-1,3-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0
1,1,2-Trichloroethane	N	ug/kg	10	< 10.0	< 10.0
Dibromochloromethane	N	ug/kg	10	< 10.0	< 10.0
1,3-Dichloropropane	N	ug/kg	10	< 10.0	< 10.0
1,2-dibromoethane	M	ug/kg	10	< 10.0	< 10.0
Styrene	N	ug/kg	10	< 10.0	< 10.0
Propylbenzene	N	ug/kg	10	< 10.0	< 10.0
2-Chlorotoluene	N	ug/kg	10	< 10.0	< 10.0
1,2,4-Trimethylbenzene	N	ug/kg	10	< 10.0	< 10.0
4-Chlorotoluene	N	ug/kg	10	< 10.0	< 10.0
t-butylbenzene	N	ug/kg	10	< 10.0	< 10.0
1,3,5-Trimethylbenzene	N	ug/kg	10	< 10.0	< 10.0
1-methylpropylbenzene	N	ug/kg	10	< 10.0	< 10.0
o-cymene	N	ug/kg	10	< 10.0	< 10.0
1,3-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0
Butylbenzene	N	ug/kg	10	< 10.0	< 10.0
1,2-Dibromo-3-chloropropane	N	ug/kg	10	< 10.0	< 10.0
Hexachlorobutadiene	N	ug/kg	10	< 10.0	< 10.0
1,2,3-Trichlorobenzene	N	ug/kg	10	< 10.0	< 10.0
Naphthalene	N	ug/kg	10	< 10.0	< 10.0
1,2,4-Trichlorobenzene	N	ug/kg	10	< 10.0	< 10.0
1,4-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0
1,2-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0
Bromoform	N	ug/kg	10	< 10.0	< 10.0

Tests marked N are not UKAS accredited.

Results Summary

Report No.: 15-04836

ELAB Reference	46902	46906
Customer Reference		
Sample ID		
Sample Type	SOIL	SOIL
Sample Location	TP20	TP21
Sample Depth (m)	0.30	0.90
Sampling Date	26/11/2015	26/11/2015

Determinand	Codes	Units	LOD		
SVOC					
Phenol	N	mg/kg	0.01	0.04	0.02
Aniline	N	mg/kg	0.01	< 0.01	< 0.01
Bis(2-chloroethyl)ether	N	mg/kg	0.01	< 0.01	< 0.01
2-Chlorophenol	N	mg/kg	0.01	< 0.01	< 0.01
1,3-Dichlorobenzene	N	mg/kg	0.01	< 0.01	< 0.01
1,4-Dichlorobenzene	N	mg/kg	0.01	< 0.01	< 0.01
Benzyl Alcohol	N	mg/kg	0.01	< 0.01	< 0.01
1,2-Dichlorobenzene	N	mg/kg	0.01	< 0.01	< 0.01
2-Methylphenol	N	mg/kg	0.01	0.01	< 0.01
Bis(2-chloroisopropyl)ether	N	mg/kg	0.01	< 0.01	< 0.01
3 and 4-methylphenol	N	mg/kg	0.01	0.04	< 0.01
N-Nitrosodi-n-propylamine	N	mg/kg	0.01	< 0.01	< 0.01
Hexachloroethane	N	mg/kg	0.01	< 0.01	< 0.01
Nitrobenzene	N	mg/kg	0.01	< 0.01	< 0.01
Isophorone	N	mg/kg	0.01	< 0.01	< 0.01
2-Nitrophenol	N	mg/kg	0.01	< 0.01	< 0.01
2,4-Dimethylphenol	N	mg/kg	0.01	0.02	< 0.01
Bis(2-chloroethoxy)methane	N	mg/kg	0.01	< 0.01	< 0.01
2,4-Dichlorophenol	N	mg/kg	0.01	0.02	< 0.01
1,3,5-Trichlorobenzene	N	mg/kg	0.01	< 0.01	< 0.01
Naphthalene	N	mg/kg	0.01	0.05	< 0.01
3-Chloroaniline	N	mg/kg	0.01	< 0.01	< 0.01
Hexachloro-1,3-butadiene	N	mg/kg	0.01	< 0.01	< 0.01
4-Chloro-3-methylphenol	N	mg/kg	0.01	0.03	< 0.01
2-Methylnaphthalene	N	mg/kg	0.01	0.02	< 0.01
1-Methylnaphthalene	N	mg/kg	0.01	0.02	< 0.01
Hexachlorocyclopentadiene	N	mg/kg	0.01	< 0.01	< 0.01
2,4,6-Trichlorophenol	N	mg/kg	0.01	0.03	< 0.01
2,4,5-Trichlorophenol	N	mg/kg	0.01	0.04	< 0.01
1-Chloronaphthalene	N	mg/kg	0.01	< 0.01	< 0.01
2-Nitroaniline	N	mg/kg	0.01	< 0.01	< 0.01
1,4-Dinitrobenzene	N	mg/kg	0.01	< 0.01	< 0.01
Dimethyl phthalate	N	mg/kg	0.01	< 0.01	< 0.01
1-3-dinitrobenzene	N	mg/kg	0.01	< 0.01	< 0.01
2-6-dinitrotoluene	N	mg/kg	0.01	< 0.01	< 0.01
Acenaphthylene	N	mg/kg	0.01	0.30	< 0.01
1,2-Dinitrobenzene	N	mg/kg	0.01	< 0.01	< 0.01
3-Nitroaniline	N	mg/kg	0.01	< 0.01	< 0.01
Acenaphthene	N	mg/kg	0.01	0.06	< 0.01
4-nitrophenol	N	mg/kg	0.01	< 0.01	< 0.01
Dibenzofuran	N	mg/kg	0.01	0.03	< 0.01
2,3,5,6-Tetrachlorophenol	N	mg/kg	0.01	0.06	< 0.01
2,3,4,6-Tetrachlorophenol	N	mg/kg	0.01	0.05	< 0.01
Diethyl phthalate	N	mg/kg	0.01	< 0.01	< 0.01
1-chloro-4-phenoxybenzene	N	mg/kg	0.01	< 0.01	< 0.01
Fluorene	N	mg/kg	0.01	0.06	< 0.01
4-Nitroaniline	N	mg/kg	0.01	< 0.01	< 0.01
Dinitro-o-cresol	N	mg/kg	0.01	< 0.01	< 0.01
Diphenylamine	N	mg/kg	0.01	0.01	< 0.01
Azobenzene	N	mg/kg	0.01	< 0.01	< 0.01
1-bromo-4-phenoxybenzene	N	mg/kg	0.01	< 0.01	< 0.01
Hexachlorobenzene	N	mg/kg	0.01	< 0.01	< 0.01
Pentachlorophenol	N	mg/kg	0.01	0.08	< 0.01

Tests marked N are not UKAS accredited.

Results Summary

Report No.: 15-04836

ELAB Reference	46902	46906
Customer Reference		
Sample ID		
Sample Type	SOIL	SOIL
Sample Location	TP20	TP21
Sample Depth (m)	0.30	0.90
Sampling Date	26/11/2015	26/11/2015

Determinand	Codes	Units	LOD		
SVOC					
Phenanthrene	N	mg/kg	0.01	1.08	< 0.01
Anthracene	N	mg/kg	0.01	0.62	< 0.01
Carbazole	N	mg/kg	0.01	0.05	< 0.01
Dibutyl phthalate	N	mg/kg	0.01	< 0.01	< 0.01
Fluoranthene	N	mg/kg	0.01	4.51	0.02
Pyrene	N	mg/kg	0.01	3.76	0.02
Butyl benzyl phthalate	N	mg/kg	0.01	< 0.01	< 0.01
Bis-2-ethylhexyladipate	N	mg/kg	0.01	< 0.01	< 0.01
Butyl benzyl phthalate	N	mg/kg	0.01	< 0.01	< 0.01
Benzo(a)anthracene	N	mg/kg	0.01	2.25	< 0.01
Chrysene	N	mg/kg	0.01	2.14	0.01
Bis(2-ethylhexyl)phthalate	N	mg/kg	0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	N	mg/kg	0.01	1.43	0.01
Benzo(k)fluoranthene	N	mg/kg	0.01	1.85	0.01
Benzo(a)pyrene	N	mg/kg	0.01	2.78	0.01
Indeno(1,2,3-cd)pyrene	N	mg/kg	0.01	1.62	< 0.01
Dibenz(ah)anthracene	N	mg/kg	0.01	0.76	< 0.01
Benzo[g,h,i]perylene	N	mg/kg	0.01	1.90	0.01

Results Summary

Report No.: 15-04836

			ELAB Reference	46931	46933	46936
			Customer Reference			
			Sample ID			
			Sample Type	WATER	WATER	WATER
			Sample Location	TP19	TP3	TP7
			Sample Depth (m)			
			Sampling Date	24/11/2015	25/11/2015	26/11/2015
Determinand	**Codes**	**Units**	**LOD**			
Anions						
Sulphate	U	mg/l	0.5	7.2	4.0	2.7
Miscellaneous						
pH	U	pH units	0.1	5.5	5.6	5.2

Unit A2, Windmill Road, Ponswood Industrial Estate, St Leonards on Sea, East Sussex, TN38 9BY
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Results Summary

Report No.: 15-04836

Asbestos Qualitative Results

Analytical result only applies to the sample as submitted by the client. Any comments, opinions or interpretations (marked #) in this report are outside UKAS accreditation (Accreditation No2683). They are subjective comments only which must be verified by the client.

Elab No	Depth (m)	Clients Reference	Description of Sample Matrix #	Result
46902	0.30	TP20	Silty loam	No asbestos detected
46906	0.90	TP21	Sandy loam	No asbestos detected
46912	0.40	TP1	Silty loam	No asbestos detected
46913	0.40	TP2	Silty loam	No asbestos detected

Method Summary

Report No.: 15-04836

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
PAH (GC-MS)	M	As submitted sample	03/12/2015		GC-MS
PCB (WHO 12 Congeners)	N	Air dried sample	03/12/2015		GC-MS
Petrol range organics in soil	N	As submitted sample	07/12/2015		GC-MS
Sulphide	N	As submitted sample	03/12/2015	109	Colorimetry
pH	M	Air dried sample	04/12/2015	113	Electromeric
Acid Soluble Sulphate	U	Air dried sample	07/12/2015	115	Ion Chromatography
Total Petroleum Hydrocarbons in solids	M	As submitted sample	03/12/2015	117	GC-FID
Aqua regia extractable metals	M	Air dried sample	04/12/2015	118	ICPMS
Phenols in solids	M	As submitted sample	03/12/2015	121	HPLC
SVOC in solids	N	As submitted sample	03/12/2015	167	GC-MS
Water soluble anions	M	Air dried sample	03/12/2015	172	Ion Chromatography
VOC in solids	M	As submitted sample	03/12/2015	181	GC-MS
BTEX in solids	M	As submitted sample	07/12/2015	181A	GC-MS
Water soluble boron	N	Air dried sample	03/12/2015	202	Colorimetry
Total cyanide	M	As submitted sample	03/12/2015	204	Colorimetry
Total organic carbon/Total sulphur	N	Air dried sample	04/12/2015	210	IR
Aliphatic hydrocarbons in soil	N	As submitted sample	03/12/2015	214	GC-FID
Aliphatic/Aromatic hydrocarbons in soil	N	As submitted sample	07/12/2015	214	GC-FID
Aromatic hydrocarbons in soil	N	As submitted sample	03/12/2015	214	GC-FID
Low range Aliphatic hydrocarbons soil	N	As submitted sample	07/12/2015	214	GC-MS
Low range Aromatic hydrocarbons soil	N	As submitted sample	07/12/2015	214	GC-MS
Basic carbon banding in soil	N	As submitted sample	03/12/2015	218	GC-FID
Diesel range organics in soil	N	As submitted sample	04/12/2015	257	GC-FID
Asbestos identification	U	As submitted sample	03/12/2015	PMAN	Microscopy
Water					
pH of waters	U		03/12/2015	113	Electromeric
Anions	U		03/12/2015	131	Ion Chromatography

Tests marked N are not UKAS accredited

Report Information

Report No.: 15-04836

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Soil sample results are expressed on an air dried basis
Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
PCB congener results may include any coeluting PCBs
Uncertainty of measurement for the determinands tested are available upon request

Deviation Codes

a	No date of sampling supplied
b	No time of sampling supplied (Waters Only)
c	Sample not received in appropriate containers
d	Sample not received in cooled condition
e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month
All water samples will be retained for 7 days following the date of the test report
Charges may apply to extended sample storage

Unit A2
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Ponswood Industrial Estate
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East Sussex
TN38 9BY
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Facsimile: (01424) 729911
info@elab-uk.co.uk

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	16-05126
Issue:	1
Date of Issue:	07/01/2016
Contact:	Tony Gerrard
Customer Details:	CC Geotechnical Ltd Unit 1 & 2 Deltic Place Deltic Way Liverpool LancashireL33 7BA
Quotation No:	Q14-00045
Order No:	Not Supplied
Customer Reference:	15-8700
Date Received:	05/01/2016
Date Approved:	07/01/2016
Details:	Dyfi Bridge, Machylleth
Approved by:	

Steve Knight, Business Development Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683

Sample Summary

Report No.: 16-05126

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
49613	BH1 14.00	08/12/2015	05/01/2016	Sand + Stones	
49614	BH2 17.00	11/12/2015	05/01/2016	Sand + Stones	
49615	BH2 26.00	11/12/2015	05/01/2016	Sand + Stones	
49616	BH5 4.00	02/12/2015	05/01/2016	Sandy clayey loam	f
49617	BH5 7.50	02/12/2015	05/01/2016	Sand + Stones	f

Results Summary

Report No.: 16-05126

			ELAB Reference	49613	49614	49615	49616	49617
			Customer Reference					
			Sample ID					
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	BH1	BH2	BH2	BH5	BH5
			Sample Depth (m)	14.00	17.00	26.00	4.00	7.50
			Sampling Date	08/12/2015	11/12/2015	11/12/2015	02/12/2015	02/12/2015
Determinand	**Codes**	**Units**	**LOD**					
Anions								
Water Soluble Sulphate	M	mg/l	20	^ < 20	^ < 20	^ < 20	f 25	f^ < 20
Water Soluble Sulphate	M	mg/kg	40	^ < 40	^ < 40	^ < 40	f < 40	f^ < 40
Miscellaneous								
pH	M	pH units	0.1	^ 7.9	^ 7.9	^ 8.0	f 7.9	f^ 7.8

Method Summary

Report No.: 16-05126

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
pH	M	Air dried sample	07/01/2016	113	Electromeric
Water soluble anions	M	Air dried sample	06/01/2016	172	Ion Chromatography

Report Information

Report No.: 16-05126

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
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Deviation Codes

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e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

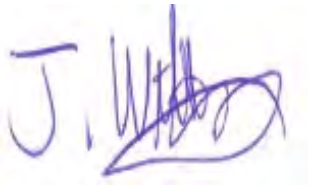
Sample Retention and Disposal

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UKAS TESTING
2683

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	16-05156
Issue:	1
Date of Issue:	11/01/2016
Contact:	Tony Gerrard
Customer Details:	CC Geotechnical Ltd Unit 1 & 2 Deltic Place Deltic Way Liverpool LancashireL33 7BA
Quotation No:	Q15-00465
Order No:	Not Supplied
Customer Reference:	15-8700
Date Received:	07/01/2016
Date Approved:	11/01/2016
Details:	Dyfi Bridge, Machylleth
Approved by:	

John Wilson, Operations Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683

Sample Summary

Report No.: 16-05156

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
49760	BH4 15.00	31/12/2015	07/01/2016	Sand & stones	
49761	BH4 29.50	31/12/2015	07/01/2016	Sand & stones	

Results Summary

2683

Report No.: 16-05156

ELAB Reference	49760	49761
Customer Reference		
Sample ID		
Sample Type	SOIL	SOIL
Sample Location	BH4	BH4
Sample Depth (m)	15.00	29.50
Sampling Date	31/12/2015	31/12/2015

Determinand	Codes	Units	LOD		
Anions					
Water Soluble Sulphate	M	g/l	0.02	^ 0.02	^ < 0.02
Miscellaneous					
pH	M	pH units	0.1	^ 8.1	^ 7.9

2683

Method Summary

Report No.: 16-05156

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
pH	M	Air dried sample	08/01/2016	113	Electromeric
Water soluble anions	M	Air dried sample	08/01/2016	172	Ion Chromatography

2683

Report Information

Report No.: 16-05156

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Soil sample results are expressed on an air dried basis
Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
PCB congener results may include any coeluting PCBs
Uncertainty of measurement for the determinands tested are available upon request

Deviation Codes

a	No date of sampling supplied
b	No time of sampling supplied (Waters Only)
c	Sample not received in appropriate containers
d	Sample not received in cooled condition
e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month
All water samples will be retained for 7 days following the date of the test report
Charges may apply to extended sample storage

Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 9BY
Telephone: (01424) 718618
Facsimile: (01424) 729911
info@elab-uk.co.uk

UKAS TESTING
2683

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	16-05260
Issue:	1
Date of Issue:	20/01/2016
Contact:	Tony Gerrard
Customer Details:	CC Geotechnical Ltd Unit 1 & 2 Deltic Place Deltic Way Liverpool LancashireL33 7BA
Quotation No:	Q15-00465
Order No:	Not Supplied
Customer Reference:	15-8700
Date Received:	15/01/2016
Date Approved:	20/01/2016
Details:	Dyfi Bridge, Machylleth
Approved by:	

John Wilson, Operations Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683

Sample Summary

Report No.: 16-05260

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
50453	BH5 9.50	03/01/2016	15/01/2016	Slate	
50454	BH5 12.50	03/01/2016	15/01/2016	Slate	
50455	BH5 15.50	03/01/2016	15/01/2016	Slate	
50456	BH3 25.50	03/01/2016	15/01/2016	Sand + Stones	
50457	BH2 25.50	12/01/2016	15/01/2016		
50458	BH3 25.50	12/01/2016	15/01/2016		
50459	BH4 25.50	12/01/2016	15/01/2016		

Results Summary

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Report No.: 16-05260

			ELAB Reference	50453	50454	50455	50456
			Customer Reference				
			Sample ID				
			Sample Type	SOIL	SOIL	SOIL	SOIL
			Sample Location	BH5	BH5	BH5	BH3
			Sample Depth (m)	9.50	12.50	15.50	25.50
			Sampling Date	03/01/2016	03/01/2016	03/01/2016	03/01/2016
Determinand	**Codes**	**Units**	**LOD**				
Anions							
Water Soluble Sulphate	M	g/l	0.02	^ 0.12	^ 0.05	^ < 0.02	^ < 0.02
Miscellaneous							
pH	M	pH units	0.1	^ 8.5	^ 8.7	^ 8.9	^ 8.0

Results Summary

2683

Report No.: 16-05260

			ELAB Reference	50457	50458	50459
			Customer Reference			
			Sample ID			
			Sample Type	WATER	WATER	WATER
			Sample Location	BH2	BH3	BH4
			Sample Depth (m)			
			Sampling Date	12/01/2016	12/01/2016	12/01/2016
Determinand	**Codes**	**Units**	**LOD**			
Anions						
Sulphate	U	mg/l	0.5	5.3	6.4	6.7
Miscellaneous						
pH	U	pH units	0.1	5.4	5.3	5.4

2683

Method Summary

Report No.: 16-05260

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
pH	M	Air dried sample	19/01/2016	113	Electromeric
Water soluble anions	M	Air dried sample	19/01/2016	172	Ion Chromatography
Water					
pH of waters	U		19/01/2016	113	Electromeric
Anions	U		18/01/2016	131	Ion Chromatography

2683

Report Information

Report No.: 16-05260

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
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SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
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U/S	Unsuitable sample
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Deviation Codes

a	No date of sampling supplied
b	No time of sampling supplied (Waters Only)
c	Sample not received in appropriate containers
d	Sample not received in cooled condition
e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

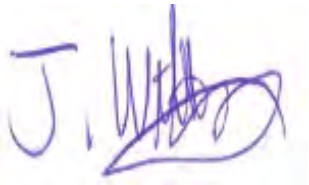
Sample Retention and Disposal

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Charges may apply to extended sample storage

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UKAS TESTING
2683

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	16-05260
Issue:	2
Date of Issue:	29/01/2016
Contact:	Tony Gerrard
Customer Details:	CC Geotechnical Ltd Unit 1 & 2 Deltic Place Deltic Way Liverpool LancashireL33 7BA
Quotation No:	Q15-00465
Order No:	Not Supplied
Customer Reference:	15-8700
Date Received:	15/01/2016
Date Approved:	29/01/2016
Details:	Dyfi Bridge, Machylleth
Approved by:	

John Wilson, Operations Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683

Sample Summary

Report No.: 16-05260

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
50453	BH5 9.50	03/01/2016	15/01/2016	Slate	
50454	BH5 12.50	03/01/2016	15/01/2016	Slate	
50455	BH5 15.50	03/01/2016	15/01/2016	Slate	
50456	BH3 25.50	03/01/2016	15/01/2016	Sand + Stones	
50457	BH2 25.50	12/01/2016	27/01/2016		cg
50458	BH3 25.50	12/01/2016	27/01/2016		cg
50459	BH4 25.50	12/01/2016	27/01/2016		cg

Results Summary

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Report No.: 16-05260

			ELAB Reference	50453	50454	50455	50456
			Customer Reference				
			Sample ID				
			Sample Type	SOIL	SOIL	SOIL	SOIL
			Sample Location	BH5	BH5	BH5	BH3
			Sample Depth (m)	9.50	12.50	15.50	25.50
			Sampling Date	03/01/2016	03/01/2016	03/01/2016	03/01/2016
Determinand	**Codes**	**Units**	**LOD**				
Anions							
Water Soluble Sulphate	M	g/l	0.02	^ 0.12	^ 0.05	^ < 0.02	^ < 0.02
Miscellaneous							
pH	M	pH units	0.1	^ 8.5	^ 8.7	^ 8.9	^ 8.0

Results Summary

2683

Report No.: 16-05260

			ELAB Reference	50457	50458	50459
			Customer Reference			
			Sample ID			
			Sample Type	WATER	WATER	WATER
			Sample Location	BH2	BH3	BH4
			Sample Depth (m)			
			Sampling Date	12/01/2016	12/01/2016	12/01/2016
Determinand	**Codes**	**Units**	**LOD**			
Dissolved Metals						
Arsenic	U	ug/l	5	< 5	< 5	< 5
Beryllium	U	ug/l	5	< 5	< 5	< 5
Calcium	U	ug/l	100	8390	4310	4380
Cadmium	U	ug/l	1	< 1	< 1	< 1
Chromium	U	ug/l	5	< 5	< 5	< 5
Copper	U	ug/l	5	< 5	< 5	< 5
Mercury	U	ug/l	0.1	< 0.1	< 0.1	< 0.1
Magnesium	U	ug/l	100	2980	2350	2340
Nickel	U	ug/l	5	< 5	< 5	< 5
Lead	U	ug/l	1	< 1	< 1	< 1
Antimony	N	ug/l	5	< 5	< 5	< 5
Selenium	U	ug/l	5	< 5	< 5	< 5
Vanadium	N	ug/l	5	< 5	< 5	< 5
Zinc	U	ug/l	5	15	24	28
Anions						
Chloride	U	mg/l	0.5	7.7	8.5	8.6
Sulphate	U	mg/l	0.5	5.3	6.4	6.7
Inorganics						
Ammoniacal Nitrogen as N	N	mg/l	0.1	g 0.2	g 0.3	g < 0.1
Total Cyanide	U	ug/l	5	c < 5	c < 5	c < 5
Miscellaneous						
Hardness (CaCO3)	N	mg/l CaCO3	0.1	33	20	21
pH	U	pH units	0.1	5.4	5.3	5.4
Organics						
>C8-C10 BCB	N	ug/l	5	g < 5.0	n/t	n/t
>C10-C12 BCB	N	ug/l	5	g < 5.0	n/t	n/t
>C12-C16 BCB	N	ug/l	5	g < 5.0	n/t	n/t
>C16-C21 BCB	N	ug/l	5	g < 5.0	n/t	n/t
Diesel Range Organics (>C8-C21)	N	ug/l	10	g < 10	n/t	n/t
Petrol Range Organics (>C6-C10)	N	ug/l	5	g < 5.0	n/t	n/t
Phenols						
Total Phenols	N	ug/l	1	g < 1	g < 1	g < 1
Polyaromatic hydrocarbons						
Naphthalene GCMS	N	ug/l	0.01	g 0.06	g 0.07	g 0.07
Acenaphthylene GCMS	N	ug/l	0.01	g 0.02	g 0.01	g < 0.01
Acenaphthene GCMS	N	ug/l	0.01	g 0.02	g 0.01	g < 0.01
Fluorene GCMS	N	ug/l	0.01	g 0.03	g 0.01	g < 0.01
Phenanthrene GCMS	N	ug/l	0.01	g 0.15	g 0.06	g 0.04
Anthracene GCMS	N	ug/l	0.01	g 0.04	g 0.02	g 0.01
Fluoranthene GCMS	N	ug/l	0.01	g 0.24	g 0.09	g 0.05
Pyrene GCMS	N	ug/l	0.01	g 0.20	g 0.08	g 0.04
Benzo (a) anthracene GCMS	N	ug/l	0.01	g 0.10	g 0.04	g 0.02
Chrysene GCMS	N	ug/l	0.01	g 0.13	g 0.06	g 0.03
Benzo (b) fluoranthene GCMS	N	ug/l	0.01	g 0.12	g 0.05	g 0.02
Benzo (k) fluoranthene GCMS	N	ug/l	0.01	g 0.15	g 0.06	g 0.03
Benzo (a) pyrene GCMS	N	ug/l	0.01	g 0.13	g 0.05	g 0.02
Indeno (1,2,3-cd) pyrene GCMS	N	ug/l	0.01	g 0.08	g 0.03	g 0.02
Dibenzo(a,h)anthracene GCMS	N	ug/l	0.01	g 0.02	g 0.01	g < 0.01
Benzo(ghi)perylene GCMS	N	ug/l	0.01	g 0.09	g 0.04	g 0.02
Total PAH(16) GCMS	N	ug/l	0.01	g 1.59	g 0.71	g 0.40

Tests marked N are not UKAS accredited.

Results Summary

2683

Report No.: 16-05260

			ELAB Reference	50457	50458	50459
			Customer Reference			
			Sample ID			
			Sample Type	WATER	WATER	WATER
			Sample Location	BH2	BH3	BH4
			Sample Depth (m)			
			Sampling Date	12/01/2016	12/01/2016	12/01/2016
Determinand	**Codes**	**Units**	**LOD**			
BTEX						
Benzene	U	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Toluene	U	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Ethylbenzene	U	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Xylenes	U	ug/l	1	g < 1.00	g < 1.00	g < 1.00
TPH CWG						
>C5-C6 Aliphatic	N	ug/l	1	g < 1.0	g < 1.0	g < 1.0
>C6-C8 Aliphatic	N	ug/l	1	g < 1.0	g < 1.0	g < 1.0
>C8-C10 Aliphatic	N	ug/l	5	g < 5.0	g < 5.0	g < 5.0
>C10-C12 Aliphatic	N	ug/l	5	g < 5.0	g < 5.0	g < 5.0
>C12-C16 Aliphatic	N	ug/l	5	g < 5.0	g < 5.0	g < 5.0
>C16-C21 Aliphatic	N	ug/l	5	g < 5.0	g < 5.0	g < 5.0
>C21-C35 Aliphatic	N	ug/l	5	g < 5.0	g < 5.0	g < 5.0
>C35-C40 Aliphatic	N	ug/l	5	g < 5.0	g < 5.0	g < 5.0
Total (>C5-C40) Aliphatic	N	ug/l	5	g < 5.0	g < 5.0	g < 5.0
>C5-C7 Aromatic	N	ug/l	1	g < 1.0	g < 1.0	g < 1.0
>C7-C8 Aromatic	N	ug/l	1	g < 1.0	g < 1.0	g < 1.0
>C8-C10 Aromatic	N	ug/l	5	< 5.0	< 5.0	< 5.0
>C10-C12 Aromatic	N	ug/l	5	g < 5.0	g < 5.0	g < 5.0
>C12-C16 Aromatic	N	ug/l	5	g < 5.0	g < 5.0	g < 5.0
>C16-C21 Aromatic	N	ug/l	5	g < 5.0	g < 5.0	g < 5.0
>C21-C35 Aromatic	N	ug/l	5	g 39.5	g < 5.0	g 21.2
>C35-C40 Aromatic	N	ug/l	5	g < 5.0	g < 5.0	g < 5.0
Total (>C5-C40) Aromatic	N	ug/l	5	g 39.5	g < 5.0	g 21.2
Total (>C5-C40) Ali/Aro	N	ug/l	5	g 39.5	g < 5.0	g 21.2
Total Petroleum Hydrocarbons						
Mineral Oil	N	ug/l	35	g < 35	n/t	n/t
Total TPH (C10-C40)	U	ug/l	100	g < 100	n/t	n/t
PCB (ICES 7 congeners)						
PCB 28	N	ug/l	0.1	g < 0.1	n/t	n/t
PCB 52	N	ug/l	0.1	g < 0.1	n/t	n/t
PCB 101	N	ug/l	0.1	g < 0.1	n/t	n/t
PCB118	N	ug/l	0.1	g < 0.1	n/t	n/t
PCB 153	N	ug/l	0.1	g < 0.1	n/t	n/t
PCB 138	N	ug/l	0.1	g < 0.1	n/t	n/t
PCB 180	N	ug/l	0.1	g < 0.1	n/t	n/t
PCB (7 Congeners)	N	ug/l	0.1	g < 0.1	n/t	n/t

Results Summary

Report No.: 16-05260

ELAB Reference			50457	50458	50459
Customer Reference					
Sample ID					
Sample Type			WATER	WATER	WATER
Sample Location			BH2	BH3	BH4
Sample Depth (m)					
Sampling Date			12/01/2016	12/01/2016	12/01/2016
Determinand	**Codes**	**Units**	**LOD**		
VOC					
MTBE	U	ug/l	1	g < 1	g < 1	g < 1
Heptane	N	ug/l	1	g < 1	g < 1	g < 1
Octane	N	ug/l	1	g < 1	g < 1	g < 1
Nonane	N	ug/l	1	g < 1	g < 1	g < 1
Benzene	U	ug/l	1	g < 1	g < 1	g < 1
Toluene	U	ug/l	1	g < 1	g < 1	g < 1
Ethylbenzene	U	ug/l	1	g < 1	g < 1	g < 1
m+p-xylene	U	ug/l	1	g < 1	g < 1	g < 1
o-xylene	U	ug/l	1	g < 1	g < 1	g < 1
cis-1,2-dichloroethene	U	ug/l	1	g < 1	g < 1	g < 1
1,1-Dichloroethane	U	ug/l	1	g < 1	g < 1	g < 1
Chloroform	U	ug/l	1	g < 1	g < 1	g < 1
Tetrachloromethane	U	ug/l	1	g < 1	g < 1	g < 1
1,1,1-Trichloroethane	U	ug/l	1	g < 1	g < 1	g < 1
Trichloroethylene	N	ug/l	1	g < 1	g < 1	g < 1
Tetrachloroethylene	U	ug/l	1	g < 1	g < 1	g < 1
1,1,1,2-Tetrachloroethane	U	ug/l	1	g < 1	g < 1	g < 1
1,1,2,2-Tetrachloroetha	N	ug/l	1	g < 1	g < 1	g < 1
Chlorobenzene	U	ug/l	1	g < 1	g < 1	g < 1
Bromobenzene	U	ug/l	1	g < 1	g < 1	g < 1
Bromodichloromethane	U	ug/l	1	g < 1	g < 1	g < 1
Methylethylbenzene	U	ug/l	1	g < 1	g < 1	g < 1
1,1-Dichloro-1-propene	U	ug/l	1	g < 1	g < 1	g < 1
Trans - 1-2 -dichloroethylene	U	ug/l	1	g < 1	g < 1	g < 1
2,2-Dichloropropane	N	ug/l	1	g < 1	g < 1	g < 1
Bromochloromethane	N	ug/l	1	g < 1	g < 1	g < 1
1,2-Dichloroethane	U	ug/l	1	g < 1	g < 1	g < 1
Dibromomethane	U	ug/l	1	g < 1	g < 1	g < 1
1,2-Dichloropropane	U	ug/l	1	g < 1	g < 1	g < 1
cis-1,3-Dichloro-1-propene	U	ug/l	1	g < 1	g < 1	g < 1
trans-1,3-Dichloro-1-propene	U	ug/l	1	g < 1	g < 1	g < 1
1,1,2-Trichloroethane	U	ug/l	1	g < 1	g < 1	g < 1
Dibromochloromethane	U	ug/l	1	g < 1	g < 1	g < 1
1,3-Dichloropropane	U	ug/l	1	g < 1	g < 1	g < 1
Dibromoethane	U	ug/l	1	g < 1	g < 1	g < 1
Styrene	U	ug/l	1	g < 1	g < 1	g < 1
Propylbenzene	U	ug/l	1	g < 1	g < 1	g < 1
2-Chlorotoluene	U	ug/l	1	g < 1	g < 1	g < 1
1,2,4-Trimethylbenzene	U	ug/l	1	g < 1	g < 1	g < 1
4-Chlorotoluene	U	ug/l	1	g < 1	g < 1	g < 1
t-butylbenzene	U	ug/l	1	g < 1	g < 1	g < 1
1,3,5-Trimethylbenzene	U	ug/l	1	g < 1	g < 1	g < 1
1-methylpropylbenzene	U	ug/l	1	g < 1	g < 1	g < 1
o-cymene	U	ug/l	1	g < 1	g < 1	g < 1
1,3-Dichlorobenzene	U	ug/l	1	g < 1	g < 1	g < 1
Butylbenzene	U	ug/l	1	g < 1	g < 1	g < 1
1,2-Dibromo-3-chloropropane	U	ug/l	1	g < 1	g < 1	g < 1
Hexachlorobutadiene	U	ug/l	1	g < 1	g < 1	g < 1
1,2,3-Trichlorobenzene	U	ug/l	1	g < 1	g < 1	g < 1
Naphthalene	U	ug/l	1	g < 1	g < 1	g < 1
1,2,4-Trichlorobenzene	U	ug/l	1	g < 1	g < 1	g < 1
1,4-Dichlorobenzene	U	ug/l	1	g < 1	g < 1	g < 1
1,2-Dichlorobenzene	U	ug/l	1	g < 1	g < 1	g < 1
Bromoform	U	ug/l	1	g < 1	g < 1	g < 1

Results Summary

2683

Report No.: 16-05260

		ELAB Reference	50457	50458	50459
		Customer Reference			
		Sample ID			
		Sample Type	WATER	WATER	WATER
		Sample Location	BH2	BH3	BH4
		Sample Depth (m)			
		Sampling Date	12/01/2016	12/01/2016	12/01/2016
Determinand	**Codes**	**Units**	**LOD**		
SVOC					
Phenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Aniline	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Bis(2-chloroethyl)ether	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
2-Chlorophenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
1,3-Dichlorobenzene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
1,4-Dichlorobenzene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Benzyl Alcohol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
1,2-Dichlorobenzene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
2-Methylphenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Bis(2-chloroisopropyl)ether	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
3 and 4-methylphenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
N-Nitrosodi-n-propylamine	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Hexachloroethane	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Nitrobenzene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Isophorone	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
2-Nitrophenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
2,4-Dimethylphenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Bis(2-chloroethoxy)methane	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
2,4-Dichlorophenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
1,3,5-Trichlorobenzene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Naphthalene	N	ug/l	0.01	g 0.08	g 0.08	g 0.08
3-Chloroaniline	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Hexachloro-1,3-butadiene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
4-Chloro-3-methylphenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
2-Methynaphthalene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
1-Methylnaphthalene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Hexachlorocyclopentadiene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
2,4,6-Trichlorophenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
2,4,5-Trichlorophenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
1-Chloronaphthalene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
2-Nitroaniline	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
1,4-Dinitrobenzene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Dimethyl phthalate	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
1-3-dinitrobenzene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
2-6-dinitrotoluene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Acenaphthylene	N	ug/l	0.01	g 0.02	g 0.01	g < 0.01
1,2-Dinitrobenzene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
3-Nitroaniline	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Acenaphthene	N	ug/l	0.01	g 0.02	g 0.02	g < 0.01
4-nitrophenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Dibenzofuran	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
2,3,5,6-Tetrachlorophenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
2,3,4,6-Tetrachlorophenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Diethyl phthalate	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
1-chloro-4-phenoxybenzene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Fluorene	N	ug/l	0.01	g 0.03	g < 0.01	g < 0.01
4-Nitroaniline	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Dinitro-o-cresol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Diphenylamine	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Azobenzene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
1-bromo-4-phenoxybenzene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Hexachlorobenzene	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Pentachlorophenol	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00

Tests marked N are not UKAS accredited.

Results Summary

Report No.: 16-05260

			ELAB Reference	50457	50458	50459
			Customer Reference			
			Sample ID			
			Sample Type	WATER	WATER	WATER
			Sample Location	BH2	BH3	BH4
			Sample Depth (m)			
			Sampling Date	12/01/2016	12/01/2016	12/01/2016
Determinand	**Codes**	**Units**	**LOD**			
SVOC						
Phenanthrene	N	ug/l	0.01	g 0.16	g 0.07	g 0.04
Anthracene	N	ug/l	0.01	g 0.04	g 0.02	g 0.01
Carbazole	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Dibutyl phthalate	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Fluoranthene	N	ug/l	0.01	g 0.25	g 0.09	g 0.05
Pyrene	N	ug/l	0.01	g 0.22	g 0.09	g 0.05
Butyl benzyl phthalate	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Bis-2-ethylhexyladipate	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Butyl benzyl phthalate	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Benzo(a)anthracene	N	ug/l	0.01	g 0.12	g 0.04	g 0.02
Chrysene	N	ug/l	0.01	g 0.12	g 0.05	g 0.03
Bis(2-ethylhexyl)phthalate	N	ug/l	1	g < 1.00	g < 1.00	g < 1.00
Benzo(b)fluoranthene	N	ug/l	0.01	g 0.16	g 0.06	g 0.02
Benzo(k)fluoranthene	N	ug/l	0.01	g 0.13	g 0.06	g 0.03
Benzo(a)pyrene	N	ug/l	0.01	g 0.13	g 0.05	g 0.03
Indeno(1,2,3-CD)pyrene	N	ug/l	0.01	g 0.09	g 0.04	g 0.02
Dibenz(ah)anthracene	N	ug/l	0.01	g 0.02	g 0.02	g 0.01
Benzo(ghi)perylene	N	ug/l	0.01	g 0.11	g 0.05	g 0.03

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Method Summary

Report No.: 16-05260

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
pH	M	Air dried sample	19/01/2016	113	Electromeric
Water soluble anions	M	Air dried sample	19/01/2016	172	Ion Chromatography
Water					
Aliphatic/Aromatic hydrocarbons in water	N		29/01/2016		GC-FID
Aromatic hydrocarbons in water	N		29/01/2016		GC-FID
Basic carbon banding in water	N		29/01/2016		GC-FID
Petrol range organics in water	N		29/01/2016		GC-MS
Phenols in waters	N		28/01/2016		HPLC
Dissolved metals by ICP in waters	U		28/01/2016	101	ICPMS
pH of waters	U		19/01/2016	113	Electromeric
Anions	U		18/01/2016	131	Ion Chromatography
PAHs and/or PCBs in waters	N		28/01/2016	135	GC-MS
Ammonia in waters	N		29/01/2016	151	Colorimetry
SVOC in waters	N		28/01/2016	167	GC-MS
PAHs and/or PCBs in waters	N		28/01/2016	170	GC-MS
Total Petroleum Hydrocarbons in waters	U		28/01/2016	178	GC-FID
VOC in waters	U		27/01/2016	200	GC-MS
BTEX in waters	U		28/01/2016	200A	GC-MS
Cyanide in waters	U		28/01/2016	205	Colorimetry
Aliphatic hydrocarbons in water	N		28/01/2016	215	GC-FID
Aromatic hydrocarbons in water	N		28/01/2016	215	GC-FID
Low range Aliphatic hydrocarbons water	N		28/01/2016	215	GC-MS
Low range Aromatic hydrocarbons water	N		28/01/2016	215	GC-MS
Diesel range organics in water	N		29/01/2016	257	GC-FID
Hardness in waters	N		29/01/2016	APHA	ICPMS

Tests marked N are not UKAS accredited

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Report Information

Report No.: 16-05260

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Soil sample results are expressed on an air dried basis
Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
PCB congener results may include any coeluting PCBs
Uncertainty of measurement for the determinands tested are available upon request

Deviation Codes

a	No date of sampling supplied
b	No time of sampling supplied (Waters Only)
c	Sample not received in appropriate containers
d	Sample not received in cooled condition
e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

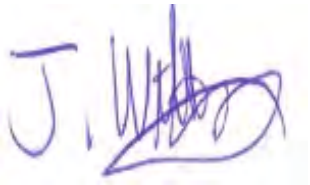
Sample Retention and Disposal

All soil samples will be retained for a period of one month
All water samples will be retained for 7 days following the date of the test report
Charges may apply to extended sample storage

Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 9BY
Telephone: (01424) 718618
Facsimile: (01424) 729911
info@elab-uk.co.uk

UKAS TESTING
2683

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	16-05839
Issue:	1
Date of Issue:	02/03/2016
Contact:	Tony Gerrard
Customer Details:	CC Geotechnical Ltd Unit 1 & 2 Deltic Place Deltic Way Liverpool LancashireL33 7BA
Quotation No:	Q15-00465
Order No:	Not Supplied
Customer Reference:	15-8700
Date Received:	26/02/2016
Date Approved:	02/03/2016
Details:	Dyfi Bridge, Machylleth
Approved by:	

John Wilson, Operations Manager

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683

Sample Summary

Report No.: 16-05839

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
55017	BH2	24/02/2016	26/02/2016		
55018	BH3	24/02/2016	26/02/2016		
55019	BH4	24/02/2016	26/02/2016		

Results Summary

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Report No.: 16-05839

			ELAB Reference	55017	55018	55019
			Customer Reference			
			Sample ID			
			Sample Type	WATER	WATER	WATER
			Sample Location	BH2	BH3	BH4
			Sample Depth (m)			
			Sampling Date	24/02/2016	24/02/2016	24/02/2016
Determinand	**Codes**	**Units**	**LOD**			
Dissolved Metals						
Arsenic	U	ug/l	5	< 5	< 5	< 5
Beryllium	U	ug/l	5	< 5	< 5	< 5
Calcium	U	ug/l	100	7510	5290	14600
Cadmium	U	ug/l	1	< 1	< 1	< 1
Chromium	U	ug/l	5	< 5	< 5	< 5
Copper	U	ug/l	5	< 5	< 5	< 5
Mercury	U	ug/l	0.1	< 0.1	< 0.1	< 0.1
Magnesium	U	ug/l	100	2480	2350	7840
Nickel	U	ug/l	5	< 5	< 5	6
Lead	U	ug/l	1	< 1	< 1	< 1
Antimony	N	ug/l	5	< 5	< 5	< 5
Selenium	U	ug/l	5	< 5	< 5	< 5
Vanadium	N	ug/l	5	< 5	< 5	< 5
Zinc	U	ug/l	5	23	29	25
Anions						
Chloride	U	mg/l	0.5	8.0	8.0	8.0
Inorganics						
Ammoniacal Nitrogen as N	N	mg/l	0.1	0.2	0.2	< 0.1
Total Cyanide	U	ug/l	5	< 5	< 5	< 5
Miscellaneous						
Hardness (CaCO3)	N	mg/l CaCO3	0.1	29	23	69
pH	U	pH units	0.1	5.6	5.6	5.8
Organics						
>C8-C10 BCB	N	ug/l	5	< 5.0	n/t	n/t
>C10-C12 BCB	N	ug/l	5	< 5.0	n/t	n/t
>C12-C16 BCB	N	ug/l	5	< 5.0	n/t	n/t
>C16-C21 BCB	N	ug/l	5	12.8	n/t	n/t
Diesel Range Organics (>C8-C21)	N	ug/l	10	13	n/t	n/t
Petrol Range Organics (>C6-C10)	N	ug/l	5	< 5.0	n/t	n/t
Phenols						
Total Phenols	N	ug/l	1	< 1	< 1	< 1
Polyaromatic hydrocarbons						
Naphthalene GCMS	N	ug/l	0.01	0.06	0.05	0.10
Acenaphthylene GCMS	N	ug/l	0.01	< 0.01	< 0.01	0.02
Acenaphthene GCMS	N	ug/l	0.01	< 0.01	< 0.01	0.01
Fluorene GCMS	N	ug/l	0.01	< 0.01	< 0.01	< 0.01
Phenanthrene GCMS	N	ug/l	0.01	0.05	0.07	0.14
Anthracene GCMS	N	ug/l	0.01	0.01	0.01	0.03
Fluoranthene GCMS	N	ug/l	0.01	0.05	0.08	0.28
Pyrene GCMS	N	ug/l	0.01	0.04	0.07	0.28
Benzo (a) anthracene GCMS	N	ug/l	0.01	0.02	0.02	0.14
Chrysene GCMS	N	ug/l	0.01	0.02	0.02	0.18
Benzo (b) fluoranthene GCMS	N	ug/l	0.01	0.02	0.04	0.15
Benzo (k) fluoranthene GCMS	N	ug/l	0.01	0.02	0.03	0.22
Benzo (a) pyrene GCMS	N	ug/l	0.01	0.02	0.04	0.21
Indeno (1,2,3-cd) pyrene GCMS	N	ug/l	0.01	0.03	0.03	0.15
Dibenzo(a,h)anthracene GCMS	N	ug/l	0.01	< 0.01	< 0.01	0.05
Benzo(ghi)perylene GCMS	N	ug/l	0.01	0.03	0.04	0.15
Total PAH(16) GCMS	N	ug/l	0.01	0.37	0.50	2.11

Tests marked N are not UKAS accredited.

Results Summary

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Report No.: 16-05839

			ELAB Reference	55017	55018	55019
			Customer Reference			
			Sample ID			
			Sample Type	WATER	WATER	WATER
			Sample Location	BH2	BH3	BH4
			Sample Depth (m)			
			Sampling Date	24/02/2016	24/02/2016	24/02/2016
Determinand	**Codes**	**Units**	**LOD**			
BTEX						
Benzene	U	ug/l	1	< 1.00	< 1.00	< 1.00
Toluene	U	ug/l	1	< 1.00	< 1.00	< 1.00
Ethylbenzene	U	ug/l	1	< 1.00	< 1.00	< 1.00
Xylenes	U	ug/l	1	< 1.00	< 1.00	< 1.00
TPH CWG						
>C5-C6 Aliphatic	N	ug/l	1	< 1.0	< 1.0	< 1.0
>C6-C8 Aliphatic	N	ug/l	1	< 1.0	< 1.0	< 1.0
>C8-C10 Aliphatic	N	ug/l	5	< 5.0	17.9	12.7
>C10-C12 Aliphatic	N	ug/l	5	< 5.0	< 5.0	< 5.0
>C12-C16 Aliphatic	N	ug/l	5	< 5.0	< 5.0	< 5.0
>C16-C21 Aliphatic	N	ug/l	5	< 5.0	19.2	11.8
>C21-C35 Aliphatic	N	ug/l	5	46.7	116	72.1
>C35-C40 Aliphatic	N	ug/l	5	< 5.0	< 5.0	< 5.0
Total (>C5-C40) Aliphatic	N	ug/l	5	46.7	154	96.6
>C5-C7 Aromatic	N	ug/l	1	< 1.0	< 1.0	< 1.0
>C7-C8 Aromatic	N	ug/l	1	< 1.0	< 1.0	< 1.0
>C8-C10 Aromatic	N	ug/l	5	< 5.0	< 5.0	< 5.0
>C10-C12 Aromatic	N	ug/l	5	< 5.0	< 5.0	< 5.0
>C12-C16 Aromatic	N	ug/l	5	< 5.0	< 5.0	< 5.0
>C16-C21 Aromatic	N	ug/l	5	12.8	17.0	11.5
>C21-C35 Aromatic	N	ug/l	5	48.0	89.9	74.7
>C35-C40 Aromatic	N	ug/l	5	< 5.0	< 5.0	< 5.0
Total (>C5-C40) Aromatic	N	ug/l	5	60.8	107	86.1
Total (>C5-C40) Ali/Aro	N	ug/l	5	108	260	183
Total Petroleum Hydrocarbons						
Mineral Oil	N	ug/l	35	< 35	n/t	n/t
Total TPH (C10-C40)	U	ug/l	100	< 100	n/t	n/t
PCB (ICES 7 congeners)						
PCB 28	N	ug/l	0.1	< 0.1	n/t	n/t
PCB 52	N	ug/l	0.1	< 0.1	n/t	n/t
PCB 101	N	ug/l	0.1	< 0.1	n/t	n/t
PCB118	N	ug/l	0.1	< 0.1	n/t	n/t
PCB 153	N	ug/l	0.1	< 0.1	n/t	n/t
PCB 138	N	ug/l	0.1	< 0.1	n/t	n/t
PCB 180	N	ug/l	0.1	< 0.1	n/t	n/t
PCB (7 Congeners)	N	ug/l	0.1	< 0.1	n/t	n/t

Results Summary

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Report No.: 16-05839

			ELAB Reference	55017	55018	55019
			Customer Reference			
			Sample ID			
			Sample Type	WATER	WATER	WATER
			Sample Location	BH2	BH3	BH4
			Sample Depth (m)			
			Sampling Date	24/02/2016	24/02/2016	24/02/2016
Determinand	**Codes**	**Units**	**LOD**			
VOC						
MTBE	U	ug/l	1	< 1	< 1	< 1
Heptane	N	ug/l	1	< 1	< 1	< 1
Octane	N	ug/l	1	< 1	< 1	< 1
Nonane	N	ug/l	1	< 1	< 1	< 1
Benzene	U	ug/l	1	< 1	< 1	< 1
Toluene	U	ug/l	1	< 1	< 1	< 1
Ethylbenzene	U	ug/l	1	< 1	< 1	< 1
m+p-xylene	U	ug/l	1	< 1	< 1	< 1
o-xylene	U	ug/l	1	< 1	< 1	< 1
cis-1,2-dichloroethene	U	ug/l	1	< 1	< 1	< 1
1,1-Dichloroethane	U	ug/l	1	< 1	< 1	< 1
Chloroform	U	ug/l	1	< 1	< 1	< 1
Tetrachloromethane	U	ug/l	1	< 1	< 1	< 1
1,1,1-Trichloroethane	U	ug/l	1	< 1	< 1	< 1
Trichloroethylene	N	ug/l	1	< 1	< 1	< 1
Tetrachloroethylene	U	ug/l	1	< 1	< 1	< 1
1,1,1,2-Tetrachloroethane	U	ug/l	1	< 1	< 1	< 1
1,1,2,2-Tetrachloroetha	N	ug/l	1	< 1	< 1	< 1
Chlorobenzene	U	ug/l	1	< 1	< 1	< 1
Bromobenzene	U	ug/l	1	< 1	< 1	< 1
Bromodichloromethane	U	ug/l	1	< 1	< 1	< 1
Methylethylbenzene	U	ug/l	1	< 1	< 1	< 1
1,1-Dichloro-1-propene	U	ug/l	1	< 1	< 1	< 1
Trans - 1-2 -dichloroethylene	U	ug/l	1	< 1	< 1	< 1
2,2-Dichloropropane	N	ug/l	1	< 1	< 1	< 1
Bromochloromethane	N	ug/l	1	< 1	< 1	< 1
1,2-Dichloroethane	U	ug/l	1	< 1	< 1	< 1
Dibromomethane	U	ug/l	1	< 1	< 1	< 1
1,2-Dichloropropane	U	ug/l	1	< 1	< 1	< 1
cis-1,3-Dichloro-1-propene	U	ug/l	1	< 1	< 1	< 1
trans-1,3-Dichloro-1-propene	U	ug/l	1	< 1	< 1	< 1
1,1,2-Trichloroethane	U	ug/l	1	< 1	< 1	< 1
Dibromochloromethane	U	ug/l	1	< 1	< 1	< 1
1,3-Dichloropropane	U	ug/l	1	< 1	< 1	< 1
Dibromoethane	U	ug/l	1	< 1	< 1	< 1
Styrene	U	ug/l	1	< 1	< 1	< 1
Propylbenzene	U	ug/l	1	< 1	< 1	< 1
2-Chlorotoluene	U	ug/l	1	< 1	< 1	< 1
1,2,4-Trimethylbenzene	U	ug/l	1	< 1	< 1	< 1
4-Chlorotoluene	U	ug/l	1	< 1	< 1	< 1
t-butylbenzene	U	ug/l	1	< 1	< 1	< 1
1,3,5-Trimethylbenzene	U	ug/l	1	< 1	< 1	< 1
1-methylpropylbenzene	U	ug/l	1	< 1	< 1	< 1
o-cymene	U	ug/l	1	< 1	< 1	< 1
1,3-Dichlorobenzene	U	ug/l	1	< 1	< 1	< 1
Butylbenzene	U	ug/l	1	< 1	< 1	< 1
1,2-Dibromo-3-chloropropane	U	ug/l	1	< 1	< 1	< 1
Hexachlorobutadiene	U	ug/l	1	< 1	< 1	< 1
1,2,3-Trichlorobenzene	U	ug/l	1	< 1	< 1	< 1
Naphthalene	U	ug/l	1	< 1	< 1	< 1
1,2,4-Trichlorobenzene	U	ug/l	1	< 1	< 1	< 1
1,4-Dichlorobenzene	U	ug/l	1	< 1	< 1	< 1
1,2-Dichlorobenzene	U	ug/l	1	< 1	< 1	< 1
Bromoform	U	ug/l	1	< 1	< 1	< 1

Results Summary

2683

Report No.: 16-05839

			ELAB Reference	55017	55018	55019
			Customer Reference			
			Sample ID			
			Sample Type	WATER	WATER	WATER
			Sample Location	BH2	BH3	BH4
			Sample Depth (m)			
			Sampling Date	24/02/2016	24/02/2016	24/02/2016
Determinand	**Codes**	**Units**	**LOD**			
SVOC						
Phenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
Aniline	N	ug/l	1	< 1.00	< 1.00	< 1.00
Bis(2-chloroethyl)ether	N	ug/l	1	< 1.00	< 1.00	< 1.00
2-Chlorophenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
1,3-Dichlorobenzene	N	ug/l	1	< 1.00	< 1.00	< 1.00
1,4-Dichlorobenzene	N	ug/l	1	< 1.00	< 1.00	< 1.00
Benzyl Alcohol	N	ug/l	1	< 1.00	< 1.00	< 1.00
1,2-Dichlorobenzene	N	ug/l	1	< 1.00	< 1.00	< 1.00
2-Methylphenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
Bis(2-chloroisopropyl)ether	N	ug/l	1	< 1.00	< 1.00	< 1.00
3 and 4-methylphenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
N-Nitrosodi-n-propylamine	N	ug/l	1	< 1.00	< 1.00	< 1.00
Hexachloroethane	N	ug/l	1	< 1.00	< 1.00	< 1.00
Nitrobenzene	N	ug/l	1	< 1.00	< 1.00	< 1.00
Isophorone	N	ug/l	1	< 1.00	< 1.00	< 1.00
2-Nitrophenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
2,4-Dimethylphenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
Bis(2-chloroethoxy)methane	N	ug/l	1	< 1.00	< 1.00	< 1.00
2,4-Dichlorophenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
1,3,5-Trichlorobenzene	N	ug/l	1	< 1.00	< 1.00	< 1.00
Naphthalene	N	ug/l	0.01	0.07	0.05	0.08
3-Chloroaniline	N	ug/l	1	< 1.00	< 1.00	< 1.00
Hexachloro-1,3-butadiene	N	ug/l	1	< 1.00	< 1.00	< 1.00
4-Chloro-3-methylphenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
2-Methynaphthalene	N	ug/l	1	< 1.00	< 1.00	< 1.00
1-Methylnaphthalene	N	ug/l	1	< 1.00	< 1.00	< 1.00
Hexachlorocyclopentadiene	N	ug/l	1	< 1.00	< 1.00	< 1.00
2,4,6-Trichlorophenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
2,4,5-Trichlorophenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
1-Chloronaphthalene	N	ug/l	1	< 1.00	< 1.00	< 1.00
2-Nitroaniline	N	ug/l	1	< 1.00	< 1.00	< 1.00
1,4-Dinitrobenzene	N	ug/l	1	< 1.00	< 1.00	< 1.00
Dimethyl phthalate	N	ug/l	1	< 1.00	< 1.00	< 1.00
1-3-dinitrobenzene	N	ug/l	1	< 1.00	< 1.00	< 1.00
2-6-dinitrotoluene	N	ug/l	1	< 1.00	< 1.00	< 1.00
Acenaphthylene	N	ug/l	0.01	< 0.01	< 0.01	0.01
1,2-Dinitrobenzene	N	ug/l	1	< 1.00	< 1.00	< 1.00
3-Nitroaniline	N	ug/l	1	< 1.00	< 1.00	< 1.00
Acenaphthene	N	ug/l	0.01	< 0.01	< 0.01	0.01
4-nitrophenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
Dibenzofuran	N	ug/l	1	< 1.00	< 1.00	< 1.00
2,3,5,6-Tetrachlorophenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
2,3,4,6-Tetrachlorophenol	N	ug/l	1	< 1.00	< 1.00	< 1.00
Diethyl phthalate	N	ug/l	1	< 1.00	< 1.00	< 1.00
1-chloro-4-phenoxybenzene	N	ug/l	1	< 1.00	< 1.00	< 1.00
Fluorene	N	ug/l	0.01	< 0.01	< 0.01	0.01
4-Nitroaniline	N	ug/l	1	< 1.00	< 1.00	< 1.00
Dinitro-o-cresol	N	ug/l	1	< 1.00	< 1.00	< 1.00
Diphenylamine	N	ug/l	1	< 1.00	< 1.00	< 1.00
Azobenzene	N	ug/l	1	< 1.00	< 1.00	< 1.00
1-bromo-4-phenoxybenzene	N	ug/l	1	< 1.00	< 1.00	< 1.00
Hexachlorobenzene	N	ug/l	1	< 1.00	< 1.00	< 1.00
Pentachlorophenol	N	ug/l	1	< 1.00	< 1.00	< 1.00

Tests marked N are not UKAS accredited.

Results Summary

2683

Report No.: 16-05839

			ELAB Reference	55017	55018	55019
			Customer Reference			
			Sample ID			
			Sample Type	WATER	WATER	WATER
			Sample Location	BH2	BH3	BH4
			Sample Depth (m)			
			Sampling Date	24/02/2016	24/02/2016	24/02/2016
Determinand	**Codes**	**Units**	**LOD**			
SVOC						
Phenanthrene	N	ug/l	0.01	0.03	0.06	0.13
Anthracene	N	ug/l	0.01	< 0.01	< 0.01	< 0.01
Carbazole	N	ug/l	1	< 1.00	< 1.00	< 1.00
Dibutyl phthalate	N	ug/l	1	< 1.00	< 1.00	< 1.00
Fluoranthene	N	ug/l	0.01	0.05	0.07	0.26
Pyrene	N	ug/l	0.01	0.04	0.05	0.27
Butyl benzyl phthalate	N	ug/l	1	< 1.00	< 1.00	< 1.00
Bis-2-ethylhexyladipate	N	ug/l	1	< 1.00	< 1.00	< 1.00
Butyl benzyl phthalate	N	ug/l	1	< 1.00	< 1.00	< 1.00
Benzo(a)anthracene	N	ug/l	0.01	0.01	0.03	< 0.01
Chrysene	N	ug/l	0.01	0.02	0.03	< 0.01
Bis(2-ethylhexyl)phthalate	N	ug/l	1	< 1.00	< 1.00	< 1.00
Benzo(b)fluoranthene	N	ug/l	0.01	0.02	0.03	0.15
Benzo(k)fluoranthene	N	ug/l	0.01	0.02	0.03	0.16
Benzo(a)pyrene	N	ug/l	0.01	0.02	0.01	0.20
Indeno(1,2,3-CD)pyrene	N	ug/l	0.01	0.02	0.03	0.13
Dibenz(ah)anthracene	N	ug/l	0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	N	ug/l	0.01	0.03	0.04	0.16

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Method Summary

Report No.: 16-05839

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Water					
Aliphatic/Aromatic hydrocarbons in water	N		01/03/2016		GC-FID
Aromatic hydrocarbons in water	N		01/03/2016		GC-FID
Basic carbon banding in water	N		01/03/2016		GC-FID
Petrol range organics in water	N		01/03/2016		GC-MS
Phenols in waters	N		29/02/2016		HPLC
Dissolved metals by ICP in waters	U		29/02/2016	101	ICPMS
pH of waters	U		29/02/2016	113	Electromeric
Anions	U		29/02/2016	131	Ion Chromatography
PAHs and/or PCBs in waters	N		01/03/2016	135	GC-MS
Ammonia in waters	N		01/03/2016	151	Colorimetry
SVOC in waters	N		01/03/2016	167	GC-MS
PAHs and/or PCBs in waters	N		01/03/2016	170	GC-MS
Total Petroleum Hydrocarbons in waters	U		01/03/2016	178	GC-FID
VOC in waters	U		26/02/2016	200	GC-MS
BTEX in waters	U		29/02/2016	200A	GC-MS
Cyanide in waters	U		29/02/2016	205	Colorimetry
Aliphatic hydrocarbons in water	N		29/02/2016	215	GC-FID
Aromatic hydrocarbons in water	N		01/03/2016	215	GC-FID
Low range Aliphatic hydrocarbons water	N		29/02/2016	215	GC-MS
Low range Aromatic hydrocarbons water	N		29/02/2016	215	GC-MS
Diesel range organics in water	N		01/03/2016	257	GC-FID
Hardness in waters	N		01/03/2016	APHA	ICPMS

Tests marked N are not UKAS accredited

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Report Information

Report No.: 16-05839

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"

Soil sample results are expressed on an air dried basis
Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
PCB congener results may include any coeluting PCBs
Uncertainty of measurement for the determinands tested are available upon request

Deviation Codes

a	No date of sampling supplied
b	No time of sampling supplied (Waters Only)
c	Sample not received in appropriate containers
d	Sample not received in cooled condition
e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month
All water samples will be retained for 7 days following the date of the test report
Charges may apply to extended sample storage

APPENDIX 10: GROUNDWATER MONITORING DATA

GAS AND WATER MONITORING RESULTS

	Date:	12/01/16	20/01/16	27/01/16	17/03/16	24/03/15							
	Visit Number	1	2	3	4	5							
	Atmos Press mb	994	1019	998	1011	1019							
	Pressure Trend	Steady	Steady	Steady	Steady	Steady							
	Air Temp °C	4	-1	10	5	-3							
	Cloud cover	Overcast	Low cloud	Overcast	Overcast	Clear							
	Wind velocity	Windy	Breezy	Strong Wind	Light Breeze	Light Breeze							
	Precipitation	Rain	Dry	Heavy Rain	Rain	Dry							
	State of Ground	Wet	Wet	Flooded	Wet	Wet							
BH2	CH_4 (%) (max/steady):	Nil	Nil		Nil	Nil							
	CO_2 (%) (max/steady):	0.5	0.7		<0.1	0.8							
	O_2 (%) (max/steady):	20.2	19.9	Position Flooded	20.0	19.7							
	H_2S (ppm) (max/steady):	Nil	Nil		Nil	Nil							
	CO (ppm) (max/steady):	Nil	Nil		Nil	Nil							
	PID (ppm) (max/steady)	0.0	0.0		0.0	0.0							
	Flow (l/hr) (max/steady)	<0.1	<0.1		<0.1	<0.1							
	Water Level / depth to base (m):	1.0/25.0	1.00		1.53	1.31							
BH3	CH_4 (%) (max/steady):	Nil	Nil		Nil	Nil							
	CO_2 (%) (max/steady):	0.4	0.5		<0.1	0.3							
	O_2 (%) (max/steady):	19.9	19.7	Position Flooded	20.1	19.7							
	H_2S (ppm) (max/steady):	Nil	Nil		Nil	Nil							
	CO (ppm) (max/steady):	Nil	Nil		Nil	Nil							
	PID (ppm) (max/steady)	0.0	0.0		0.0	0.0							
	Flow (l/hr) (max/steady)	<0.1	<0.1		<0.1	<0.1							
	Water Level / depth to base (m):	0.99/25.0	1.00		1.48	1.32							
BH4	CH_4 (%) (max/steady):	Nil	Nil		Nil	Nil							
	CO_2 (%) (max/steady):	0.4	0.6		<0.1	4.6							
	O_2 (%) (max/steady):	20.0	19.7	Position Flooded	20.0	10.4							
	H_2S (ppm) (max/steady):	Nil	Nil		Nil	Nil							
	CO (ppm) (max/steady):	Nil	Nil		Nil	Nil							
	PID (ppm) (max/steady)	0.0	0.0		0.0	0.0							
	Flow (l/hr) (max/steady)	<0.1	<0.1		<0.1	<0.1							
	Water Level / depth to base (m):	1.0/10.0	1.00		1.45	1.46							
	CH_4 (%) (max/steady):												
	CO_2 (%) (max/steady):												
	O_2 (%) (max/steady):												
	H_2S (ppm) (max/steady):												
	CO (ppm) (max/steady):												
	PID (ppm) (max/steady)												
	Flow (l/hr) (max/steady)												
	Water Level / depth to base (m):												
	CH_4 (%) (max/steady):												
	CO_2 (%) (max/steady):												
	O_2 (%) (max/steady):												
	H_2S (ppm) (max/steady):												
	CO (ppm) (max/steady):												
	PID (ppm) (max/steady)												
	Flow (l/hr) (max/steady)												
	Water Level / depth to base (m):												

Job No: CCG-C-15-8700

Site: Dyfi Bridge

Instrument:

APPENDIX 11: CALIBRATION CERTIFICATES

TEST DATE AND CONDITIONS	
Date	14/05/2015
Atmospheric Pressure	996 mB
Ambient Temp	24.0 °C
Environics Serial No.	n/a

GAS DATA LTD

Pegasus House
Seven Stars Estate
Wheler Rd.
Coventry
CV3 4LB
Tel: 024 76 303311 Fax: 024 76 307711

LMS FINAL INSPECTION & CALIBRATION CERTIFICATE

INSTRUMENT DETAILS		
Serial No	1498	CUSTOMER
S/W Version	G3.17j-LT	CC Geotechnical Ltd

INSTRUMENT CHECKS			
Keyboard	✓	Clock Set / Running	✓
Pump In/Out	✓	Labels Fitted	✓
Display Contrast	✓	Recalibration Due	14/05/2016

GASES					
CH4		CO2		O2	
Test %	Reading %	Test %	Reading %	Test %	Reading
0 accept <= 0.1	0	0 accept <= 0.1	0	0 accept <= 0.1	0.1
6.4 accept 6.2-6.6	6.2	5.4 accept 5.2-5.6	5.2	21 accept 20.5-21.2	20.6
53 accept 51.0-55.0	52	45 accept 41.0-50.0	45		

PRESSURES			
Absolute/Relative		Differential	
Atmos accept current +/-1	996	0.0	x
Atmos + 50 mbar accept current +48-+52	1047	+30 mbar accept 29.5-30.5	x
Atmos - 50 mbar accept current -48--52	946	-30 mbar accept -29.5--30.5	x

TEMPERATURE	
Applied °C	Reading °C
0 accept -0.1-+0.1	0
25 accept 24.5-25.5	25
40 accept 37.5-40.5	40.2

OPTIONS					
Borehole Flow (see other Side)	✓	LEL	✓	Temp Probe (see above)	x
Extraction Flow	x			Toxic Gasses (see other Side)	✓

PACKING						
Charger	UK✓	US	Euro	Sample Pipe	Standard	Flow
Manual	x			Serial Cable	x	
Leather Bag	✓			Software	x	
Strap	✓			Cal Certificate	✓	

TEST DATE AND CONDITIONS	
Date	14/05/2015
Atmospheric Pressure	996 mB
Ambient Temp	24.0 ^{0}C
Environics Serial No.	n/a

GAS DATA LTD

Pegasus House
Seven Stars Estate
Wheler Rd.
Coventry
CV3 4LB
Tel: 024 76 303311 Fax: 024 76 307711

LMS FINAL INSPECTION & CALIBRATION CERTIFICATE (OPTIONS)

Toxic Gasses			
Gas Type	Range	Tested @	Reading
H2S	1500ppm	75ppm	76.6ppm
CO	1000ppm	315ppm	314ppm

Cross Gas Effects					
Applied gas		Readings			
Type	Concentration	Toxic 1: H2S	Toxic 2: CO	Toxic 3:	Toxic 4:
H2S	75ppm	76.6ppm	0.0ppm		
CO	315ppm	5.4ppm	314ppm		

Flow Tests - Low Range Option					
Target Flow	-5 L/Hr	0 L/Hr	5 L/Hr	10 L/Hr	20 L/Hr
Applied	-5	0.0	5	10	20
Flow Reading	-5.1 accept applied +/- 0.5	0.0 accept applied +/- 0.0	5.1 accept applied +/-0.5	10 accept applied +/-0.7	20 accept applied +/-3.0
dp Applied (Pa)	-13	0.0	13	30	76
dp Reading (Pa)	-13 accept applied +/-5	0.0 accept applied +/-0.0	-13.4 accept applied +/-5	-30.3 accept applied +/-10	76.3 accept applied +/-20
Flow Tests - High Range Option					
Target Flow	-30 L/Hr	0 L/Hr	30 L/Hr	60 L/Hr	120 L/Hr
Applied	-30	0.0	30	60	120
Flow Reading	x accept applied +/-3.0	0.0 accept applied +/-0.0	x accept applied +/-3.0	x accept applied +/-4.0	x accept applied +/-15
dp Applied (Pa)	x	0.0	x	x	x
dp Reading (Pa)	x accept applied +/-15	0.0 accept applied +/-0.0	x accept applied +/-15	x accept applied +/-50	x accept applied +/-200

Tested ..... Approved .....

APPENDIX 12: NOTES ON LIMITATIONS

Standard Terms and Conditions of Engagement
Notes on Limitations
For
Geoenvironmental and Geotechnical Services

CC GEOTECHNICAL LTD (***CCG***) has prepared this report solely for the use of the Client. Should any third party other than those nominated by the Client wish to use or rely upon the contents of the report, written approval must be sought from ***CCG*** and a charge may be levied against such approval.

CCG accepts no responsibility or liability for:

- the consequences of this document being used for any purpose or project other than for which it was commissioned

and/or

- the consequences of use of this document by any party with whom an agreement has not been executed.

The investigation of the site has been carried out to a scope determined by other parties.

The exploratory holes undertaken, investigate only a small volume of the ground in relation to the size of the site, and can only provide a general indication of the site conditions. The data contained in this report is based on the ground conditions apparent at the site of each of the exploratory holes. There may be ground conditions present on the site that have not been disclosed by this investigation, and which have therefore not been taken into account in this report.

The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that groundwater levels will vary owing to seasonal, tidal, weather, or other effects.

Appendix D

Site Investigation No. M5025, Factual and Interpretative Report, A487 Pont-ar-Dyfi Improvement. CJ Associates Geotechnical Ltd, November 2001.

NAMAS
TESTING
No. 1429



Site Investigation No. M0525
Factual and Interpretative Report

A487
Pont ar Dyfi improvement

November 2001

C.J. associates

BRITISH DRILLING ASSOCIATION

C.J. Associates Geotechnical Limited.
King Road Avenue, Avonmouth,
Bristol BS11 9HF
Tel: 0117 982 1473 Fax: 0117 982 8200

C.J. associates

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SITE PLANS
Site Location Plan
Borehole and Trial Pit Location Plan

C.J. associates

1. INTRODUCTION

Powys County Council commissioned this investigation to determine ground conditions of a site near Machynlleth as relevant to a proposed development. The extent of the investigation was specified by the Client.

The Client's brief was expressed at the time of the initial request for this investigation, in tender documents accompanying a letter dated 3rd May 2001. These requested twenty-two cable percussion boreholes, some to be extended by rotary drilling, eighteen trial pits, associated in situ and laboratory testing, including for contamination, and an interpretative report. The brief was later modified with one of the boreholes and one of the trial pits being deleted due to access difficulties.

It is understood that this investigation is to produce recommendations which might influence the choice of a proposed road improvement scheme and new crossing of the Afon Dyfi.

This report describes fieldwork carried out during September 2001, under the direction of the Client. Subsequent laboratory testing and the findings of the investigation are also described. It is pointed out that there may be particular circumstances relating to this site that have not been discovered by the fieldwork or laboratory testing and which, therefore, have not been taken into account in the recommendations. This report has been prepared for the above-named Client for the site as indicated and for the purpose stated. C.J.Associates Geotechnical Limited accepts no responsibility for any other purpose, site or Client.

All information in this report is based on isolated tests that were thought at the time of writing to be representative of the site as a whole. The report should be reviewed at all stages of construction by someone familiar with the terms and assumptions it contains.

It is essential that the engineering department of Powys County Council, or a suitably qualified and experienced Consulting Engineer of equivalent status, be appointed for the design of the works and to supervise construction.

2. SITE DESCRIPTION

2.1 - Location

The site is centred at National Grid reference SH 745017 in the valley of the Afon Dyfi approximately 0.5 km north of Machynlleth railway station, and is shown on the attached site location plan.

2.2 - Description

The site lies on the flood plain of the Afon Dyfi. It is predominantly approximately level and surfaced with grass used as pasture or for silage. The northernmost part of the site lies on the rising ground above the flood plain on the existing A487 Machynlleth to Dolgellau road. The Afon Dyfi flows through the northern part of the site but there was no standing water present at the time of the investigation. It is understood however that the site area can and does flood when the river overflows its banks. There are many trees on the site, predominantly along the field boundaries.

2.3 - History

No information regarding the previous history of the site was made available to C.J.Associates Geotechnical Limited.

2.4 - General Geology

According to the British Geological Survey geological map of the area, and other available information, the site under investigation is underlain by Silurian rocks of the

Llandovery Series. These are generally blue. Black and grey graptolitic shales and mudstones with only occasional interbedded sandy bands

3. FIELDWORK

3.1 - General

The extent of the fieldwork was specified by the Client. Fieldwork was carried out generally in accordance with BS 5930:1999 "Code of Practice for Site Investigations" and the Client's instructions unless otherwise stated. On completion all samples recovered from the site were taken to C.J.Associates Geotechnical Limited's UKAS accredited laboratory for further examination and testing.

Details of the depths and type of samples recovered are included on the attached log sheets. The locations of the boreholes and trial pits are shown approximately on the attached location plan.

3.2 - Cable Percussive Boring

Fifteen 150 mm diameter boreholes were sunk by cable percussion equipment to depths of between 9.50 m and 26.10 m below existing ground level at positions indicated by the Client. Representative disturbed samples were recovered as drilling proceeded. Standard penetration tests using the split spoon sampler or cone point were conducted at regular intervals of depth and undisturbed 100 mm diameter samples were recovered as appropriate. The boreholes were backfilled on completion with arisings.

Where necessary, chiselling techniques were employed to advance the boreholes through obstructions or into a hard stratum (as defined in the Specification for Ground Investigation). The latter does not necessarily represent a suitable bearing stratum and may only be an obstruction.

Details of groundwater conditions were noted. These observations are those at the time of the investigation and do not necessarily reflect seasonal or tidal fluctuations. Water levels were monitored during site work but not subsequently. Water levels may have been affected by the installation of casing or the addition of water to aid boring. These effects were assessed as closely as possible during boring.

3.3 - Rotary Drilling

Five of the cable percussive boreholes were extended by four-wheel-drive, lorry-mounted rotary coring rig to depths of between 18.80 m and 29.00 m below existing ground level.

In addition, six purely rotary holes were sunk to depths of between 1.85 m and 15.50 m below existing ground level at positions indicated by the Client. These boreholes were initially sunk using a rock roller bit, producing a 115 mm nominal diameter hole, until material suitable for rotary coring was encountered.

In all cases a 412 double tube core barrel, producing 76 mm nominal diameter cores in a semi rigid plastic liner, was utilised and air was used as the flushing medium. Cores were stored in boxes immediately on extraction.

Details of ground water conditions were noted where possible. Water levels may have been affected by the installation of casing to the boreholes or the use of air as a flushing medium. In addition, water level observations are those at the time of the investigation and do not necessarily reflect seasonal or tidal fluctuations.

Logging of the rock cores was completed in accordance with BS 5930:1999.

3.4 - Trial Pitting

To supplement the borehole investigation seventeen trial pits were taken out by wheeled excavator with extending hydraulic backhoe, under the direct and continuous supervision

of the writer of this report. Trial pit locations were determined by the Client, in accordance with the objectives of the investigation.

The trial pits were terminated at depths of between 0.50 m and 3.00 m, as specified by the Client, or at the practicable depth limit of the machine in the materials encountered, whichever was shallower.

In situ hand shear vane tests were completed as appropriate and representative disturbed samples were recovered from the excavated material as pitting proceeded. In situ California Bearing Ratio tests were conducted at shallow depths in the pits using a dynamic cone penetrometer. Details of groundwater conditions were noted. The trial pits were backfilled immediately on completion of sampling and testing.

4. LABORATORY WORK

Samples were selected as relevant to the objectives of the investigation in accordance with the Client's instructions, and subjected to the following tests according to BS 1377:1990 "Methods of Test for Soils for Civil Engineering Purposes", unless otherwise stated. Reference is made to the test schedule issued by the writer on 9th October 2001.

BS 1377 Test No.	Description
Part 2 Clause 3.2	Moisture content
Part 2 Clauses 4.4 and 5	Liquid and plastic limits and plasticity index
Part 2 Clause 8.2	Specific gravity
Part 2 Clause 9.2	Particle size distribution by wet sieving

Part 3 Clause 3	Organic matter content
Part 3 Clause 5.2	Total sulphate content of soil
Part 3 Clause 5.4	Sulphate content of ground water
Part 3 Clause 7	Chloride content of soil
Part 3 Clause 9.5	pH value (electrometric method)
Part 4 Clause 3.3	Dry density moisture content relationship (2.5 Kg rammer)
Part 4 Clause 7	California Bearing Ratio
Part 5 Clause 3	One-dimensional consolidation properties
Part 7 Clause 9	Quick undrained triaxial compression without pore water pressure measurement (100 mm diameter)

Non BS 1377 Tests	Description
ICRCL	Contamination testing

Details of test results are shown in the attached appendix and discussed in the following sections.

5. FINDINGS AND OBSERVATIONS

The ground conditions encountered in each exploratory hole are fully described on the attached borehole and trial pit log sheets. The strata revealed by this investigation across the flood plain to the south of the river can be generally summarised as soft to firm silty clay to between approximately 1.00 m to 3.00 m over medium dense becoming very dense river-deposited gravel with occasional sand or silt/clay horizons to between 15.60 m to 22.10 over moderately strong to strong siltstone or shale bedrock. To the

north of the river bedrock was found at much shallower depths, varying between 0.30 m and 8.60 m, although the overlying deposits were the same as those to the south.

Groundwater was generally encountered upon reaching the granular sand and/or gravel deposits.

Stratum A - clays

Triaxial test results revealed cohesions ranging between 8 kN/m² and 48 kN/m². Hand shear vane readings produced cohesions varying between 20 kN/m² and 58 kN/m². These values indicate a consistency for this material ranging from very soft to soft-to-firm. Consolidation test results indicate that this deposit is in the range of high compressibility. Based on the Extended Casagrande Soil Classification the liquid and plastic limits and plasticity index tests classified the fine-grained fraction of this material as _____. Chemical test results indicate that Class _____ conditions apply in respect of total and aqueous sulphate content with pH values _____. Contamination test results indicate that there are no metals present in this material at levels in excess of ICRCL trigger concentration thresholds. In situ California Bearing Ratio tests gave results generally varying between 0.5 to 1 % but occasionally reaching 10 % where quantities of gravel were present.

Stratum B – sands and gravels

SPT N-values indicate that this material increases in density with depth from predominantly medium dense, but occasionally loose, at shallow depths to very dense just above the bedrock. These materials are geologically Recent and have probably never suffered any loading, for instance by glaciation or burial, and so this increase in density with depth probably just reflects self-consolidation. Particle size distribution test results show this material to be _____. Chemical test results indicate that Class _____ conditions apply in respect of total and aqueous sulphate content with pH values _____.

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6. CONCLUSIONS AND RECOMMENDATIONS

The results of the boreholes and trial pits indicate that the site is underlain by soft silty clays to up to 3.0 m over loose becoming very dense gravels with occasional sand and silt horizons over shales and siltstone rock. The latter rocks represent the Llandovery age deposits described above and conform to the predicted geological sequence. All of the overlying materials are flood plain deposits of the Afon Dyfi.

In the absence of any design information the following recommendations with regard to foundation solutions are necessarily general.

STRUCTURES

On the southern side of the river it is understood that the new bridge may be in the area of boreholes 8 and 9 or in the area of boreholes 17, 18 and 19. The deposits encountered in the boreholes at both of these locations were similar and so both will be considered together here.

Shallow foundations

The soft to firm silty clays at shallow depth should give an allowable bearing pressure of 75 kN/m² based on a square pad footing not exceeding a total area of four square metres at a depth of 1.0 m below existing ground level. A strip footing of similar area would give excessive vertical stress within the sands gravels underlying the clays (these have N-values as low as 4) which would only support an allowable bearing pressure of 25 kN/m² for a 1.0 m wide footing reducing to 10 kN/m² for a 4.0 m wide footing.

Piled foundations

If the above allowable bearing pressures are insufficient for the proposed structure, it will be necessary to transfer the loads to a greater depth by means of a piled foundation. Quotations should be sought from reputable piling contractors who should be provided

with a copy of this report. The possibility of damage to any adjacent services should be considered if a piled foundation is adopted.

The choice between driven or bored piles must consider (a) the presence of relatively high running water at the site, (b) possible artesian water pressure in the superficial deposits and (c) the probable non-uniformity of the rock head across the site.

The presence of water in the first two instances causes construction difficulties and makes for particularly unfavourable conditions for bored or replacement piles. Possible pile defects may also occur after the withdrawal of casing for cast-in-situ piles through pile necking due to the washing out of cement by running water.

A driven precast pile solution would therefore seem most applicable at this site. Such piles should be driven to refusal considering the variability of superficial deposits and the probable non-uniformity of the rock-head. The ultimate load capacity of the piles will depend on their material and geometry and should be discussed with any reputable contractors contacted for quotations.

The likely need to adjust pile lengths can be overcome by employing jointed precast concrete piles. With these, adjustments in length can be made by adding or taking away short lengths of pile that are jointed by devices capable of developing the same bending and tensile resistance as the main body of the pile. It should be noted that certain minimum unjointed pile lengths are required by some Codes. Once again, reputable contractors should be consulted regarding the maximum safe working loads of their proprietary designs. Uniform joint-length piles could also be used but the relatively low safe working load of these would probably necessitate an increase in the number of piles.

Pile driving should be carefully controlled to avoid excessive crushing of the bedrock, should this be reached, and to ensure that the pile concrete is not damaged.

Horizontal loading of the piles, for instance during times of flood, should also be considered. The ultimate horizontal load on a pile depends on its stiffness, the compressibility of the soil and depth of embedment of the pile. The latter of these cannot be determined at this stage.

In general, vertical piles offer poor resistance to horizontal loads and, given the likely danger of flooding, it would be advisable to make field loading tests on trial piles having at least three different shaft lengths in order to assess the effect of embedment depth and structural stiffness. Alternatively, the use of raking piles, which are more appropriate for this purpose, should be considered.

Sand layers were encountered in many of the boreholes. The problem of "False Sets" should therefore be appreciated. This may become apparent where the piles pass through large proportions of saturated fine sand. If piles appear to have reached refusal, and such horizons are suspected, driving should cease for approximately 30 minutes to allow pore water pressures to dissipate before attempting to continue driving.

Pile tests should be conducted on working piles chosen at random, to a load of 1.5 times the intended working load. It is generally suggested that two tests should be carried out on each pile group. It should be noted that particular care is usually exercised in testing piles driven to refusal in mudstone to ensure adequate bearing capacity. It may therefore be necessary to make other test pile arrangements outside the pile group but within the immediate vicinity of the proposed structure.

Piles may be driven to the shale and siltstone rocks encountered at the base of the cable percussive boreholes and proved in the rotary boreholes. Study of these rocks shows that individual fragments vary in strength from moderately strong to strong (i.e. ranging in compressive strength from 12.5 MN/m^2 to 100 MN/m^2). Given the highly fractured nature of much of this rock however it is recommended that a relatively conservative

ultimate end bearing capacity of 25 MN/m^2 is taken for concrete piles driven to refusal in the shale and siltstone bedrock.

There may be differential settlement between piled structures and the surrounding ground level. Provision should, therefore, be made to make up ground levels at threshold positions.

On the northern side of the river it is understood that the new bridge may be in the area of boreholes 10 and 13 or in the area of boreholes 20, 21 and 22. The deposits encountered in the boreholes at these locations were somewhat varied and so each will be considered separately here.

In boreholes 10 and 13 rock was encountered at depths of only 0.30 m and 0.50 m. While this should be suitable for shallow foundations it is considered likely that the depth to rock will vary across the larger site area and hence that there may be a possible need for some deep trench footings in this area. Again it is considered that the bedrock should be considered as having an ultimate bearing capacity of 25 MN/m^2. With loads of this magnitudes total settlements are not considered likely to exceed the generally accepted tolerance of 25 mm although differential settlements of up to approximately half this value may occur.

In boreholes 20, 21 and 22 rock was encountered at depths of between 6.80 m and 8.60 m. Above this lie gravels and silty clays and also, in borehole 21, made ground. Assuming similar densities within the gravels as on the southern side of the river, it is recommended that footings on the northern side of the river be taken to the rock by means of piling. Comments regarding piling given above for the south bank of the river should also be considered for this area of the north bank.

Should pads be used on one bank of the river and piles on the other, it will be essential to ensure suitable articulation in the bridge to allow for differential settlement between supports.

On either bank of the river, consideration may also be given to the adoption of vibrocompaction techniques to improve the bearing capacity of the existing ground. Given the generally granular nature of the superficial deposits at the site and the presence of water within these, it is thought that vibrocompaction may well be successful. The improvement in bearing capacity available will depend upon the particular technique used. Quotations and design advice should therefore be sought from reputable contractors who should be provided with a copy of this report. It is thought, however, that due to the limited area of ground to be treated, vibrocompaction may not be economically viable when compared to piling. The possibility of damage to any adjacent services should be considered if this method of ground improvement is adopted.

The foundations of the proposed structure will be on the flood plain of a large river. The clays and great thickness of gravels encountered in the boreholes are river flood plain deposits and illustrate the potential power of the floodwaters. All foundations should therefore be designed bearing in mind the potential for flooding and the possibility of severe scouring around the footings. Considerations of scour and flooding are beyond the scope of this report save that piled foundations probably have greater resistance to the former.

EMBANKMENTS

The ground crossed by embankments for either route is generally up to 3.0 m of silty clay, which ranges in consistency from very soft to firm, over considerable thicknesses of

granular materials, usually water-bearing. Boreholes in this area were taken to depths in excess of 15.00 m without encountering bedrock.

Based on tests on samples from the boreholes and on observations from the trial pits in this area it is recommended that only very low allowable bearing pressures may be available from the silty clays at shallow depth. This may result in excessive settlement or failure of the ground in these areas during construction. As these materials are also highly compressible it may be advisable to remove them prior to construction. If necessary they could be stockpiled and later used for landscaping purposes. Settlement of these materials is likely to take longer than the construction period and so accepting a degree of settlement and then making-up of levels prior to final construction is unlikely to be successful. During site operations, it was noted that the near surface materials silty clay materials in this area, if damp, did not provide a good surface for the movement of vehicles. Depending upon the condition of the ground when construction is taking place, it may be necessary to construct a haul road across the site to allow access by vehicles bringing in fill material for the embankment.

The underlying granular materials will have allowable bearing pressures generally of at least 75 kN/m^2 and should settle relatively rapidly within the construction period.

The maximum possible embankment slope angles will depend upon the material used to create them. The TRRL Research Report 199: *A Survey of Slope Condition on Motorway Earthworks in England and Wales*, which indicates recommended maximum slopes for embankments created in various geological materials, may be of some assistance in this matter.

Differential settlement between embankments and structures is likely to occur whether the latter are founded on piles or on spread footings. Allowance should therefore be made to make up levels at threshold positions once settlement has taken place.

Given the known risk of flooding of this area it is recommended that drains should be installed through embankments to prevent the ponding of water on their uphill side. Facing blocks or other protective measures should be incorporated into the faces of embankments likely to be washed by floodwaters in order to prevent scour.

GENERAL

It is likely that groundwater will be encountered in shallow excavations. Should this occur or should surface run-off be allowed to stand within excavations, rapid softening and resulting loss of strength of any cohesive material, especially in the excavation walls, may result. If excavations are to remain open before construction proceeds a thin blinding layer of concrete should be laid immediately after excavation.

Deep excavations will probably encounter ground water ingress and specialist advice may be necessary.

All excavations should be closely inspected by a suitably qualified and experienced Chartered Civil Engineer before construction proceeds. Any soft spots should be removed and replaced by selected, well-compacted granular fill or lean mix concrete. Care must be taken in such circumstances to avoid the development of local "quick" conditions.

The presence of trees within and close to the site boundaries indicates that foundations could be within their influence zone. In order to avoid possible excessive settlement due to water removal by trees during dry periods or ground heave due to tree removal, the recommendations of the National House Building Council Practice Standard "Building Near Trees", although not strictly applicable, should be closely followed.

Slope stability analysis is outside the scope of this report. However, it should be noted that the north bank of the river has a steep slope. This should be taken into consideration during the design process.

SULPHATES

The results of the chemical tests indicate that the site may be considered as falling within Class ____ of the classification given in the Building Research Establishment Digest 363 "Sulphate and Acid Resistance of Concrete in the Ground". The recommendations given in this digest with respect to minimum cement content and water:cement ratio should be followed for all below ground level concrete.

CONTAMINATION

The above note applies only to the sulphate content and pH of the ground. While a contamination survey has been carried out it is pointed out that this is necessarily limited and that only a very small percentage of the site under consideration has been tested. Results of these tests do not necessarily, therefore, apply to the whole of the site. No liability can be accepted for the presence of contaminants not analysed. C.J.Associates Geotechnical Limited does not accept any liability for pollution or contamination.

All contamination tests have been carried out for the range of metal contaminants outlined in ICRCL 59/83 "Guidance on the Assessment and Redevelopment of Contaminated Land". This document relates contaminant concentrations to trigger and action threshold values dependent on the planned uses of the site.

Testing of four samples revealed no contaminants exceeding the ICRCL trigger concentration thresholds for metals. On the basis of this limited evidence it is possible to recommend that, with regard to metals contamination, no remedial works are necessary on the site.

It is emphasised that only a small number of tests have been carried out and that the possibility of contamination elsewhere on the site cannot be entirely ruled out. It may be prudent to carry out further monitoring tests for contamination during the construction period.

7. GENERAL

The recommendations given in this report are based on the results of a limited site investigation only and are dependant on the findings of the boreholes and trial pits being representative of the site as a whole. They are subject to the weather and ground conditions prevailing at the time of the investigation. Opinions expressed in this report with regard to possible configurations of strata between the exploratory hole positions, or on the presence of features based on either visual, verbal or published evidence, are for guidance only and no liability can be accepted for their accuracy.

The recommendations should be reviewed in the light of future detailed design proposals.

A draft copy of this report was submitted to the Engineer on 19th November 2001. The final report was issued on _____.

Report by: **Approved by:**

I.T. Hill, B.Sc. (Hons), FGS C.J. Adams, B.Sc., C.Eng, MICE, MIStructE, FGS

C.J. associates

8. LIST OF REFERENCES

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LOGSHEETS

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KEY TO SYMBOLS

CABLE PERCUSSIVE LOG SHEETS

S	Standard penetration test (split spoon)
C	Standard penetration test (cone)
N	Penetration resistance: number of blows- (63.5kg hammer, 0.76m drop) for 300mm penetration
D	Disturbed sample
B	Bulk sample
W	Water sample
U	Undisturbed sample
b	No. of blows to drive U100 using 160kg hammer
X%	Percentage recovery in U100 or SPT
V	Vane test
P	Piston sample

ROTARY LOG SHEETS

OH	Open hole drilling
RR	Rock roller drilling
DTH	"Down the hole" hammer drilling
C	Coring
W	Water sample
D	Disturbed sample
S	Standard penetration test (split spoon)
C	Standard penetration test (cone)

TRIAL PIT LOG SHEETS

D	Disturbed sample
B	Bulk disturbed sample
U38	Undisturbed 38mm dia. sample
U100	Undisturbed 100mm dia. sample
BU	Block undisturbed sample
MP	Mackintosh probe test
HSV	Hand shear vane test
PBT	Plate bearing test
CBR(M)	California bearing ratio mould sample
CBR(P)	California bearing ratio penetrometer method
CBR(S)	California bearing ratio standard plunger method
W	Water sample

All rock and soil legends in accordance with B.S. 5930:1981 "Code of practice for site investigations".

Cable Percussive Borehole Log Sheet

BH No: 1

Site: A487 MACHYNLLETH

Start Date: 04/10/2001

Job Number: M0525

Logged by: IH

Client: Powys County Council

Vertical Scale: 1:50

Rig Type: PILCON 150

Sheet 1 of 2

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Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
									0.30	(0.30)		TOPSOIL	
0.50	B1											Medium dense, brown-grey, clayey sandy, fine to coarse subangular shale GRAVEL.	
1.00	D2	S	2,2	2,2,2,4	N=10								
1.50	B3									(2.30)			
2.00	D4	S	2,2	3,2,3,3	N=11								
2.50	B5								2.60				
3.00	D6	S	4,4	4,3,4,3	N=14							Loose to medium dense, grey-brown, fine to coarse subangular GRAVEL.	
3.50	B7												
4.00	D8	S	1,2	2,3,2,2	N=9					(2.40)			
4.50	B9												
5.00	D10	S	3,4	3,3,5,6	N=17				5.00				
5.50	B11											Medium dense to dense, brown-grey, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
6.00	D12	S	4,4	5,6,5,6	N=22								
7.00	B13												
7.50	D14	S	5,6	5,7,11,11	N=34					(4.60)			
8.50	B15												
9.00	D16	S	3,5	5,7,7,8	N=27								
									9.60				
10.00	B17											Medium dense, becoming very dense, grey, fine to coarse subangular GRAVEL.	
10.50	D18	S	5,4	5,4,4,5	N=18								

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks
05/10/2001	14.00	14.00	1.40	Start of shift

Chiselling		
From (m)	To (m)	Time (hrs)

Casing Record	
Depth (m)	Dia. (mm)
15.00	150

Groundwater Strikes (depths in m. below G.L.)				
Strike	Casing	Water (20mins)	Sealed	Remarks
2.60	1.50	1.40		Struck

General Remarks:

Cable Percussive Borehole Log Sheet

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 150

BH No: **1**
Start Date: 04/10/2001
Logged by: IH
Vertical Scale: 1:50
Sheet 2 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Blow Counts Test Drive	Blow Counts N-value	Pen. (mm) Seat	Pen. (mm) Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
11.50	B19											Medium dense, becoming very dense, grey, fine to coarse subangular GRAVEL.	
12.00	D20	S	5,5	6,7,9,9	N=31								
12.50	B21									(5.90)			
13.50	D22	S	4,8	10,11,12,15	N=48								
14.50	B23												
15.00	D24	S	5,7	11,12,14,16	N>50				15.50			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: 2

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 150

Start Date: 01/10/2001
Logged by: IH
Vertical Scale: 1:50
Sheet 1 of 3

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Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.50	B1								0.50	(0.50)		TOPSOIL	
1.00	D2	S	1,-	-,1,-,1	N=2							Soft, brown, sandy SILT/CLAY.	
1.00	B3									(1.00)			
1.50	B4								1.50				
2.00	U5							78b / 100%				Soft, grey, sandy SILT/CLAY.	
2.45	D6									(1.10)			
2.60	B7								2.60				
3.00	D8	S	1,-	-,-,1,-	N=1							Loose, grey, silty SAND.	
3.50	B9								3.60	(1.00)			
4.00	D10	S	4,5	5,4,5,5	N=19							Medium dense, grey, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
4.50	B11												
5.00	D12	S	2,3	2,3,3,3	N=11								
5.50	B13												
6.00	D14	S	1,3	2,3,3,4	N=12					(4.70)			
7.00	B15												
7.50	D16	S	2,2	2,3,2,3	N=10								
8.50	B17								8.30			Medium dense to dense, brown-grey, fine to coarse subangular to subrounded GRAVE and cobbles, with occasional boulders.	
9.00	D18	S	6,5	5,4,5,5	N=19								
10.00	B19												
10.50	D20	S	4,5	6,6,5,6	N=23								

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
01/10/2001	1.30	13.00	1.90	End of am shift
02/10/2001	13.00	13.00	1.60	Start of shift

Chiselling

From (m)	To (m)	Time (hrs)
8.20	8.50	0.75
9.60	9.90	1.00
11.70	11.80	0.50
21.70	22.60	1.25
23.20	23.60	0.50

Casing Record

Depth (m)	Dia. (mm)
13.00	150
25.00	150
25.50	150

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks
2.60	1.50	2.00		Struck

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **2**

Site: **A487 MACHYNLLETH**

Start Date: 01/10/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale: 1:50

Rig Type: PILCON 150

Sheet 2 of 3

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Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery
11.50	B21							
12.00	D22	S	7,8	7,7,9,7	N=30			
13.00	B23							
13.50	D24	S	2,3	5,7,7,8	N=27			
14.50	B25							
15.00	D26	S	3,4	5,5,7,8	N=25			
16.10	B27							
16.50	D28	S	2,2	3,3,4,5	N=15			
17.60	B29							
18.00	U30							17b / 100%
18.45	D31							
19.00	B32							
19.50	D33	S	2,2	1,2,2,3	N=8			
20.50	B34							
21.00	D35	S	2,2	2,3,3,2	N=10			

Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
	(7.80)		Medium dense to dense, brown-grey, fine to coarse subangular to subrounded GRAVE and cobbles, with occasional boulders.	
16.10	(1.50)		Soft, pale brown-grey, SILT/CLAY.	
17.60	(1.40)		Soft to firm, grey, sandy SILT/CLAY.	
19.00	(2.70)		Loose to medium dense, dark grey, silty SAND.	
21.70			(Continued on next sheet)	

Hole Progress with Time (Depths in m. below G.L.)					Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

Site:	**A487 MACHYNLLETH**	BH No:	**2**
Job Number:	**M0525**	Start Date:	01/10/2001
Client:	Powys County Council	Logged by:	IH
Rig Type:	PILCON 150	Vertical Scale:	1:50
		Sheet 3 of 3	

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Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
22.00	B36											Very dense, grey-brown, fine to coarse subangular GRAVEL, with cobbles and boulders.	
22.50	D37	S	7,11	11,12,12,15	N=50								
23.50	B38												
24.00	D39	S	8,11	14,15,15,17	N>50					(4.35)			
24.50	B40												
25.00	D41	S	9,10	12,14,16,18	N>50								
25.60	D42	C	10,10	13,15,17,20	N>50								
									26.05			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **3**

Site: **A487 MACHYNLLETH**

Start Date: 03/10/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale: 1:50

Rig Type: PILCON 150

Sheet 1 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
										(0.50)		TOPSOIL	
0.50	B1								0.50				
												Soft, brown, silty CLAY.	
1.00	U2							7b / 40%					
1.45	D3									(1.80)			
1.60	B4												
2.00	U5							8b / 100%					
									2.30				
2.45	B6									(0.40)		Soft, grey, slightly sandy SILT/CLAY.	
2.70	B7								2.70				
3.00	D8	S	2,1	2,2,3,3	N=10							Loose to medium dense, brown-grey, fine to coarse subangular GRAVEL.	
3.50	B9												
										(2.30)			
4.00	D10	S	2,1	-,-,-,-	N=0								
4.50	B11												
5.00	D12	S	3,4	5,5,4,5	N=19				5.00				
5.50	B13											Medium dense, becoming very dense, grey-brown, fine to coarse subangular, occasionally subrounded GRAVEL and cobbles, with occasional boulders.	
6.00	D14	S	5,5	5,6,5,6	N=22								
7.00	B15												
7.50	D16	S	9,8	9,8,6,9	N=32								
8.50	B17												
9.00	D18	S	6,7	9,9,8,8	N=34								
10.00	B19												
10.50	D20	S	5,10	11,12,15,11	N=49								
										(11.50)			

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
03/10/2001	14.50	14.50	3.30	End of shift
04/10/2001	14.50	14.50	1.60	Start of shift

Chiselling

From (m)	To (m)	Time (hrs)
6.80	7.10	0.50
10.00	10.10	0.25
14.20	14.50	0.75

Casing Record

Depth (m)	Dia. (mm)
14.50	150
16.00	150

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks
2.60	1.50	1.60		Struck

General Remarks:

Cable Percussive Borehole Log Sheet

Site:	A487 MACHYNLLETH	BH No:	3
Job Number:	M0525	Start Date:	03/10/2001
Client:	Powys County Council	Logged by:	IH
Rig Type:	PILCON 150	Vertical Scale:	1:50
		Sheet 2 of 2	

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
11.50	B21											Medium dense, becoming very dense, grey-brown, fine to coarse subangular, occasionally subrounded GRAVEL and cobbles, with occasional boulders.	
12.00	D22	S	4,8	10,12,12,15	N=49								
13.00	B23												
13.50	D24	S	4,7	9,10,14,15	N=48								
14.50	B25												
15.00	D26	S	8,7	10,10,10,10	N=40								
15.50	B27												
16.00	D28	S	6,9	11,10,11,13	N=45				16.50			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **4**

Site: **A487 MACHYNLLETH**

Start Date: 19/09/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale: 1:50

Rig Type: PILCON 1TON

Sheet 1 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
									0.10	(0.10)		TOPSOIL	
0.50	D1											Soft to firm, brown, slightly sandy SILT/CLAY.	
1.00	U2							14b / 80%					
1.45	D3									(2.40)			
1.45	1.604												
2.00	1.605	S	1,-	-,-,-,-	N=0								
2.00	W9												
2.60	1.606								2.50			Soft, grey, sandy SILT/CLAY.	
3.00	U7							32b / 100%		(0.80)			
3.45	D8								3.30			Loose, brown-grey, sandy, fine to coarse subangular GRAVEL.	
3.70	D10									(0.70)			
4.00	D11	C	3,2	2,2,1,3	N=8				4.00			Medium dense, becoming very dense, grey-brown fine to coarse subangular, occasionally subrounded, GRAVEL and cobbles, with occasional boulders - quartz cobbles encountered at 13.50m - 13.80m.	
4.70	D12												
5.00	D13	C	3,5	5,5,5,6	N=21								
5.80	D14												
6.50	D15	C	5,7	9,12,8,7	N=36								
7.50	D16												
8.00	D17	C	4,9	9,4,4,4	N=21								
9.00	D18												
9.50	D19	C	3,4	5,8,8,8	N=29					(11.95)			
10.50	D20												

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks

Chiselling

From (m)	To (m)	Time (hrs)
13.50	13.70	1.00

Casing Record

Depth (m)	Dia. (mm)
14.00	150
15.50	150

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks
3.00	3.00	2.00		Struck

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: 4

Site: **A487 MACHYNLLETH**

Start Date: 19/09/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale: 1:50

Rig Type: PILCON 1TON

Sheet 2 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
11.00	D21	C	6,7	10,8,8,8	N=34							Medium dense, becoming very dense, grey-brown fine to coarse subangular, occasionally subrounded, GRAVEL and cobbles, with occasional boulders - quartz cobbles encountered at 13.50m - 13.80m.	
12.00	D22												
12.50	D23	C	5,7	7,8,8,10	N=33								
13.50	D24												
13.80	D25												
14.00	D26	C	9,10	12,12,13,15	N>50								
15.00	D27												
15.50	D28	C	7,10	10,12,14,15	N>50				15.95			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks

Chiselling		
From (m)	To (m)	Time (hrs)

Casing Record	
Depth (m)	Dia. (mm)

Groundwater Strikes (depths in m. below G.L.)				
Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 1TON

BH No: **5**
Start Date: 04/10/2001
Logged by: IH
Vertical Scale: 1:50
Sheet 1 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Blow Counts Test Drive	Blow Counts N-value	Pen. (mm) Seat	Pen. (mm) Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
									0.10	(0.10)		TOPSOIL	
0.50	D1											Soft to firm, brown-grey, slightly sandy SILT/CLAY.	
										(1.30)			
1.00	U2							21b / 80%					
1.45	D3								1.40				
1.60	D4											Medium dense, becoming very dense, brown-grey, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
1.70	W5												
2.00	D6	C	4,5	3,4,4,4	N=15								
2.60	D7												
3.00	D8	C	3,4	4,4,4,4	N=16								
3.50	B9												
4.00	D10	C	4,5	9,9,8,8	N=34								
4.60	D11												
5.00	D12	C	5,6	9,9,9,9	N=36								
6.00	D13												
6.50	D14	C	8,8	9,9,9,10	N=37								
7.50	D15												
8.00	D16	C	7,9	9,10,11,10	N=40								
										(14.55)			
9.00	D17												
9.50	D18	C	7,8	9,11,12,12	N=44								
10.50	D19												

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks
							14.00	150	1.80	1.80	1.70		Struck
							15.50	150					

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **5**

Site: **A487 MACHYNLLETH**

Start Date: 04/10/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale: 1:50

Rig Type: PILCON 1TON

Sheet 2 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
11.00	D20	C	10,11	11,12,12,13	N=48							Medium dense, becoming very dense, brown-grey, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
12.00	D21												
12.50	D22	C	9,11	12,10,12,12	N=46								
13.50	D23												
14.00	D24	C	10,10	12,12,13,14	N>50								
15.00	D25												
15.50	D26	C	11,11	11,13,13,15	N>50				15.95			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks

Chiselling		
From (m)	To (m)	Time (hrs)

Casing Record	
Depth (m)	Dia. (mm)

Groundwater Strikes (depths in m. below G.L.)				
Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: 6

Site: A487 MACHYNLLETH
Job Number: M0525
Client: Powys County Council
Rig Type: PILCON 1TON

Start Date: 02/10/2001
Logged by: IH
Vertical Scale: 1:50
Sheet 1 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
									0.10	(0.10)		TOPSOIL	
0.50	D1											Soft to firm, brown-grey, slightly sandy SILT/CLAY, with occasional fine to coarse subangular shale gravel.	
1.00	U2							21b / 80%		(1.50)			
1.45	D3												
1.60	D4								1.60				
1.80	W6											Medium dense, becoming very dense, grey-brown, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
2.00	D5	S	2,5	8,9,7,7	N=31								
2.60	D7												
3.00	D8	C	4,6	6,6,6,6	N=24								
3.60	D9												
4.00	D10	C	3,5	4,3,6,6	N=19								
4.60	D11												
5.00	D12	C	4,9	8,6,6,7	N=27								
5.70	B13												
6.50	D14	C	3,3	6,6,6,6	N=24								
7.30	D15												
8.00	D16	C	6,6	6,8,8,8	N=30								
										(14.35)			
9.00	D17												
9.50	D18	C	3,4	6,7,8,10	N=31								
10.50	D19												

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks
							14.00	150	2.00	2.00	1.80		Struck
							15.50	150					

General Remarks:

Cable Percussive Borehole Log Sheet

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 1TON

BH No: **6**
Start Date: 02/10/2001
Logged by: IH
Vertical Scale: 1:50
Sheet 2 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
11.00	D20	C	4,6	9,9,9,12	N=39							Medium dense, becoming very dense, grey-brown, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
12.00	D21												
12.50	D22	C	12,12	14,11,9,9	N=43								
13.50	D23												
14.00	D24	C	5,6	12,12,13,15	N>50								
15.00	D25												
15.50	D26	C	7,9	10,10,14,17	N>50				15.95			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **7**

Site: **A487 MACHYNLLETH**

Start Date: 03/10/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale: 1:50

Rig Type: PILCON 1TON

Sheet 1 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
									0.10	(0.10)		TOPSOIL	
0.50	D1											Soft to firm, brown-grey, slightly sandy SILT/CLAY.	
1.00	U2							20b / 65%		(1.90)			
1.45	D3												
1.60	D4												
1.80	W7												
2.00	D5	S	5,5	5,6,6,6	N=23				2.00				
2.60	D6											Medium dense, becoming very dense, grey-brown, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
3.00	D8	C	3,4	5,6,6,6	N=23								
3.60	D9												
4.00	D10	C	2,1	1,2,3,4	N=10								
4.50	D11												
5.00	D12	C	3,3	5,5,7,7	N=24								
6.00	D13												
6.50	D14	C	5,7	9,9,9,10	N=37								
7.50	D15												
8.00	D16	C	6,10	12,12,13,14	N>50								
9.00	D17									(13.95)			
9.50	D18	C	7,9	9,8,9,10	N=36								
10.50	D19												

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks

Chiselling

From (m)	To (m)	Time (hrs)
7.70	8.00	1.00

Casing Record

Depth (m)	Dia. (mm)
13.00	150
15.50	150

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks
2.00	2.00	1.80		Struck

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **7**

Site: **A487 MACHYNLLETH**

Start Date: 03/10/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale: 1:50

Rig Type: PILCON 1TON

Sheet 2 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
11.00	D20	C	9,11	10,11,11,12	N=44							Medium dense, becoming very dense, grey-brown, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
12.00	D21												
12.50	D22	C	4,7	10,10,11,11	N=42								
13.50	D23												
14.00	D24	C	10,11	11,12,13,15	N>50								
15.00	D25												
15.50	D26	C	9,11	13,15,14,15	N>50								
									15.95			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **8**

Site: **A487 MACHYNLLETH**

Start Date: 26/09/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale 1:52

Rig Type: PILCON 150

Total BH Depth: 27.00m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
										(0.50)		MADE GROUND (Driller records - grey mudstone).	
0.50	B1								0.50				
												Soft to firm, brown-grey, slightly sandy silty CLAY.	
1.00	U2							22b / 60%		(1.00)			
1.45	D3								1.50				
1.45	B26												
1.60	B4											Medium dense to dense, grey-brown, slightly clayey, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
2.00	D5	S	3,3	5,5,4,5	N=19								
2.50	B6												
3.00	D7	S	3,4	4,5,5,6	N=20								
3.50	B8												
4.00	D9	S	7,9	11,8,7,7	N=33								
4.50	B10												
5.00	D11	S	5,5	6,7,6,8	N=27								
5.50	B12									(8.20)			
6.00	D13	S	3,3	3,3,4,5	N=15								
6.00	B14												
7.00	B15												
7.50	D16	S	7,8	10,10,10,12	N=42								
8.50	B17												
9.00	D18	S	3,4	4,5,5,5	N=19								
									9.70	(0.10)			
									9.80				
												(Continued on next sheet)	

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
26/09/2001	5.50	5.50	3.30	End of am shift
27/09/2001	5.50	5.50	2.30	Start of shift
27/09/2001	19.00	19.00	4.00	End of shift
28/09/2001	19.00	19.00	2.30	Start of shift

Chiselling

From (m)	To (m)	Time (hrs)
3.70	3.90	0.50
7.00	7.30	0.75
10.20	10.40	0.50
13.60	13.70	1.00
23.70	24.00	1.00

Casing Record

Depth (m)	Dia. (mm)
5.50	150
19.00	150
23.70	150

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks: Water added to assist drilling at 2.00m.

Cable Percussive Borehole Log Sheet

BH No: 8

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 150

Start Date: 26/09/2001
Logged by: IH
Vertical Scale 1:52
Total BH Depth: 27.00m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery
10.00	B19							
10.50	D20	S	2,4	5,6,6,7	N=24			
11.50	B21							
12.00	D22	S	5,5	7,7,8,8	N=30			
13.00	B23							
13.50	D24	C	12,-	50,-,-,-	N>50		25	
13.50	B25							
14.50	D26							
15.00	B27	S	14,12	9,8,7,6	N=30			
16.00	D28							
16.50	B29	C	3,4	4,3,4,5	N=16			
16.50	B30							
18.00	B31							
18.50	D32	C	2,3	3,2,3,3	N=11			
18.50	B33							

Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
			Cont: (9.70-9.80) - Soft, grey, sandy SILT/CLAY.	
	(6.20)		(9.80-16.00) Medium dense, brown-grey, slightly clayey fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
16.00				
	(2.00)		Medium dense, grey, fine to coarse subangular GRAVEL.	
18.00				
			Medium dense, grey-brown silty SAND.	
			(Continued on next sheet)	

Hole Progress with Time (Depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks

Chiselling		
From (m)	To (m)	Time (hrs)

Casing Record	
Depth (m)	Dia. (mm)

Groundwater Strikes (depths in m. below G.L.)				
Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks: Water added to assist drilling at 2.00m.

Cable Percussive Borehole Log Sheet

BH No: 8

Site: A487 MACHYNLLETH
Job Number: M0525
Client: Powys County Council
Rig Type: PILCON 150

Start Date: 26/09/2001
Logged by: IH
Vertical Scale 1:52
Total BH Depth: 27.00m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
20.00	B34												
20.50	D35	S	3,5	5,7,8,8	N=28							Medium dense, grey-brown silty SAND.	
										(5.70)			
21.50	B36												
22.00	D37	S	2,4	6,7,9,8	N=30								
23.00	B38												
23.50	D39	S	3,14	50,25,-,-	N>50		150						
23.70	B40								23.70				
24.00	D41	C	50,-	15,-,-,-	N>50	75	75			(0.45)		Grey SILTSTONE, moderately strong to strong.	
									24.15			BH CONTINUED BY ROTARY DRILLING	

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Rotary Borehole Log Sheet

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: TERRAMEC 400

BH No: **8**
Start Date: 01/10/2001
Logged by: IH
Vertical Scale 1:52
Final BH Depth: 27.00m

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
										See Cable Percussive Sheet	
			24.00				24.00				
			26.00	5	5	2		(3.00)		Grey, slightly weathered SILTSTONE, moderately strong to strong, with two sets of approximately perpendicular, extremely close to medium spaced discontinuities, dipping at approx. 45°	
			27.00	10	10	4	27.00			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
01/10/2001	0.00	0.00	1.02	Seepage throughout
01/10/2001	24.00	24.00	1.02	Start of shift
01/10/2001	27.00	24.00		

Flush

From (m)	To (m)	Type	Returns
0.00	0.00	Air	Good

Casing Record

Depth (m)	Dia. (mm)
24.00	115

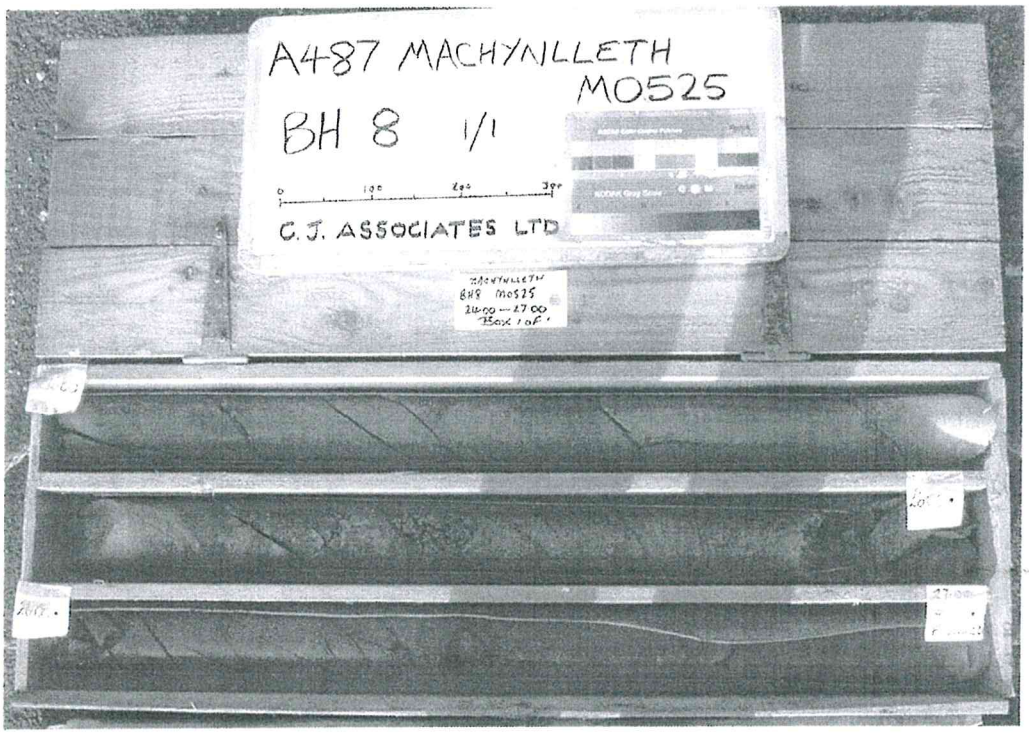
Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks

Core bit type:
Core barrel:
General Remarks:

C.J. associates

Borehole 8



Cable Percussive Borehole Log Sheet

BH No: 9

Site:	A487 MACHYNLLETH	Start Date:	27/09/2001
Job Number:	M0525	Logged by:	IH
Client:	Powys County Council	Vertical Scale	1:52
Rig Type:	PILCON 1TON	Total BH Depth:	29.00m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery
0.50	D1							
1.00	U2							32b / 75%
1.45	D3							
1.60	D4							
2.00	D5	S	1,1	1,1,1,1	N=4			
2.60	D6							
2.60	W9							
3.00	U7							16b / 100%
3.45	D8							
3.70	D10							
4.00	D11	C	7,7	5,5,6,7	N=23			
4.60	D12							
5.00	D13	C	6,4	3,3,2,3	N=11			
6.00	B14							
6.50	D15	C	3,5	3,6,4,5	N=18			
7.50	D16							
8.00	D17	C	5,8	8,14,17,20	N>50			
9.10	D18							
9.50	D19	C	5,5	5,4,5,6	N=20			

Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.10	(0.10)		TOPSOIL Soft to firm, brown-grey, slightly sandy silty CLAY, with occasional fine to coarse subangular gravel.	
2.50	(2.40)		Loose, grey, silty SAND, with occasional fine to coarse subangular gravel.	
3.60	(1.10)		Medium dense, becoming very dense, grey-brown, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks

Chiselling

From (m)	To (m)	Time (hrs)
7.80	8.00	1.00
9.20	9.50	1.00
13.60	13.90	1.00
25.20	25.50	1.00
25.80	26.00	1.00

Casing Record

Depth (m)	Dia. (mm)
10.00	150
18.00	150
25.80	150

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **9**

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 1TON

Start Date: 27/09/2001
Logged by: IH
Vertical Scale 1:52
Total BH Depth: 29.00m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
10.50	D20											Medium dense, becoming very dense, grey-brown, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
11.00	D21	C	7,7	9,11,11,12	N=43								
12.00	D22												
12.50	D23	C	5,7	7,10,12,18	N=47								
13.50	D24												
14.00	D25	C	4,5	6,8,14,17	N=45								
										(22.20)			
15.00	D26												
15.50	D27	C	7,9	10,10,13,15	N=48								
16.50	D28												
17.00	D29	C	8,8	8,12,12,15	N=47								
18.00	D30												
18.50	D31	C	5,7	7,8,8,10	N=33								
19.50	D32												

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **9**

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 1TON

Start Date: 27/09/2001
Logged by: IH
Vertical Scale 1:52
Total BH Depth: 29.00m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
20.00	D33	C	4,5	8,8,10,12	N=38							Medium dense, becoming very dense, grey-brown, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
21.00	D34												
21.50	D35	C	2,2	3,5,8,10	N=26								
22.50	D36												
23.00	D37	C	8,9	9,11,13,15	N=48								
24.00	D38												
24.50	D39	C	5,9	10,12,12,14	N=48								
25.80	D40								25.80				
26.00	D41	C	25,-	50,-,-,-	N>50	20	10		26.10	(0.30)		Grey SILTSTONE, moderately strong to strong.	
												BH CONTINUED BY ROTARY DRILLING	

Hole Progress with Time (Depths in m. below G.L.)					Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**
Job Number:	**M0525**
Client:	Powys County Council
Rig Type:	TERRAMEC 400

BH No:	**9**
Start Date:	02/10/2001
Logged by:	IH
Vertical Scale	1:52
Final BH Depth:	29.00m

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
										See Cable Percussive Log Sheet	
			26.10				26.10				
				10	0	0		(0.90)		Grey, moderately weathered SHALE, moderately weak to moderately strong, with extremely close spaced discontinuities.	
			27.10				27.00				
				5	4	1		(2.00)		Grey, slightly weathered SILTSTONE, moderately strong to strong, with two sets of approximately perpendicular, extremely close to close spaced discontinuities, dipping at approx 45°.	
			29.00				29.00				
										END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
02/10/2001	0.00	0.00		Seepage throughout

Flush

From (m)	To (m)	Type	Returns
0.00	0.00	Air	Good

Casing Record

Depth (m)	Dia. (mm)
26.10	115

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks

Core bit type: Core barrel:

General Remarks:

C.J. associates

Borehole 9



Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**	BH No:	**10**
Job Number:	**M0525**	Start Date:	20/09/2001
Client:	Powys County Council	Logged by:	IH
Rig Type:	TERRAMEC 400	Vertical Scale	1:53
		Sheet 1 of 1	

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
		Open hole drilling with ODEX from G.L. - 1.00m.	1.00				0.30	(0.30)		MADE GROUND (Tarmac)	
							0.50	(0.20)		MADE GROUND (Hardcore)	
			2.50	2	0	0		(3.20)		Grey, highly weathered SHALE, moderately strong, with extremely close spaced discontinuities.	
			3.10	17	0	0					
			3.40	28	0	0					
			3.90	18	8	0	3.70				
			4.50	15	10	0	4.50	(0.80)		Grey, fresh SILTSTONE, strong, with one set of close to medium spaced discontinuities, dipping at approx. 45°.	
										END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks
20/09/2001	0.00	0.00		Dry

Flush			
From (m)	To (m)	Type	Returns
0.00	0.00	Air	Good

Casing Record	
Depth (m)	Dia. (mm)

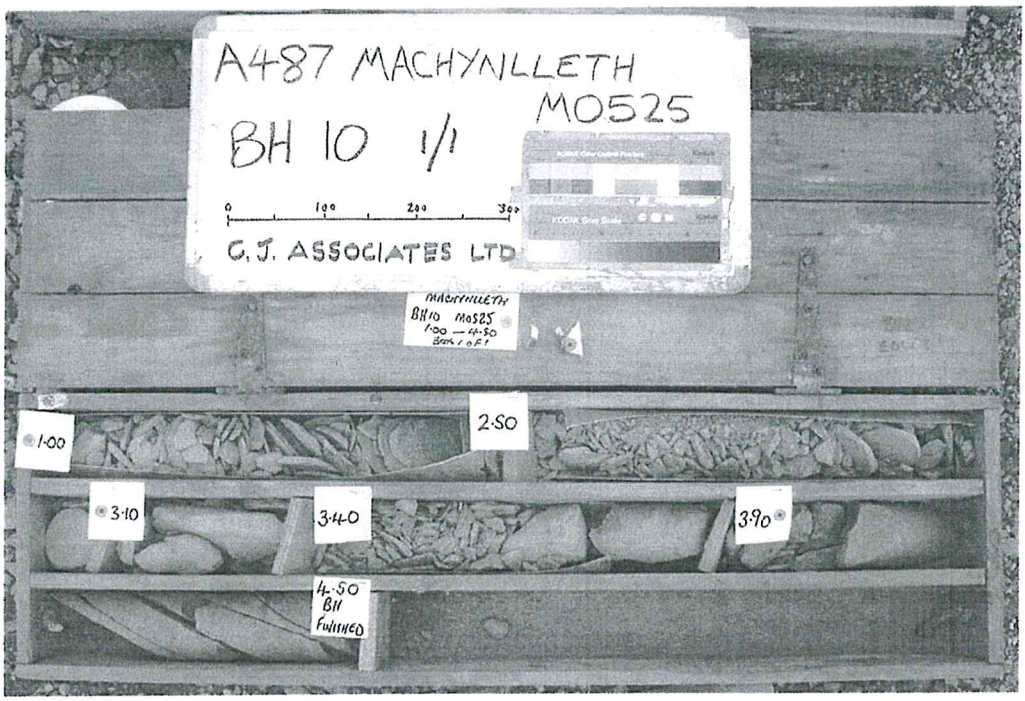
Groundwater Strikes (depths in m. below G.L.)				
Strike	Casing	Water (20mins)	Sealed	Remarks

Core bit type: Core barrel:

General Remarks: Sawtooth 412 bit used, with air as flushing medium from 1.00 - 4.50m.

C.J. associates

Borehole 10



Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**
Job Number:	**M0525**
Client:	Powys County Council
Rig Type:	TERRAMEC 400

BH No:	**12**
Start Date:	20/09/2001
Logged by:	IH
Vertical Scale	1:53
Sheet 1 of 1	

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
		Open hole drilling with ODEX from 0.00 - 1.10m.						(0.40)		MADE GROUND (Tarmac)	
							0.40	(0.20)		MADE GROUND (Brown cobbles)	
							0.60	(0.40)		Grey, highly weathered SHALE.	
			1.10				1.00				
			1.50	22	0	0		(0.85)		Grey, slightly weathered SHALE, moderately strong, with extremely close spaced discontinuities.	
			1.85	29	0	0	1.85			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks
20/09/2001	0.00	0.00		Dry

Flush			
From (m)	To (m)	Type	Returns
0.00	0.00	Air	Good

Casing Record	
Depth (m)	Dia. (mm)
1.00	115

Groundwater Strikes (depths in m. below G.L.)				
Strike	Casing	Water (20mins)	Sealed	Remarks

Core bit type: Core barrel:

General Remarks: Sawtooth 412 bit used, with air as flushing medium from 1.10 - 1.85m.

C.J. associates

Borehole 12



Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**	BH No:	**13**
Job Number:	**M0525**	Start Date:	20/09/2001
Client:	Powys County Council	Logged by:	IH
Rig Type:	TERRAMEC 400	Vertical Scale	1:53
		Sheet 1 of 1	

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
		Open hole drilling with ODEX from 0.00 - 0.70m.	0.70	100	0	0	0.30	(0.30)		MADE GROUND (Tarmac)	
			1.50	14	11	0				Grey, slightly weathered, becoming fresh SILTSTONE, moderately strong to strong, with two sets of approximately perpendicular, extremely close to close spaced discontinuities dipping at approx. 45°.	
			2.45	11	6	0		(4.00)			
			3.80	1	0	0					
			4.30	18	4	0	4.30			END OF BOREHOLE	

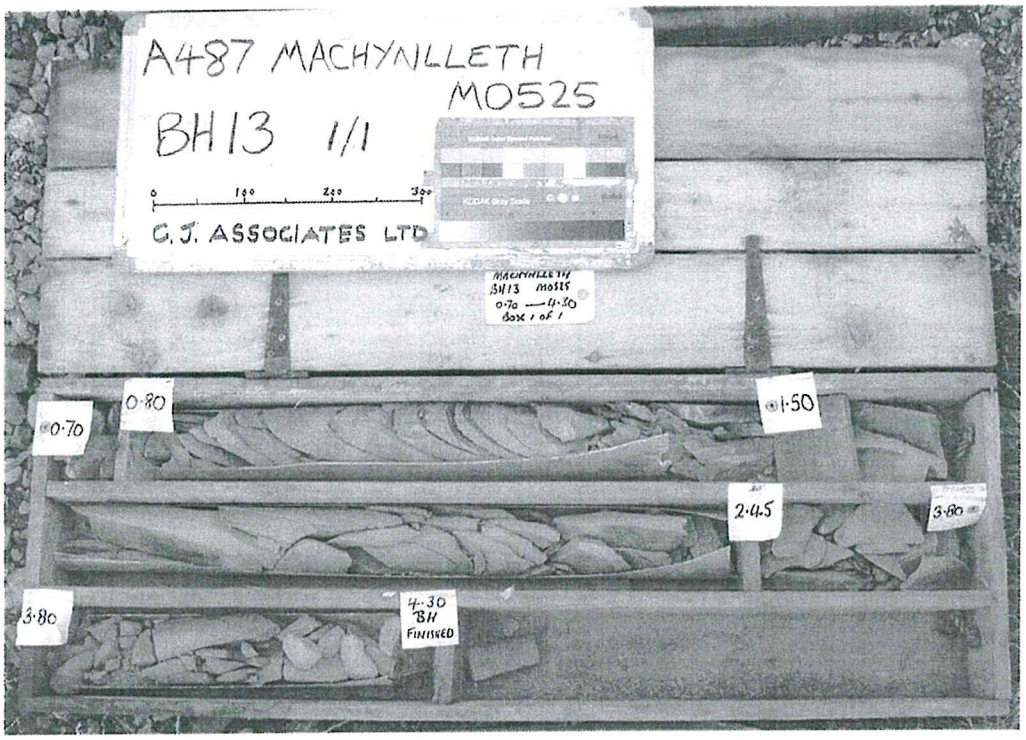
Hole Progress with Time (Depths in m. below G.L.)					Flush				Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Type	Returns	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks
20/09/2001	0.00	0.00		Dry	0.00	0.00	Air	Good							

Core bit type: Core barrel:

General Remarks: Sawtooth 412 bit used with air as flushing medium from 0.70 - 4.30m.

C.J. associates

Borehole 13



Cable Percussive Borehole Log Sheet

BH No: **14**

Site: **A487 MACHYNLLETH**

Start Date: 17/09/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale: 1:50

Rig Type: PILCON 1TON

Sheet 1 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
									0.10	(0.10)		TOPSOIL	
0.50	D1											Soft to firm, brown-grey-green mottled, slightly sandy SILT/CLAY.	
1.00	U2							22b / 65%		(1.70)			
1.45	D3												
1.70	W9												
1.80	D4								1.80				
2.00	D5	S	1,-	-,-,1,-	N=1							Very soft, grey, sandy SILT/CLAY.	
2.70	D6									(1.50)			
3.00	U7							32b / 100%					
3.45	D8								3.30				
3.50	B10											Medium dense, grey-brown, sandy fine GRAVEL.	
4.00	D11	S	4,5	6,6,5,5	N=22					(1.20)			
4.60	D12								4.50				
5.00	D13	S	8,7	5,6,5,5	N=21							Medium dense becoming very dense, grey-brown, fine to coarse subangular, occasionally subrounded, GRAVEL and cobbles, with occasional boulders.	
5.60	D14												
6.00	D15	C	8,12	12,10,10,12	N=44								
6.70	D16												
7.00	D17	C	3,5	6,6,6,7	N=25								
7.60	D18												
8.00	D19	C	5,5	6,6,6,10	N=28								
8.70	D20												
9.00	D21	C	7,8	8,8,7,6	N=29								
9.70	D22												
10.00	D23	C	8,10	8,8,7,7	N=30								
10.60	D24									(11.95)			

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks
								11.00	150	3.00	3.00	1.70		Struck
								16.00	150					

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **14**

Site: **A487 MACHYNLLETH**

Start Date: 17/09/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale: 1:50

Rig Type: PILCON 1TON

Sheet 2 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
11.00	D25	C	7,7	8,8,9,9	N=34							Medium dense becoming very dense, grey-brown, fine to coarse subangular, occasionally subrounded, GRAVEL and cobbles, with occasional boulders.	
11.60	D26												
12.00	D27	C	6,9	9,9,10,10	N=38								
12.60	D28												
13.00	D29	C	7,8	8,10,10,10	N=38								
13.60	D30												
14.00	D31	C	7,9	9,9,10,10	N=38								
14.80	D32												
15.00	D33	C	8,10	10,12,14,17	N>50								
15.60	D34												
16.00	D35	C	7,9	10,15,15,15	N>50				16.45			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **15**

Site: **A487 MACHYNLLETH**

Start Date: 18/09/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale: 1:50

Rig Type: PILCON 1TON

Sheet 1 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery
0.50	D1							
1.00	U2							20b / 50%
1.45	D3							
1.60	D4							
2.00	D5	S	1,-	-,1,2,4	N=7			
2.00	W8							
2.60	D6							
3.00	D7	C	6,8	8,8,9,10	N=35			
3.60	D9							
4.00	D10	C	6,7	7,7,7,7	N=28			
4.60	D11							
5.00	D12	C	4,4	3,3,3,2	N=11			
5.70	D13							
6.00	D14	C	1,1	1,3,2,2	N=8			
6.70	D15							
7.00	D16	C	5,5	6,5,5,5	N=21			
7.70	D17							
8.00	D18	C	6,5	5,5,5,5	N=20			
8.60	D19							
9.00	D20	C	5,5	6,6,6,5	N=23			
9.50	D21							
10.00	D22	C	6,7	7,7,7,6	N=27			
10.60	D23							

Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.10	(0.10)		TOPSOIL Soft to firm, brown, sandy SILT/CLAY.	
2.30	(2.20)		Medium dense to dense, brown-grey, sandy fine to coarse subangular GRAVEL.	
4.80	(2.50)		Medium dense becoming very dense, grey-brown, fine to coarse subangular, occasionally subrounded, GRAVEL and cobbles, with occasional boulders.	
	(11.65)		(Continued on next sheet)	

Hole Progress with Time (Depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks

Chiselling		
From (m)	To (m)	Time (hrs)

Casing Record	
Depth (m)	Dia. (mm)
13.00	150
16.00	150

Groundwater Strikes (depths in m. below G.L.)				
Strike	Casing	Water (20mins)	Sealed	Remarks
3.00	3.00	2.00		Struck

General Remarks:

Cable Percussive Borehole Log Sheet

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 1TON

BH No: **15**
Start Date: 18/09/2001
Logged by: IH
Vertical Scale: 1:50
Sheet 2 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery
11.00	D24	C	8,8	8,8,8,8	N=32			
11.60	D25							
12.00	D26	C	7,7	7,8,8,9	N=32			
12.70	D27							
13.00	D28	C	3,6	9,10,12,12	N=43			
13.60	D29							
14.00	D30	C	5,8	10,10,12,12	N=44			
14.50	D31							
15.00	D32	C	10,11	11,13,13,15	N>50			
15.70	D33							
16.00	D34	C	9,10	13,13,14,14	N>50			

Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
			Medium dense becoming very dense, grey-brown, fine to coarse subangular, occasionally subrounded, GRAVEL and cobbles, with occasional boulders.	
16.45			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks

Chiselling		
From (m)	To (m)	Time (hrs)

Casing Record	
Depth (m)	Dia. (mm)

Groundwater Strikes (depths in m. below G.L.)				
Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **16**

Site: **A487 MACHYNLLETH**

Start Date: 25/09/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale: 1:50

Rig Type: PILCON 1TON

Sheet 1 of 2

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
									0.10	(0.10)		TOPSOIL	
0.50	D1											Soft to firm, brown, sandy SILT/CLAY, with some fine to coarse subangular gravel.	
1.00	U2							33b / 1005					
1.45	D3									(2.80)			
1.60	D4												
2.00	D5	S	6,8	8,8,9,10	N=35								
2.70	D6												
2.70	W10								2.90				
3.00	D7	C	3,6	5,6,6,7	N=24							Medium dense to dense, brown-grey, fine to coarse subangular GRAVEL.	
3.70	D8												
4.00	D9	C	5,6	9,9,9,9	N=36								
4.50	B10												
5.00	D12	C	5,7	7,7,8,9	N=31								
6.00	D13												
6.50	D14	C	5,7	9,8,4,5	N=26								
7.50	D15									(8.90)			
8.00	D16	C	4,7	7,9,12,9	N=37								
9.00	D17												
9.50	D18	C	4,4	5,5,7,7	N=24								
10.50	D19												

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks

Chiselling

From (m)	To (m)	Time (hrs)
14.80	15.20	1.00

Casing Record

Depth (m)	Dia. (mm)
2.00	150
15.50	150
20.00	150

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks
3.50	3.50	2.70		Struck

General Remarks:

Cable Percussive Borehole Log Sheet

Site:	A487 MACHYNLLETH	BH No:	16
Job Number:	M0525	Start Date:	25/09/2001
Client:	Powys County Council	Logged by:	IH
Rig Type:	PILCON 1TON	Vertical Scale:	1:50
		Sheet 2 of 2	

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
11.00	D20	C	5,7	7,13,12,10	N=42							Medium dense to dense, brown-grey, fine to coarse subangular GRAVEL.	
11.80	D21								11.80	(0.30)			
									12.10			Firm, brown-grey, mottled silty CLAY.	
12.30	D22											Very dense, grey-brown, occasionally clayey, fine to coarse subangular, occasionally subrounded GRAVEL and cobbles, with occasional boulders.	
12.50	D23	C	6,10	12,14,15,17	N>50								
13.50	D24												
14.00	D25	C	15,14	15,14,14,14	N>50								
15.00	D26												
15.50	D27	C	6,10	12,15,15,17	N>50					(8.35)			
16.50	D28												
17.00	D29	C	9,13	15,17,20,22	N>50								
18.00	D30												
18.50	D31	C	10,12	14,17,20,21	N>50								
19.50	D32												
20.00	D33	C	10,10	12,16,20,26	N>50				20.45			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: 17

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 1TON

Start Date: 21/09/2001
Logged by: IH
Vertical Scale 1:52
Total BH Depth: 25.90m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.40	D1								0.50	(0.50)		TOPSOIL	
0.60	D2											Soft to firm, brown-grey, sandy SILT/CLAY, with some fine to coarse subangular gravel.	
1.00	U3							30b / 100%					
1.45	D4												
1.60	D5								2.50	(2.00)			
2.00	D6	S	4,3	1,1,1,1	N=4								
2.70	D7											Loose, grey, silty SAND, with some fine to coarse subangular gravel.	
2.70	W9									(0.50)			
3.00	D8	S	5,7	5,5,5,5	N=20				3.00				
3.50	D10											Medium dense becoming very dense, grey-brown, fine to coarse subangular, occasionally subrounded, GRAVEL and cobbles.	
4.00	D11	C	4,5	5,6,6,7	N=24								
4.70	D12												
5.00	D13	C	4,6	10,10,11,11	N=42								
6.00	D14												
6.50	D15	C	4,7	7,6,5,5	N=23								
7.50	D16												
8.00	D17	C	6,4	6,7,7,7	N=27								
9.00	D18												
9.50	D19	C	12,12	8,9,9,9	N=35								

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks

Chiselling

From (m)	To (m)	Time (hrs)
5.70	6.00	1.00
12.20	12.50	1.00
19.70	20.00	1.00
20.80	21.20	1.00

Casing Record

Depth (m)	Dia. (mm)
4.00	150
12.50	150
21.50	150

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks
3.00	3.00	2.70		Struck

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: 17

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 1TON

Start Date: 21/09/2001
Logged by: IH
Vertical Scale 1:52
Total BH Depth: 25.90m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
10.50	D20											Medium dense becoming very dense, grey-brown, fine to coarse subangular, occasionally subrounded, GRAVEL and cobbles.	
11.00	D21	C	4,5	6,7,6,6	N=25								
12.00	D22												
12.50	D23	C	6,8	8,9,9,9	N=35					(18.70)			
13.50	D24												
14.00	D25	C	6,6	7,9,9,9	N=34								
15.00	D26												
15.50	D27	C	6,8	8,9,10,12	N=39								
16.50	D28												
17.00	D29	C	6,8	12,12,15,18	N>50								
18.00	D30												
18.50	D31	C	5,9	12,16,20,22	N>50								
19.50	D32												

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks

Chiselling		
From (m)	To (m)	Time (hrs)

Casing Record	
Depth (m)	Dia. (mm)

Groundwater Strikes (depths in m. below G.L.)				
Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **17**

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 1TON

Start Date: 21/09/2001
Logged by: IH
Vertical Scale 1:52
Total BH Depth: 25.90m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
20.00	D33	C	8,10	10,12,14,15	N>50							Medium dense becoming very dense, grey-brown, fine to coarse subangular, occasionally subrounded, GRAVEL and cobbles.	
21.00	D34												
21.50	D35	S	8,8	14,14,16,18	N>50				21.70	(0.25)		Grey SILTSTONE, moderately strong.	
									21.95			BH CONTINUED BY ROTARY DRILLING	

Hole Progress with Time (Depths in m. below G.L.)					Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**	BH No:	**17**
Job Number:	**M0525**	Start Date:	25/09/2001
Client:	Powys County Council	Logged by:	IH
Rig Type:	TERRAMEC 400	Vertical Scale	1:52
		Final BH Depth:	25.90m

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value / Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
										See Cable Percussive Log Sheet	
		Open hole drilling with 113mm Rock Roller from 21.50 - 22.00m.					21.50	(0.60)		Grey, coarse GRAVEL.	
		Open hole drilling with 113mm dia Rock Roller from 22.50 - 22.70m.					22.10	(0.90)		Grey, moderately weathered SHALE, moderately weak to moderately strong, with extremely close spaced discontinuities.	
			22.70	9	8	6	23.00			Grey, slightly weathered to fresh SILTSTONE, strong, with subvertical extremely close to close spaced discontinuities.	
			23.80	5	5	3		(2.90)			
			25.90				25.90			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
25/09/2001	0.00	0.00		Seepage throughout

Flush

From (m)	To (m)	Type	Returns
0.00	0.00	Air	Good

Casing Record

Depth (m)	Dia. (mm)
21.50	115
22.50	115

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks

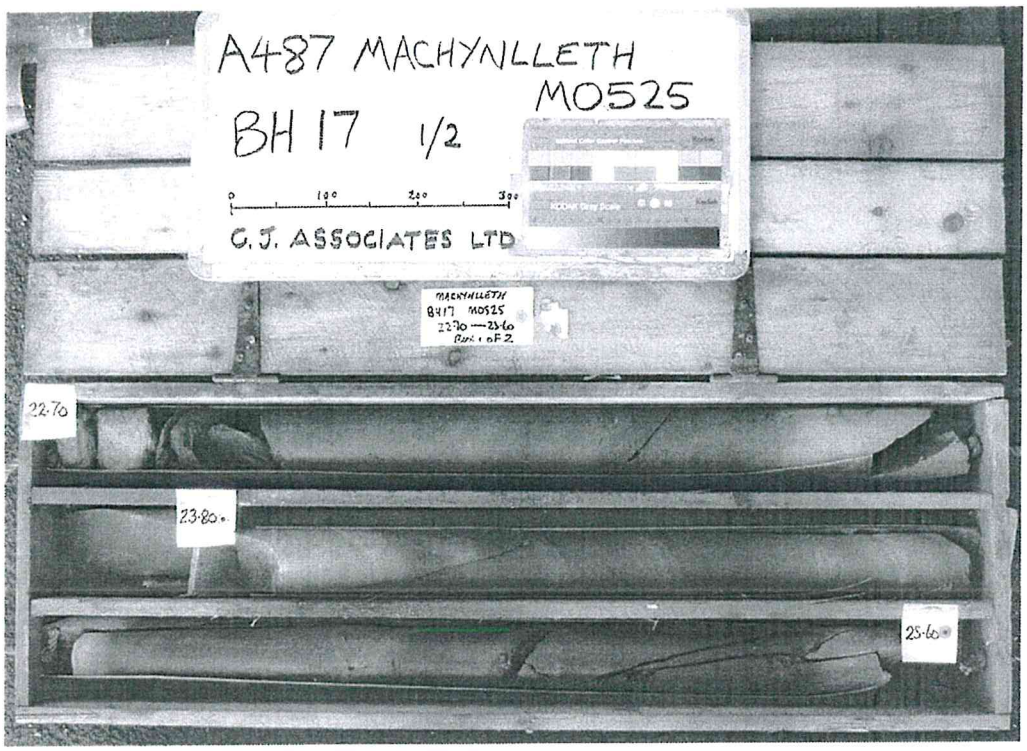
Core bit type:

Core barrel:

General Remarks:

C.J. associates

Borehole 17





Cable Percussive Borehole Log Sheet

BH No: **18**

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 150

Start Date: 24/09/2001
Logged by: IH
Vertical Scale 1:52
Total BH Depth: 22.90m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery
0.50	B1							
1.00	U2							17b / 80%
1.45	D3							
1.60	B4							
2.00	D5	S	5,5	7,8,8,8	N=31			
2.50	B6							
3.00	D7	S	4,5	6,7,7,9	N=29			
3.50	B8							
4.00	D9	S	3,4	7,8,11,9	N=35			
4.50	B10							
5.00	D11	S	4,5	7,7,8,8	N=30			
5.50	B12							
6.00	D13	S	24,17	15,11,11,11	N=48			
7.00	B14							
7.50	D15	S	6,6	7,7,8,9	N=31			
8.50	B16							
9.00	D17	S	5,6	7,8,7,9	N=31			

Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
	(1.50)		Soft to firm, brown, sandy silty CLAY.	
1.50				
	(4.10)		Dense, grey-brown, sandy clayey, fine to coarse subangular GRAVEL.	
5.60				
	(1.00)		Very dense, grey-brown, sandy clayey, fine to coarse subangular GRAVEL and cobbles.	
6.60			Medium dense becoming dense, grey-brown, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
24/09/2001	6.60	6.60	2.40	End of shift
25/09/2001	6.60	6.60	2.30	Start of shift
26/09/2001	13.50	13.50	2.30	Start of shift

Chiselling

From (m)	To (m)	Time (hrs)
5.60	6.00	1.25
6.50	6.60	0.75
6.60	7.00	1.25
12.90	13.10	0.50
19.10	19.30	0.50

Casing Record

Depth (m)	Dia. (mm)
6.45	150
13.50	150
20.40	150

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: 18

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 150

Start Date: 24/09/2001
Logged by: IH
Vertical Scale 1:52
Total BH Depth: 22.90m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
10.00	B18											Medium dense becoming dense, grey-brown, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
10.50	D19	S	3,4	5,4,5,5	N=19								
11.50	B20												
12.00	D21	S	4,4	5,6,5,6	N=22								
13.00	B22												
13.50	D23	S	6,5	5,6,6,7	N=24					(13.80)			
14.50	B24												
15.00	D25	S	3,3	3,5,6,6	N=20								
16.00	B26												
16.50	D27	S	3,3	4,5,7,8	N=24								
17.50	B28												
18.00	D29	S	3,5	5,6,8,10	N=29								
19.00	B30												
19.60	D31	S	6,8	9,10,9,8	N=36								

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **18**

Site: **A487 MACHYNLLETH**
Job Number: **M0525**
Client: Powys County Council
Rig Type: PILCON 150

Start Date: 24/09/2001
Logged by: IH
Vertical Scale 1:52
Total BH Depth: 22.90m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
20.40 20.50 20.50	B32 D33	S	50,-	15,-,-,-	N>50	75	75		20.40 20.50	(0.10)		Medium dense becoming dense, grey-brown, fine to coarse subangular GRAVEL and cobbles, with occasional boulders. Grey SILTSTONE, moderately strong. BH CONTINUED BY ROTARY DRILLING	

Hole Progress with Time (Depths in m. below G.L.)					Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**	BH No:	**18**
Job Number:	**M0525**	Start Date:	26/09/2001
Client:	Powys County Council	Logged by:	IH
Rig Type:	TERRAMEC 400	Vertical Scale	1:52
		Final BH Depth:	22.90m

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
			20.50				20.50			See Cable Percussive Log Sheet	
			21.10	14	0	0		(1.50)		Grey, moderately weathered SHALE, moderately weak to moderately strong, with extremely close spaced discontinuities.	
			22.90	6	3	3	22.00	(0.90)		Grey, slightly weathered to fresh SILTSTONE, strong, with two sets of approximately perpendicular, close to medium spaced discontinuities, dipping at approx. 45°.	
							22.90			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
26/09/2001	22.90	20.50	2.30	End of borehole

Flush

From (m)	To (m)	Type	Returns
0.00	0.00	Air	Good

Casing Record

Depth (m)	Dia. (mm)
20.50	115

Groundwater Strikes (depths in m. below G.L.)

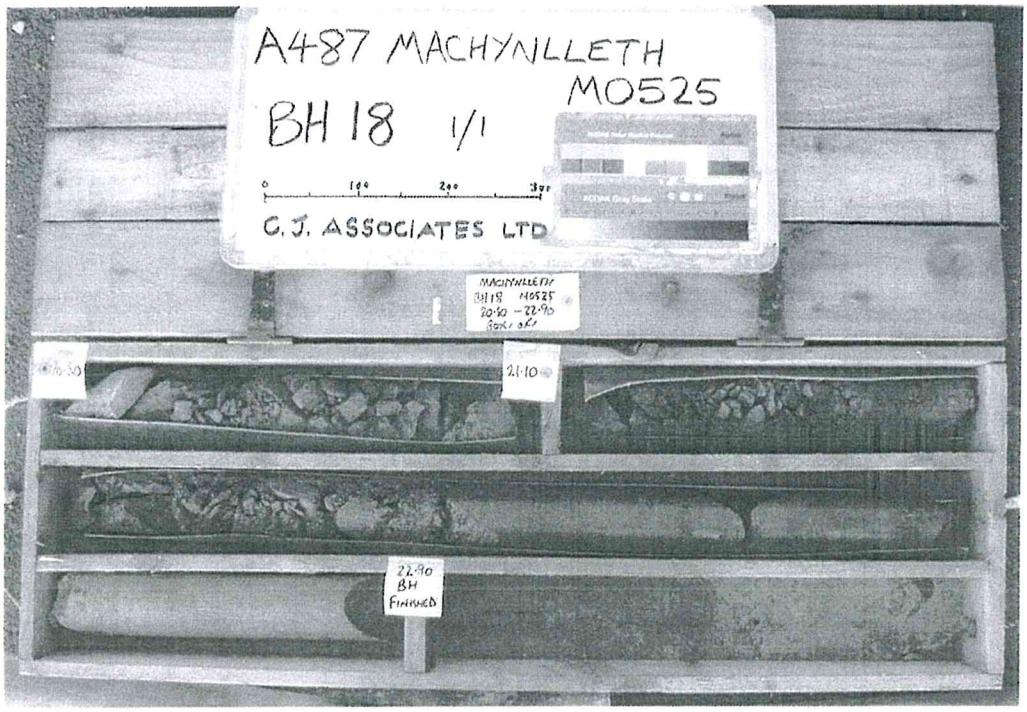
Strike	Casing	Water (20mins)	Sealed	Remarks

Core bit type: Core barrel:

General Remarks:

C.J. associates

Borehole 18



Cable Percussive Borehole Log Sheet

Site:	**A487 MACHYNLLETH**	BH No:	**19**
Job Number:	**M0525**	Start Date:	20/09/2001
Client:	Powys County Council	Logged by:	IH
Rig Type:	PILCON 1TON	Vertical Scale	1:52
		Total BH Depth:	18.80m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's) Test type	Blow Counts Seat.	Test Drive	N-value	Pen. (mm) Seat	Test	U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
									0.10	(0.10)		TOPSOIL	
0.50	D1											Soft to firm, brown silty SAND, with some fine to coarse subangular gravel.	
1.00	D2	S	3,2	2,2,2,2	N=8					(2.00)			
1.60	D3												
2.00	U4							90b / 100%	2.10				
2.45	D5											Medium dense, grey-brown, sandy, fine to coarse subangular GRAVEL.	
2.60	W10												
2.70	D6												
3.00	D7	C	6,4	4,6,2,4	N=16					(1.90)			
3.60	D8												
4.00	D9	C	4,4	5,6,6,6	N=23				4.00				
4.60	D11											Medium dense to very dense, grey-brown, fine to coarse subangular GRAVEL and cobbles, with occasional boulders.	
5.00	D12	C	4,7	6,6,6,6	N=24								
6.00	D13												
6.50	D14	C	15,15	18,18,10,6	N>50					(5.50)			
7.50	B15												
8.00	D16	C	8,10	8,8,8,8	N=32								
9.10	D17												
9.50	D18	C	25,-	50,-,-,-	N>50	40	20		9.50				
9.50	D19												

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks

Chiselling

From (m)	To (m)	Time (hrs)
8.60	8.80	1.00
8.80	9.00	1.00
9.50	9.50	1.00

Casing Record

Depth (m)	Dia. (mm)
9.00	150
9.50	150

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks
4.00	4.00	2.60		Struck

General Remarks:

Cable Percussive Borehole Log Sheet

BH No: **19**

Site: **A487 MACHYNLLETH**

Start Date: 20/09/2001

Job Number: **M0525**

Logged by: IH

Client: Powys County Council

Vertical Scale 1:52

Rig Type: PILCON 1TON

Total BH Depth: 18.80m

C.J. associates

Depth (m)	Sample Ref.	Standard Penetration Tests (SPT's)						U100 Blows / % recovery	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
		Test type	Blow Counts			Pen. (mm)							
			Seat.	Test Drive	N-value	Seat	Test						
												BH CONTINUED BY ROTARY DRILLING	

Hole Progress with Time (Depths in m. below G.L.)				Chiselling			Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Time (hrs)	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks

General Remarks:

Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**
Job Number:	**M0525**
Client:	Powys County Council
Rig Type:	TERRAMEC 400

BH No:	**19**
Start Date:	21/09/2001
Logged by:	IH
Vertical Scale	1:52
Final BH Depth:	18.80m

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
		Open hole drilling with 113mm dia Rock Roller from 10.00 - 15.80m.								Grey, coarse GRAVEL.	
		Open hole drilling withh 113mm dia Rock Roller from 12.00 - 13.10m.						(6.10)			
							15.60			Grey, distinctly weathered SHALE, moderately weak to moderately strong, with extremely close spaced discontinuities.	
			16.00					(0.90)			
				6	2	2	16.50	(0.50)		Grey, fresh SILTSTONE, strong.	
							17.00			Grey, distinctly weathered SHALE, moderately weak to moderately strong, with extremely close spaced discontinuities.	
			17.50					(1.20)			
				8	4	2	18.20			Grey, slightly weathered to fresh SILTSTONE, strong, with two sets of approximately perpendicular, close to medium spaced discontinuities.	
			18.80					(0.60)			
							18.80			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
21/09/2001	12.00	12.00	2.60	End of pm shift
24/09/2001	12.00	12.00	2.60	Start of am shift
25/09/2001	16.00	15.80	2.60	Start of am shift
25/09/2001	18.80	15.80	2.60	End of borehole

Flush

From (m)	To (m)	Type	Returns
0.00	0.00	Air	Good

Casing Record

Depth (m)	Dia. (mm)
12.00	115
15.80	115

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks

Core bit type: Core barrel:

General Remarks: Sawtooth 412 bit used with air as flushing medium from 16.00 - 18.80m.

C.J. associates

Borehole 19



Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**	BH No:	**20**
Job Number:	**M0525**	Start Date:	18/09/2001
Client:	Powys County Council	Logged by:	IH
Rig Type:	TERRAMEC 400	Vertical Scale	1:53
		Sheet 1 of 2	

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value / Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
		Open hole drilling with 115mm dia ODEX from 0.00 - 2.40m.					0.50	(0.50)		Brown, gravelly silty CLAY. (Drillers description)	
										Grey-brown, shale GRAVEL. (Drillers description)	
		Open hole drilling with 113mm dia Rock Roller from 2.40 - 7.00m.						(4.90)			
							5.40			Brown, coarse GRAVEL (Drillers description)	
								(1.40)			
							6.80			Grey, fresh SILTSTONE, strong, with two sets of approximately perpendicular, extremely close to close spaced discontinuities, dipping at approx. 45°.	
			7.00								
				7	6	5					
			8.50								
				8	7	5		(4.40)			
			9.75								

(Continued on next sheet)

Hole Progress with Time (Depths in m. below G.L.)					Flush				Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Type	Returns	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks
19/09/2001	11.20	6.80	6.10	End of borehole	0.00	0.00	Air	Good	2.40 6.80	115 115	6.10	6.10	6.10		Struck

Core bit type: Core barrel:

General Remarks: Sawtooth 412 bit used with air as flushing medium from 7.00 - 11.20m.

Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**	BH No:	**20**
Job Number:	**M0525**	Start Date:	18/09/2001
Client:	Powys County Council	Logged by:	IH
Rig Type:	TERRAMEC 400	Vertical Scale	1:53
		Sheet 2 of 2	

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
			11.20	7	6	5	11.20			Grey, fresh SILTSTONE, strong, with two sets of approximately perpendicular, extremely close to close spaced discontinuities, dipping at approx. 45°.	
										END OF BOREHOLE	

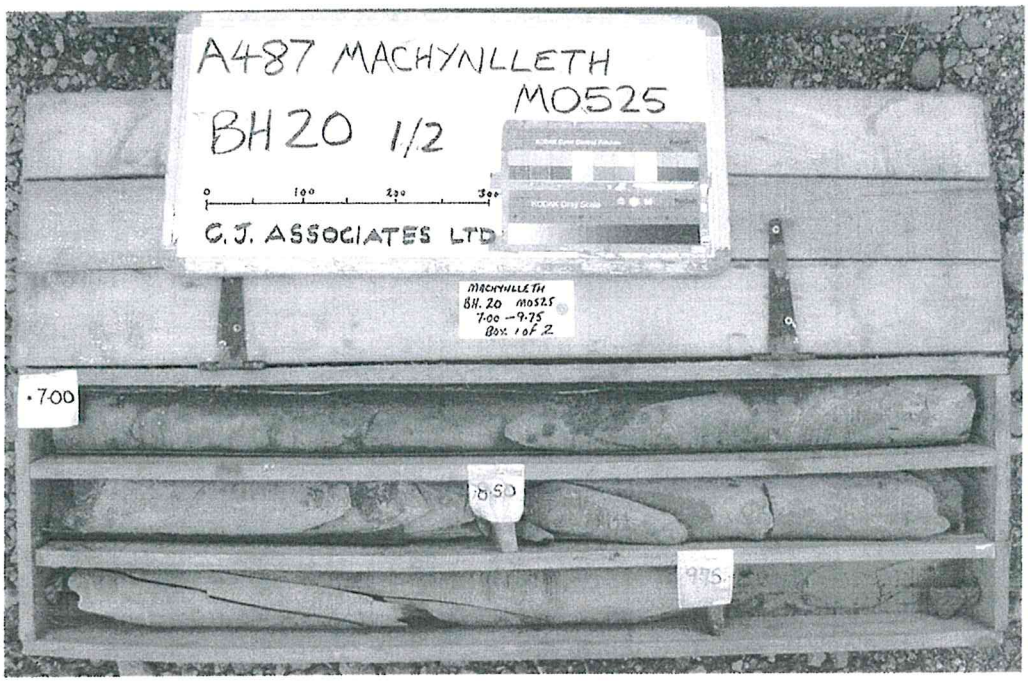
Hole Progress with Time (Depths in m. below G.L.)					Flush				Casing Record		Groundwater Strikes (depths in m. below G.L.)				
Date	Hole depth	Casing depth	Depth to water	Remarks	From (m)	To (m)	Type	Returns	Depth (m)	Dia. (mm)	Strike	Casing	Water (20mins)	Sealed	Remarks
19/09/2001	11.20	6.80	6.10	End of borehole	0.00	0.00	Air	Good	2.40 6.80	115 115	6.10	6.10	6.10		Struck

Core bit type: Core barrel:

General Remarks: Sawtooth 412 bit used with air as flushing medium from 7.00 - 11.20m.

C.J. associates

Borehole 20





Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**
Job Number:	**M0525**
Client:	Powys County Council
Rig Type:	TERRAMEC 400

BH No:	**21**
Start Date:	12/09/2001
Logged by:	IH
Vertical Scale	1:53
Sheet 1 of 2	

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value / Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
		Open hole drilling with 115mm dia ODEX from 0.00 - 3.00m.								MADE GROUND (Grey-brown, clayey gravel - drillers description)	
		Open hole drilling with 113mm dia Rock Roller from 3.00 - 3.50m.									
		Open hole drilling with 115mm dia ODEX from 3.50 - 7.50m.						(8.60)			
		Open hole drilling with 113mm Rock Roller from 7.50 - 10.20m.					8.60			Brown, coarse GRAVEL. (Drillers description)	
								(1.30)			
							9.90				
							10.10	(0.20)		(Continued on next sheet)	

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
14/09/2001	12.65	10.10	8.60	End of am shift
17/09/2001	12.65	10.10	6.80	Start of am shift
17/09/2001	15.50	10.10	6.80	End of borehole

Flush

From (m)	To (m)	Type	Returns
0.00	0.00	Air	Good

Casing Record

Depth (m)	Dia. (mm)
3.00	115
7.50	115
10.10	115

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks
8.60	8.60	0.00		Struck

Core bit type: Core barrel:

General Remarks: Sawtooth 412 bit used with air as flushing medium, from 10.20 - 15.50m.

Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**	BH No:	**21**
Job Number:	**M0525**	Start Date:	12/09/2001
Client:	Powys County Council	Logged by:	IH
Rig Type:	TERRAMEC 400	Vertical Scale	1:53
		Sheet 2 of 2	

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
			10.30	100	0	0				Cont: (9.90-10.10) - COBBLES and boulders. (Drillers description)	
			12.65	4	4	2				(10.10-15.50) Grey, slightly weathered to fresh SILTSTONE, strong, with two sets of approximately perpendicular, extremely close to thinly spaced discontinuities, dipping at approx. 45°.	
			14.05	7	4	4		(5.40)			
			14.85	13	11	4					
			15.50	15	12	8	15.50			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
14/09/2001	12.65	10.10	8.60	End of am shift
17/09/2001	12.65	10.10	6.80	Start of am shift
17/09/2001	15.50	10.10	6.80	End of borehole

Flush

From (m)	To (m)	Type	Returns
0.00	0.00	Air	Good

Casing Record

Depth (m)	Dia. (mm)
3.00	115
7.50	115
10.10	115

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks
8.60	8.60	0.00		Struck

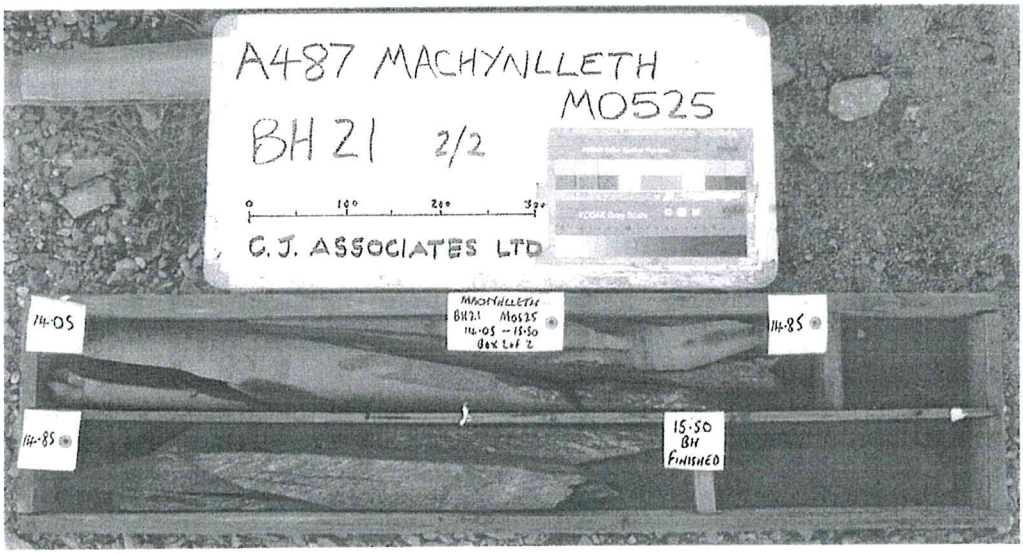
Core bit type: Core barrel:

General Remarks: Sawtooth 412 bit used with air as flushing medium, from 10.20 - 15.50m.

C.J. associates

Borehole 21





Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**
Job Number:	**M0525**
Client:	Powys County Council
Rig Type:	TERRAMEC 400

BH No:	**22**
Start Date:	17/09/2001
Logged by:	IH
Vertical Scale	1:53
Sheet 1 of 2	

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
		Open hole drilling with 115mm dia ODEX from 0.00 - 7.50m.					0.30	(0.30)		TOPSOIL (Drillers description)	
							1.40	(1.10)		Brown, gravelly silty CLAY. (Drillers description)	
								(4.90)		Grey-brown GRAVEL. (Drillers description)	
							6.30	(1.10)		Brown, coarse GRAVEL (Drillers description)	
			7.50				7.40				
			7.95	22	21	0				Grey, slightly weathered to fresh SILTSTONE, strong, with two sets of approximately perpendicular, extremely close to thickly spaced discontinuities, dipping at approx. 45°.	
			8.75	13	11	3					
			9.70	11	9	4		(4.60)			
										(Continued on next sheet)	

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
17/09/2001	7.50	7.50	6.50	End of pm shift
18/09/2001	7.50	7.50	6.50	Start of shift
18/09/2001	12.00	7.50	6.50	End of borehole

Flush

From (m)	To (m)	Type	Returns
0.00	0.00	Air	Good

Casing Record

Depth (m)	Dia. (mm)
7.50	115

Groundwater Strikes (depths in m. below G.L.)

Strike	Casing	Water (20mins)	Sealed	Remarks
6.50	6.50	6.50		Struck

Core bit type: Core barrel:

General Remarks: Sawtooth 412 bit used with air as flushing medium.

Rotary Borehole Log Sheet

Site:	**A487 MACHYNLLETH**	BH No:	**22**
Job Number:	**M0525**	Start Date:	17/09/2001
Client:	Powys County Council	Logged by:	IH
Rig Type:	TERRAMEC 400	Vertical Scale	1:53
		Sheet 2 of 2	

C.J. associates

Depth (m)	Sample / Test	SPT seating / drive blows (seating / drive penetration) N-value / Drilling remarks	Core Recovery Depth (m)	TCR (%)	SCR (%)	RQD (%)	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
			11.00	8	6	3				Grey, slightly weathered to fresh SILTSTONE, strong, with two sets of approximately perpendicular, extremely close to thickly spaced discontinuities, dipping at approx. 45°.	
			12.00	10	10	8	12.00			END OF BOREHOLE	

Hole Progress with Time (Depths in m. below G.L.)

Date	Hole depth	Casing depth	Depth to water	Remarks
17/09/2001	7.50	7.50	6.50	End of pm shift
18/09/2001	7.50	7.50	6.50	Start of shift
18/09/2001	12.00	7.50	6.50	End of borehole

Flush

From (m)	To (m)	Type	Returns
0.00	0.00	Air	Good

Casing Record

Depth (m)	Dia. (mm)
7.50	115

Groundwater Strikes (depths in m. below G.L.)

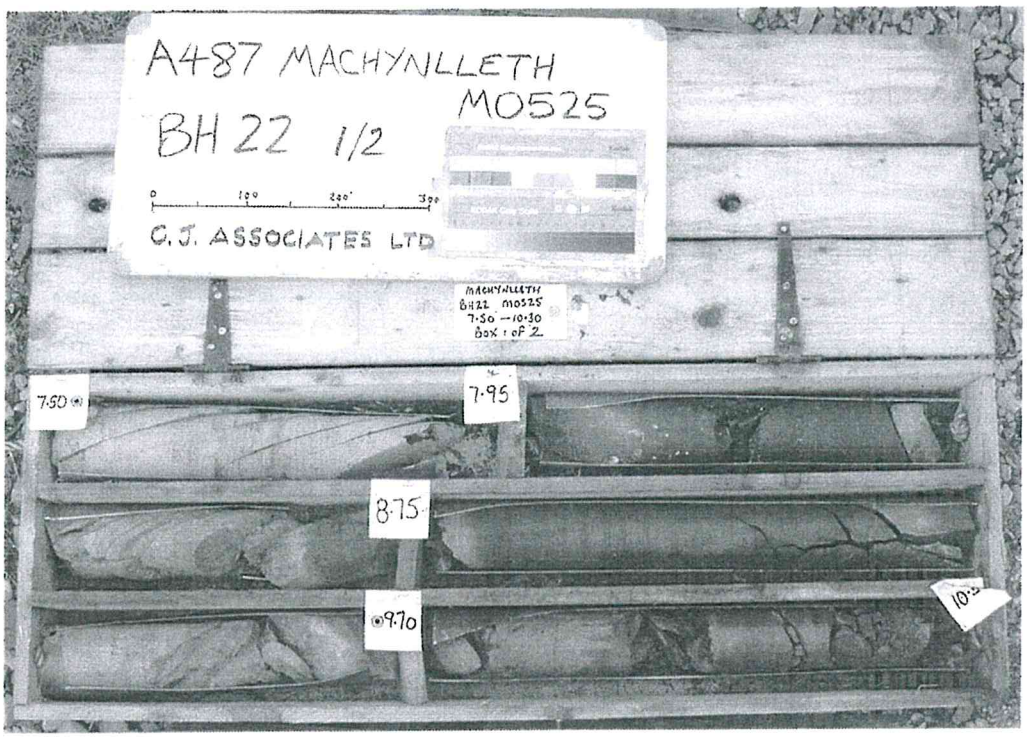
Strike	Casing	Water (20mins)	Sealed	Remarks
6.50	6.50	6.50		Struck

Core bit type: Core barrel:

General Remarks: Sawtooth 412 bit used with air as flushing medium.

C.J. associates

Borehole 22





Trial Pit Log Sheet

TP No 1

Site: A487 MACHYNLLETH

Job Number: M0525

Sheet 1 of 1

Client: Powys County Council

Date: 11/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.00				0.20	(0.20)		Soft to firm, brown-grey silty CLAY, with many roots and rootlets.	
0.50		0.60	CBR = >10%	0.80	(0.60)		Soft to firm, grey silty CLAY, with some fine to coarse subangular, predominantly tabular, shale gravel.	
1.00	D1	1.00		1.90	(1.10)		Medium dense (?) grey, fine to coarse subangular, predominantly tabular, shale GRAVEL and occasional cobbles.	
2.00							Soft, grey silty CLAY, with occasional fine to coarse subangular, predominantly tabular, shale gravel.	
2.50	D2	2.50		3.00	(1.10)		END OF TRIAL PIT	
3.00								
3.50								
4.00								
4.50								
5.00								

Groundwater Observations

Depth to Water (m)	Flow Rate	Remarks
0.80		Seepage

Trial Pit Width (m)

Trial Pit Length (m)

Orientation :

Logged By : IH

Side Stability : Some spalling of pit sides between 0.80 - 1.90m.

General Remarks :

Trial Pit Log Sheet

TP No 2

Site: **A487 MACHYNLLETH**

Job Number: **M0525**

Sheet 1 of 1

Client: Powys County Council

Date: 11/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.00								
					(0.70)		MADE GROUND (Soft, brown-grey silty clay, with many roots and rootlets).	
0.50								
				0.70				
	D1	0.80			(0.20)		MADE GROUND (Soft, grey silty clay, with some brick fragments).	
				0.90				
1.00							Soft, brown silty CLAY.	
	D2	1.20	CBR = 0.5% HSV c = 20 kPa		(0.60)			
1.50				1.50				
							Soft, grey silty CLAY, with occasional fine to coarse subrounded shale gravel and organic fragments.	
2.00								
					(1.50)			
2.50	D3	2.50						
3.00				3.00			END OF TRIAL PIT	
3.50								
4.00								
4.50								
5.00								

Groundwater Observations

Depth to Water (m)	Flow Rate	Remarks
2.20		Seepage

Trial Pit Width (m)

Trial Pit Length (m)

Orientation :

Logged By : IH

Side Stability : Stable

General Remarks :

Trial Pit Log Sheet

TP No 3

Site: **A487 MACHYNLLETH**

Job Number: **M0525**

Sheet 1 of 1

Client: Powys County Council

Date: 11/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.00								
				0.30	(0.30)		Soft, grey silty CLAY, with many roots and rootlets.	
0.50							Soft, brown silty CLAY.	
		0.70	CBR = 1% HSV c = 30 kPa					
					(1.20)			
1.00	D1	1.00						
				1.50			Very soft, brown, slightly sandy SILT.	
2.00								
					(1.50)			
2.50	D2	2.50						
				3.00			END OF TRIAL PIT	
3.50								
4.00								
4.50								
5.00								

Groundwater Observations

Depth to Water (m) | Flow Rate | Remarks

Trial Pit Width (m) | Trial Pit Length (m)

Orientation : | Logged By : IH

Side Stability : Much spalling of pit sides below 1.50m.

General Remarks :

Trial Pit Log Sheet

TP No 4

Site: **A487 MACHYNLLETH**

Job Number: **M0525**

Client: Powys County Council

Machine Type: JCB 3CX

Sheet 1 of 1

Date: 11/09/2001

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.00								
					(0.40)		Soft, grey silty CLAY, with many roots and rootlets and occasional fine to coarse subangular, predominantly tabular, shale gravel.	
				0.40				
0.50							Soft, brown SILT/CLAY.	
		0.80	CBR = 1% HSV c = 24 kPa					
1.00	D1	1.00			(1.20)			
1.50				1.60				
							Medium dense (?) grey, fine to coarse subangular, predominantly tabular, shale GRAVEL and occasional cobbles.	
2.00								
	D2	2.20			(1.40)			
2.50								
3.00				3.00			END OF TRIAL PIT	
3.50								
4.00								
4.50								
5.00								

Groundwater Observations

Depth to Water (m)	Flow Rate	Remarks
2.50		Seepage

Trial Pit Width (m)

Trial Pit Length (m)

Orientation :

Logged By : IH

Side Stability : Much spalling of pit sides below 1.60m.

General Remarks :

Trial Pit Log Sheet

TP No 5

Site: **A487 MACHYNLLETH**

Job Number: **M0525**

Sheet 1 of 1

Client: Powys County Council

Date: 12/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results
0.00			
0.50		0.70	CBR = 1% HSV c = 48 kPa
1.00	D1	1.00	
1.50			
2.00			
2.50	D2	2.20	
3.00			
3.50			
4.00			
4.50			
5.00			

Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.20	(0.20)		Soft, grey-brown silty CLAY, with many roots and rootlets.	
	(1.90)		Soft to firm, brown silty CLAY.	
2.10				
2.40	(0.30)		Medium dense (?) grey silty SAND, with occasional fine to medium shale gravel.	
			END OF TRIAL PIT	

Groundwater Observations

Depth to Water (m) | Flow Rate | Remarks

Trial Pit Width (m) | Trial Pit Length (m)

Orientation :

Logged By : IH

Side Stability : Some spalling of pit sides below 2.10m.

General Remarks :

Trial pit completed at 2.40m on encountering ground water, in order to avoid leaving a soft spot on backfilling, because of cattle in field.

Trial Pit Log Sheet

TP No 6

Site: **A487 MACHYNLLETH**

Job Number: **M0525**

Client: Powys County Council

Machine Type: JCB 3CX

Sheet 1 of 1

Date: 11/09/2001

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.00								
				0.30	(0.30)		Soft to firm, grey-brown silty CLAY, with many roots and rootlets.	
0.50							Soft to firm, becoming soft, brown silty CLAY.	
		0.80	CBR = 1% HSV c = 42 kPa					
1.00	D1	1.00						
					(2.00)			
1.50								
2.00								
				2.30				
	D2	2.40		2.40	(0.10)		Medium dense (?) grey, clayey fine to coarse subangular, predominantly tabular, shale GRAVEL.	
2.50							END OF TRIAL PIT	
3.00								
3.50								
4.00								
4.50								
5.00								

Groundwater Observations

Depth to Water (m)	Flow Rate	Remarks
2.30		Strike

Trial Pit Width (m):

Trial Pit Length (m):

Orientation :

Logged By : IH

Side Stability : Stable

General Remarks :

Trial pit completed at 2.30m, on encountering ground water, in order to avoid leaving a soft spot on backfilling because of cattle in field.

Trial Pit Log Sheet

TP No 7

Site: **A487 MACHYNLLETH**

Job Number: **M0525**

Sheet 1 of 1

Client: Powys County Council

Date: 11/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results
0.00			
0.50		0.70	CBR = 0.5% HSV c = 30 kPa
1.00	D1	1.00	
1.50			
2.00	D2	2.00	
2.50			
3.00			
3.50			
4.00			
4.50			
5.00			

Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
	(0.30)		Soft to firm, grey silty CLAY, with many roots and rootlets.	
0.30			Soft, brown silty CLAY.	
	(1.30)			
1.60			Very soft, grey silty CLAY.	
	(1.10)			
2.70	(0.10)		Medium dense (?) grey, clayey, fine to coarse, subangular predominantly tabular, shale GRAVEL.	
2.80			END OF TRIAL PIT	

Groundwater Observations

Depth to Water (m) | Flow Rate Remarks

Trial Pit Width (m) | Trial Pit Length (m)

Orientation :

Logged By : IH

Side Stability : Stable

General Remarks :

Trial pit completed at 2.80m, on encountering ground water, in order to avoid leaving a soft spot on backfilling because of cattle in field.

Trial Pit Log Sheet

TP No 8

Site: A487 MACHYNLLETH

Job Number: M0525

Client: Powys County Council

Machine Type: JCB 3CX

Sheet 1 of 1

Date: 11/09/2001

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.00								
				0.30	(0.30)		Soft, grey-brown silty CLAY, with many roots and rootlets.	
0.50							Soft, brown SILT/CLAY.	
		0.90	CBR = 1%		(1.20)			
1.00	D1	1.00	HSV c = 40 kPa					
1.50				1.50				
					(0.30)		Medium dense (?) grey, sandy, fine to medium subangular shale GRAVEL.	
	D2	1.80		1.80				
2.00							END OF TRIAL PIT	
2.50								
3.00								
3.50								
4.00								
4.50								
5.00								

Groundwater Observations

Depth to Water (m)	Flow Rate	Remarks
1.70		Strike

Trial Pit Width (m) | Trial Pit Length (m)

Orientation : | Logged By : IH

Side Stability : Some spalling of pit sides below 1.50m.

General Remarks :

Trial pit completed at 1.80m on encountering ground water, in order to avoid leaving a soft spot on backfilling because of cattle in the field.

Trial Pit Log Sheet

TP No 9

Site: A487 MACHYNLLETH

Job Number: M0525

Sheet 1 of 1

Client: Powys County Council

Date: 11/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.00				0.30	(0.30)		Soft, grey silty CLAY, with many roots and rootlets.	
0.50							Soft, brown SILT/CLAY.	
		0.80	CBR = 1% HSV c = 38 kPa					
1.00	D1	1.00		1.60	(1.30)			
1.50							Medium dense (?) grey, SAND and fine subangular shale GRAVEL.	
2.00	D2	2.00		2.10	(0.50)			
2.50							END OF TRIAL PIT	
3.00								
3.50								
4.00								
4.50								
5.00								

Groundwater Observations

Depth to Water (m)	Flow Rate	Remarks
2.00		Strike

Trial Pit Width (m)

Trial Pit Length (m)

Orientation :

Logged By : IH

Side Stability : Some spalling of pit sides below 1.60m.

General Remarks :

Trial pit completed at 2.10m on encountering ground water, in order to avoid leaving a soft spot on backfilling because of cattle in the field.

Trial Pit Log Sheet

TP No 10

Site: **A487 MACHYNLLETH**

Job Number: **M0525**

Sheet 1 of 1

Client: Powys County Council

Date: 12/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.00								
				0.30	(0.30)		Soft to firm, grey-brown silty CLAY, with many roots and rootlets.	
0.50							Firm, brown-grey, slightly sandy silty CLAY.	
		0.80	CBR = 3% HSV c = 58 kPa					
1.00	D1	1.00			(1.60)			
1.50								
				1.90				
2.00	D2	2.00			(0.80)		Medium dense (?) grey, slightly clayey silty SAND.	
2.50								
				2.70				
							END OF TRIAL PIT	
3.00								
3.50								
4.00								
4.50								
5.00								

Groundwater Observations

Depth to Water (m)	Flow Rate Remarks
2.60	Strike

Trial Pit Width (m) | Trial Pit Length (m)

Orientation : | Logged By : IH

Side Stability : Some spalling of pit sides below 1.90m.

General Remarks :

Trial pit completed at 2.70m on encountering ground water, in order to avoid leaving a soft spot on backfilling because of cattle in the field.

Trial Pit Log Sheet

TP No 12

Site: A487 MACHYNLLETH

Job Number: **M0525**

Sheet 1 of 1

Client: Powys County Council

Date: 11/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.00				0.30	(0.30)		Soft to firm, grey silty CLAY, with many roots and rootlets.	
0.50							Soft to firm, becoming very soft, brown SILT/CLAY.	
		0.80	CBR = 1% HSV c = 44 kPa					
1.00	D1	1.00		1.80	(1.50)			
1.50							Medium dense (?) grey, clayey fine to coarse subangular, predominantly tabular, shale GRAVEL.	
2.00	D2	2.00						
2.50					(1.20)			
3.00				3.00			END OF TRIAL PIT	
3.50								
4.00								
4.50								
5.00								

Groundwater Observations

Depth to Water (m)	Flow Rate	Remarks
1.80		Strike

Trial Pit Width (m)

Trial Pit Length (m)

Orientation :

Logged By : IH

Side Stability : Some spalling of pit sides below 1.80m.

General Remarks :

Trial Pit Log Sheet

TP No 13

Site: **A487 MACHYNLLETH**

Job Number: **M0525**

Sheet 1 of 1

Client: Powys County Council

Date: 12/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results
1.00	D1	0.90 1.00	CBR = 0.5% HSV c = 32 kPa
1.50	D2	1.50	

Depth (m)	Thickness (m)	Description of Strata	Reduced Level (m. O.D.)
0.00	(0.00)	Soft, grey silty CLAY, with many roots and rootlets.	
	(1.40)	Soft, brown SILT/CLAY.	
1.40	(0.40)	Medium dense (?) grey SAND, with some fine to medium subangular shale gravel.	
1.80		END OF TRIAL PIT	

Groundwater Observations

Depth to Water (m)	Flow Rate	Remarks
1.40		Strike

Trial Pit Width (m): | Trial Pit Length (m):

Orientation: | Logged By: IH

Side Stability: Some spallin gof pit sides below 1.40m.

General Remarks:

Trial pit completed at 1.80m on encountering ground water, in order to avoid leaving a soft spot on backfilling because of cattle in the field.

Trial Pit Log Sheet

TP No 14

Site: **A487 MACHYNLLETH**

Job Number: **M0525**

Sheet 1 of 1

Client: Powys County Council

Date: 12/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.00								
				0.30	(0.30)		Soft, grey silty CLAY, with many roots and rootlets.	
0.50							Soft, brown SILT/CLAY.	
		0.70	CBR = 0.5% HSV c = 36 kPa					
1.00	D1	1.00			(1.60)			
1.50								
				1.90				
2.00	D2	2.00			(0.30)		Medium dense (?) grey sandy, fine to medium subangular shale GRAVEL.	
				2.20			END OF TRIAL PIT	
2.50								
3.00								
3.50								
4.00								
4.50								
5.00								

Groundwater Observations

Depth to Water (m)	Flow Rate	Remarks
1.90		Strike

Trial Pit Width (m): Trial Pit Length (m):

Orientation: Logged By: IH

Side Stability: Some spalling of pit sides below 1.90m.

General Remarks:

Trial pit completed at 2.20m on encountering ground water, in order to avoid leaving a soft spot on backfilling because of cattle in the field.

Trial Pit Log Sheet

TP No 15

Site: A487 MACHYNLLETH

Job Number: **M0525**

Sheet 1 of 1

Client: Powys County Council

Date: 12/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.00				0.20	(0.20)		MADE GROUND (Soft, grey silty clay, with many roots and rootlets).	
0.50				0.60	(0.40)		MADE GROUND (Medium dense? grey, clayey, subangular shale gravel and cobbles).	
		0.80	CBR = 0.5% HSV c = 30 kPa	1.20	(0.60)		Soft, brown SILT/CLAY.	
1.00	D1	1.00						
1.50							Medium dense (?) grey, sandy, fine to coarse subangular to subrounded shale GRAVEL.	
2.00	D2	2.00			(1.40)			
2.50				2.60			END OF TRIAL PIT	
3.00								
3.50								
4.00								
4.50								
5.00								

Groundwater Observations

Depth to Water (m)	Flow Rate	Remarks
		Dry

Trial Pit Width (m)

Trial Pit Length (m)

Orientation :

Logged By : IH

Side Stability : Much spalling below 1.20m prevented further excavation.

General Remarks :

Trial Pit Log Sheet

TP No 16

Site: A487 MACHYNLLETH

Job Number: M0525

Sheet 1 of 1

Client: Powys County Council

Date: 12/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results
0.00			
0.50			
1.00	D1	0.90 1.00	CBR = 1.5% HSV c = 48 kPa
1.50			
2.00			
2.50	D2	2.50	
3.00			
3.50			
4.00			
4.50			
5.00			

Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
	(0.40)		Soft, grey silty CLAY, with many roots and rootlets.	
0.40				
			Soft to firm, brown SILT/CLAY.	
	(1.20)			
1.60				
			Medium dense (?) grey, sandy, fine to medium subangular shale GRAVEL.	
	(1.40)			
3.00			END OF TRIAL PIT	

Groundwater Observations

Depth to Water (m)	Flow Rate	Remarks
2.90		Strike

Trial Pit Width (m)

Trial Pit Length (m)

Orientation :

Logged By : IH

Side Stability : Much spalling of pit sides below 1.60m.

General Remarks :

Trial Pit Log Sheet

TP No 17

Site: A487 MACHYNLLETH

Job Number: M0525

Sheet 1 of 1

Client: Powys County Council

Date: 11/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results
0.00			
0.50			
1.00	D1	1.00	CBR = >10%
1.50			
2.00	D2	2.00	
2.50			
3.00			
3.50			
4.00			
4.50			
5.00			

Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.30	(0.30)		Soft, brown silty CLAY, with many roots and rootlets and some fine to coarse subangular shale gravel.	
			Medium dense (?) grey-brown, clayey, fine to coarse subrounded to subangular shale GRAVEL and occasional cobbles.	
	(2.10)			
2.40			END OF TRIAL PIT	

Groundwater Observations

Depth to Water (m) | Flow Rate Remarks

Trial Pit Width (m) | Trial Pit Length (m)

Orientation :

Logged By : IH

Side Stability : Stable

General Remarks :

Excavator could not penetrate rock at 2.40m.

Trial Pit Log Sheet

TP No 18

Site: **A487 MACHYNLLETH**

Job Number: **M0525**

Sheet 1 of 1

Client: Powys County Council

Date: 11/09/2001

Machine Type: JCB 3CX

Vertical Scale 1:25

C.J. associates

Depth (m)	Sample Ref.	Test / Sample Depth (m)	Test Results	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. O.D.)
0.00								
					(0.30)		Soft, brown silty CLAY, with many roots and rootlets.	
				0.30				
					(0.20)		Medium dense (?) grey clayey, fine to coarse subangular, predominantly tabular, shale GRAVEL and occasional cobbles.	
0.50		0.50	CBR = >10%	0.50			END OF TRIAL PIT	
1.00								
1.50								
2.00								
2.50								
3.00								
3.50								
4.00								
4.50								
5.00								

Groundwater Observations

Depth to Water (m)	Flow Rate	Remarks
Dry		

Trial Pit Width (m)

Trial Pit Length (m)

Orientation :

Logged By : iH

Side Stability : Stable

General Remarks :

Excavator could not penetrate rock at 0.50m.

C.J.
associates

LABORATORY TEST RESULTS

article Density Test Results

Site A487 Machynlleth.

Client Powys C.C.

Job Number M0525

Lab Number

C.J. associates

Hole	Sample	Depth (m)	Method	Mean Particle Density (Mg/m³)	Description
TP 14	D1	1.00	2	2.79	Refer to log sheets
TP 2	D1	0.80	2	2.76	Refer to log sheets

Methods

B 377:Part2:1990:Methods 8.2

C Documented In-house method - CJA-DIHM 108 Based on BS1377:Part2:1990:Method 8.2

Samples were prepared in accordance with BS1377:Part1:1990

Insufficient material

Determination of the One Dimensional Consolidation Properties

BS1377:Part 5:1990:Clause 3

C.J. associates

Site	**A487 Machynlleth**
Client	Powys County Council
Job Number	M0525
Lab Number	L4552

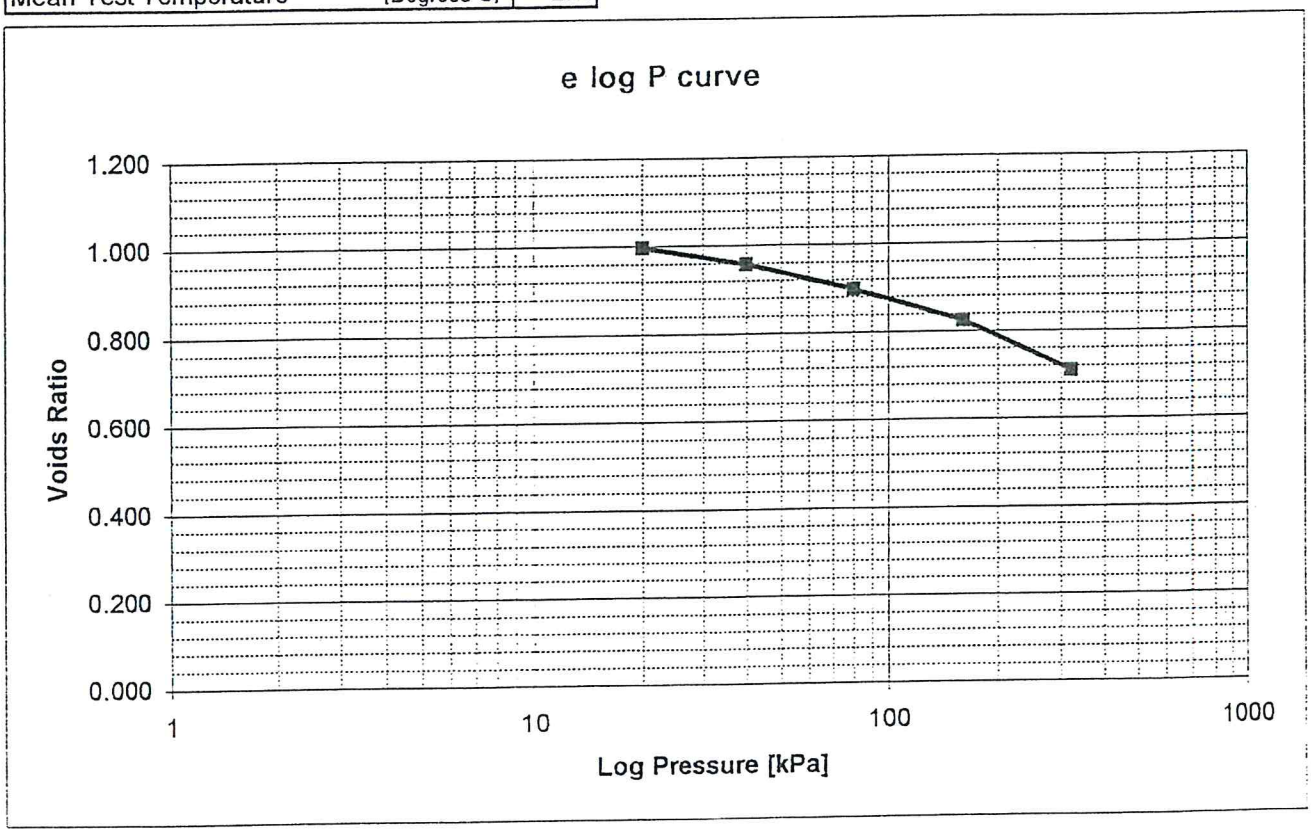
Hole	**BH2**
Sample	**U5**
Depth [m]	**2.00**
Depth within U100 sample [mm]	**20**

Sample Description / Test Comments

Grey, clayey fine SAND.

Initial Values		
Diameter	[mm]	75.10
Height	[mm]	19.890
Mass	[g]	156.8
Moisture Content	[%]	42
Bulk Density	[Mg/m^3]	1.78
Dry Density	[Mg/m^3]	1.25
Particle Density Assumed	[Mg/m^3]	2.65
Voids Ratio		1.114
Saturation	[%]	99.8
Swelling Pressure	[kPa]	n/a

Stage Number		1	2	3	4	5
Initial Pressure	[kPa]	0	20	40	80	160
Final Pressure	[kPa]	20	40	80	160	320
Voids Ratio		0.997	0.957	0.898	0.825	0.708
mv	[m^2/MN]	2.8	1.0	0.75	0.48	0.40
cv - Log time method	[m^2/Year]	4.4	4.7	2.6	2.0	2.7
cv - Root time method	[m^2/Year]					
Csec Not Requested						
Test Temperature	[Degrees C]	20.5	20.5	21.3	20.0	20.0
Mean Test Temperature	[Degrees C]	20.5				



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Approved

Issue Date - 19/11/01 - 01:59 PM

DOS = BH2 - U5.xls

Determination of the One Dimensional Consolidation Properties

BS1377:Part 5:1990:Clause 3

C.J. associates

Site	A487 Machynlleth
Client	Powys County Council
Job Number	M0525
Lab Number	L4552

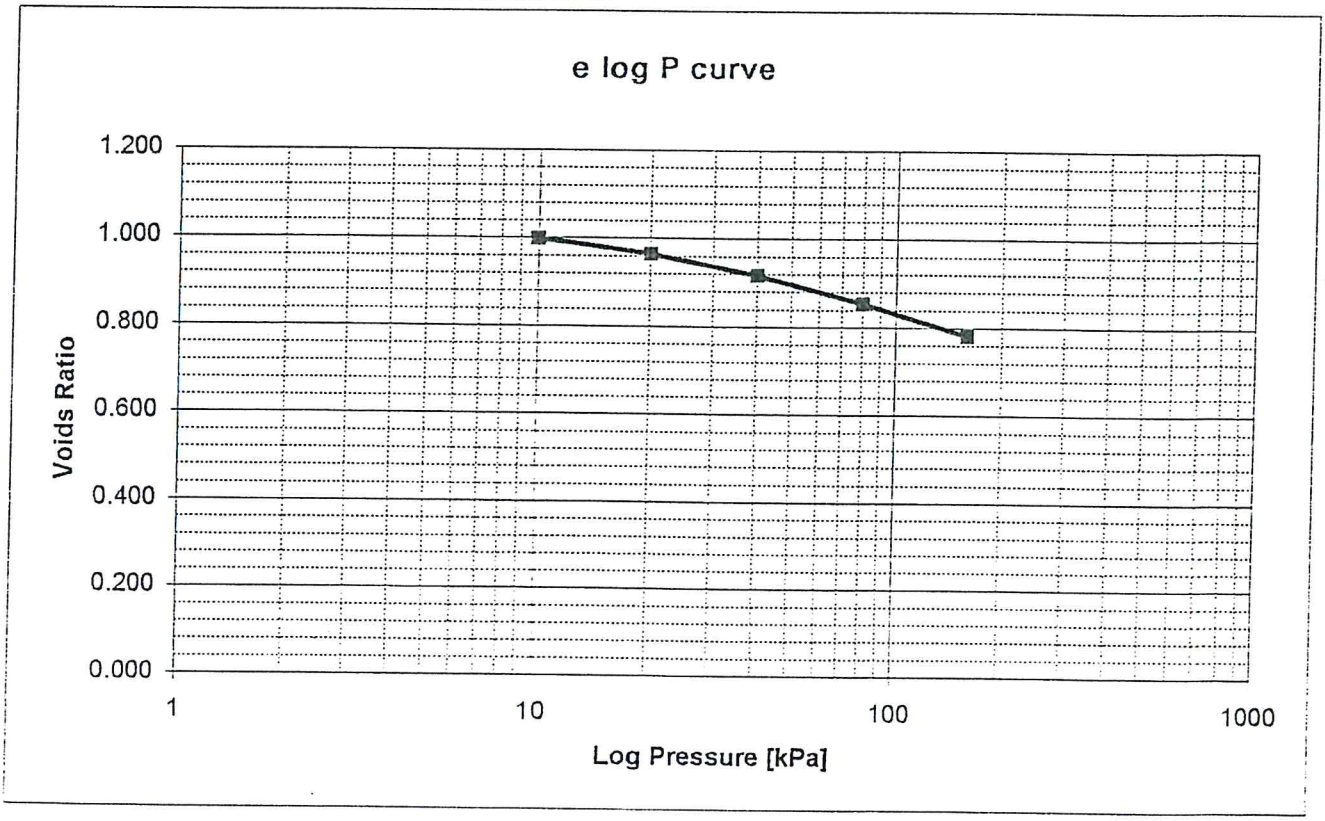
Hole	BH7
Sample	U2
Depth [m]	1.00
Depth within U100 sample [mm]	30

Sample Description / Test Comments

Soft, grey brown, silty CLAY.

Initial Values			
Diameter		[mm]	75.07
Height		[mm]	19.290
Mass		[g]	157.2
Moisture Content		[%]	49
Bulk Density		[Mg/m^3]	1.84
Dry Density		[Mg/m^3]	1.24
Particle Density	Assumed	[Mg/m^3]	2.65
Voids Ratio			1.13
Saturation		[%]	113.1
Swelling Pressure		[kPa]	n/a

Stage Number		1	2	3	4	5
Initial Pressure	[kPa]	0	10	20	40	80
Final Pressure	[kPa]	10	20	40	80	160
Voids Ratio		0.997	0.964	0.915	0.854	0.781
mv	[m^2/MN]	6.6	1.7	1.2	0.80	0.49
cv - Log time method	[m^2/Year]	1.4	0.88	0.98	0.85	1.3
cv - Root time method	[m^2/Year]					
Csec Not Requested						
Test Temperature	[Degrees C]	20.0	20.0	20.0	20.5	20.5
Mean Test Temperature	[Degrees C]	20.2				



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Approved

Issue Date - 19/11/01 - 01:37 PM

DOS = BH7 - U2.xls

Determination of the One Dimensional Consolidation Properties

BS1377:Part 5:1990:Clause 3

C.J. associates

Site	**A487 Machynlleth**
Client	Powys County Council
Job Number	M0525
Lab Number	L4552

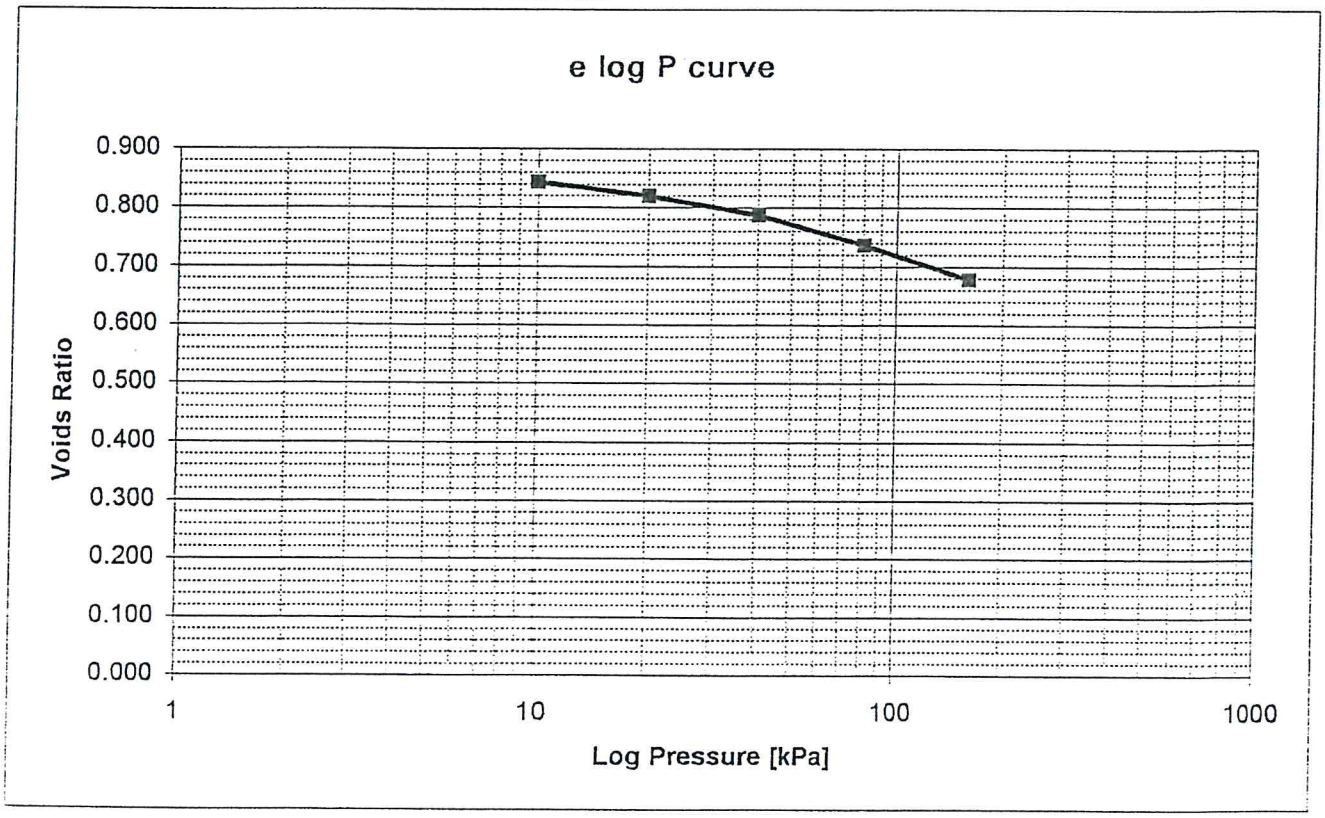
Hole	**BH8**
Sample	**U2**
Depth [m]	**1.00**
Depth within U100 sample [mm]	**20**

Sample Description / Test Comments

Soft, grey brown, silty CLAY.

Initial Values		
Diameter	[mm]	75.03
Height	[mm]	19.410
Mass	[g]	161.4
Moisture Content	[%]	36
Bulk Density	[Mg/m^3]	1.88
Dry Density	[Mg/m^3]	1.38
Particle Density Assumed	[Mg/m^3]	2.65
Voids Ratio		0.919
Saturation	[%]	104.4
Swelling Pressure	[kPa]	n/a

Stage Number		1	2	3	4	5
Initial Pressure	[kPa]	0	10	20	40	80
Final Pressure	[kPa]	10	20	40	80	160
Voids Ratio		0.842	0.819	0.787	0.735	0.677
mv	[m^2/MN]	4.0	1.3	0.87	0.72	0.42
cv - Log time method	[m^2/Year]	8.8	4.5	5.3	2.3	2.4
cv - Root time method	[m^2/Year]					
Csec Not Requested						
Test Temperature	[Degrees C]	20.0	20.0	20.0	20.5	20.5
Mean Test Temperature	[Degrees C]	20.2				



Checked

Approved

Issue Date - 19/11/01 - 01:53 PM

DOS = BH8 - U2.xls

Determination of the One Dimensional Consolidation Properties

BS1377:Part 5:1990:Clause 3

C.J. associates

Site	A487 Machynlleth
Client	Powys County Council
Job Number	M0525
Lab Number	L4552

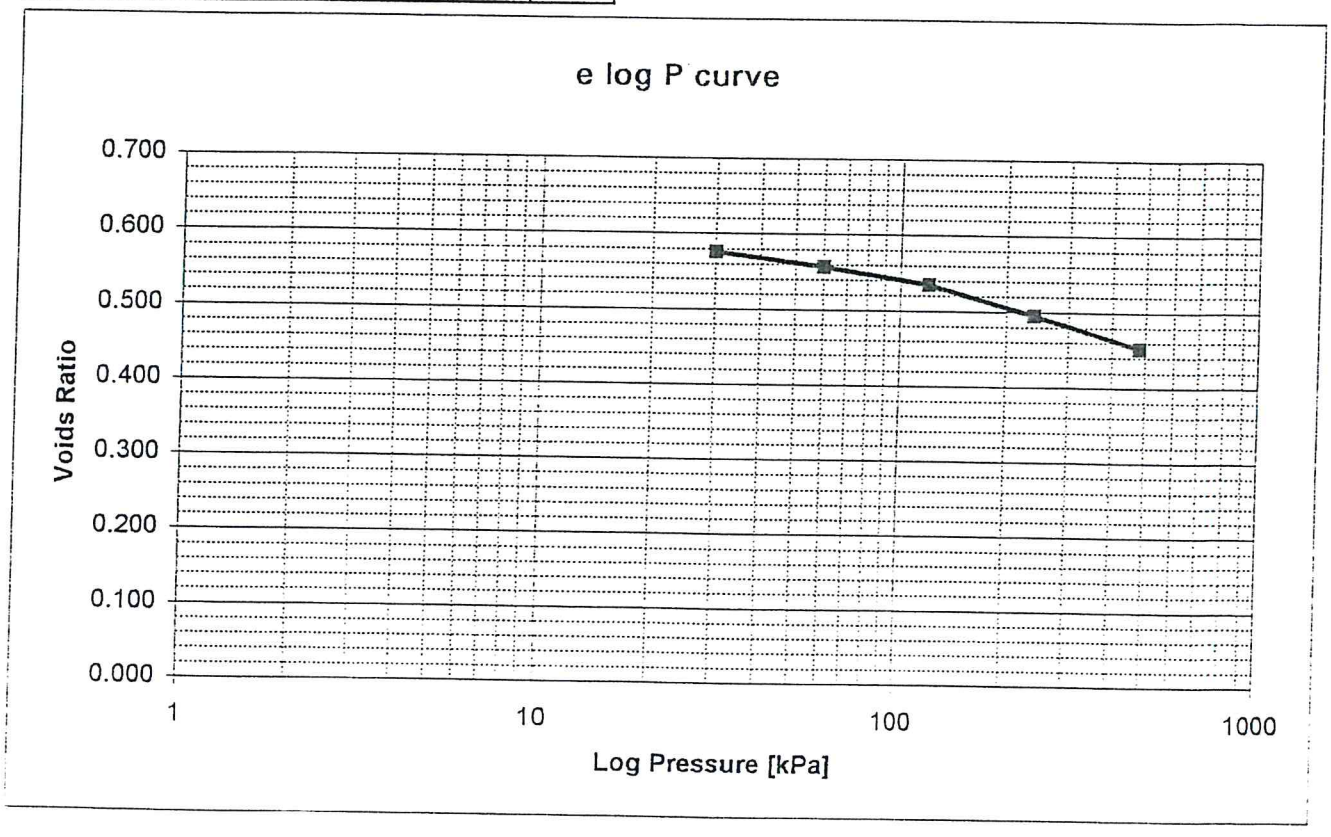
Hole	BH9
Sample	U7
Depth [m]	3.00
Depth within U100 sample [mm]	30

Sample Description / Test Comments

Soft, grey sandy CLAY.

Initial Values		
Diameter	[mm]	75.10
Height	[mm]	19.780
Mass	[g]	183.2
Moisture Content	[%]	29
Bulk Density	[Mg/m^3]	2.09
Dry Density	[Mg/m^3]	1.62
Particle Density Assumed	[Mg/m^3]	2.65
Voids Ratio		0.633
Saturation	[%]	120.7
Swelling Pressure	[kPa]	n/a

Stage Number		1	2	3	4	5
Initial Pressure	[kPa]	0	30	60	120	240
Final Pressure	[kPa]	30	60	120	240	480
Voids Ratio		0.575	0.556	0.534	0.495	0.452
mv	[m^2/MN]	1.2	0.40	0.24	0.21	0.12
cv - Log time method	[m^2/Year]	*	1.2	8.7	5.6	17
cv - Root time method	[m^2/Year]					
Csec Not Requested						
Test Temperature	[Degrees C]	19.5	19.8	21.0	20.0	20.0
Mean Test Temperature	[Degrees C]	20.1				



Checked

Approved

Consolidation Page of

Lab Report Page of

Issue Date - 19/11/01 - 01:57 PM

DOS = BH9 - U7.xls

Determination of the One Dimensional Consolidation Properties

BS1377:Part 5:1990:Clause 3

C.J. associates

Site	**A487 Machynlleth**
Client	Powys County Council
Job Number	M0525
Lab Number	L4552

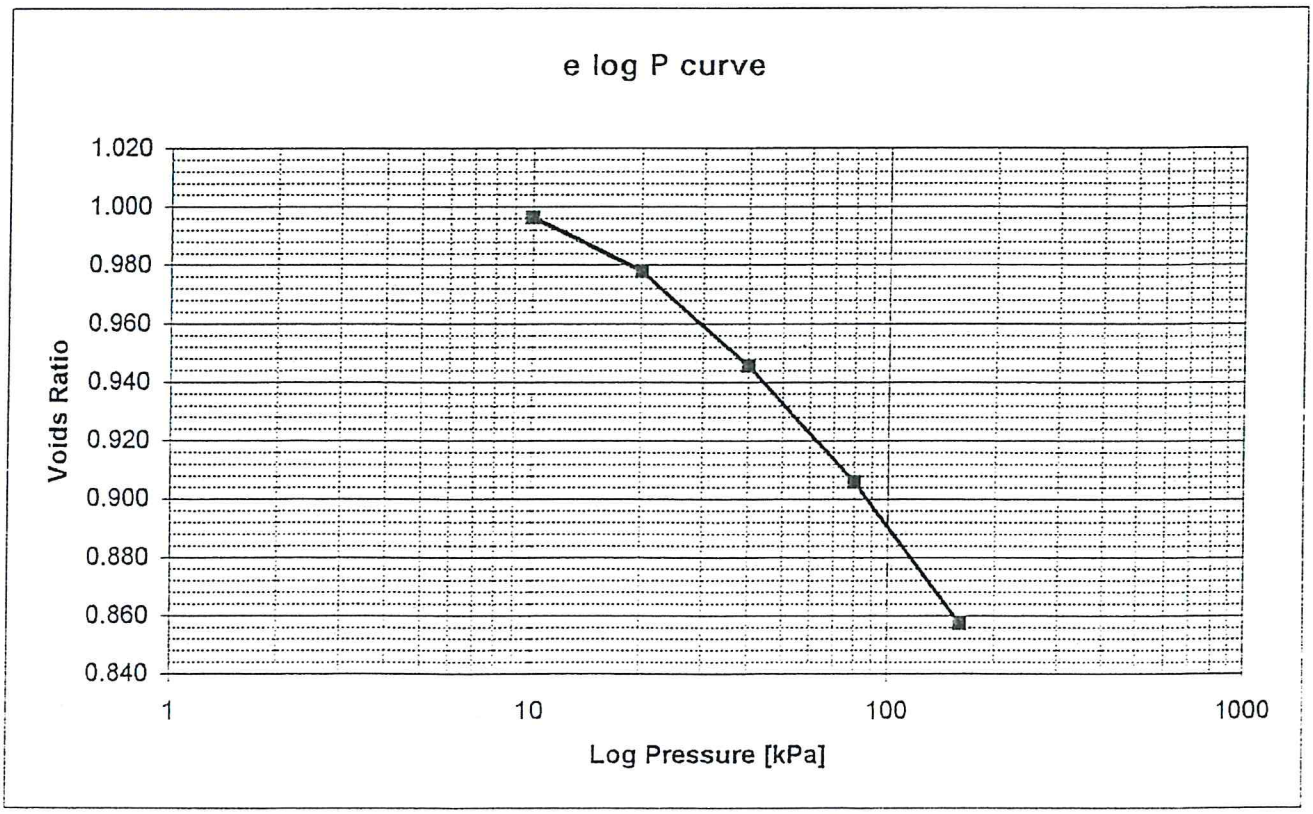
Hole	**BH16**
Sample	**U2**
Depth [m]	**1.00**
Depth within U100 sample [mm]	**250**

Sample Description / Test Comments

Soft, grey green, silty CLAY.

Initial Values			
Diameter		[mm]	75.10
Height		[mm]	19.640
Mass		[g]	157.7
Moisture Content		[%]	39
Bulk Density		[Mg/m^3]	1.81
Dry Density		[Mg/m^3]	1.30
Particle Density	Assumed	[Mg/m^3]	2.65
Voids Ratio			1.035
Saturation		[%]	100.4
Swelling Pressure		[kPa]	n/a

Stage Number		1	2	3	4	5
Initial Pressure	[kPa]	0	10	20	40	80
Final Pressure	[kPa]	10	20	40	80	160
Voids Ratio		0.996	0.978	0.946	0.906	0.857
mv	[m^2/MN]	1.9	0.92	0.82	0.51	0.32
cv - Log time method	[m^2/Year]	*	0.35	0.43	3.7	4.2
cv - Root time method	[m^2/Year]					
Csec Not Requested						
Test Temperature	[Degrees C]	20.5	23.4	20.0	20.0	20.0
Mean Test Temperature	[Degrees C]	20.8				



Checked

Approved

Issue Date - 07/11/01 - 02:28 PM

DOS = BH16 - U2.xls

Determination of the One Dimensional Consolidation Properties

BS1377:Part 5:1990:Clause 3

C.J. associates

Site	A487 Machynlleth
Client	Powys County Council
Job Number	M0525
Lab Number	L4552

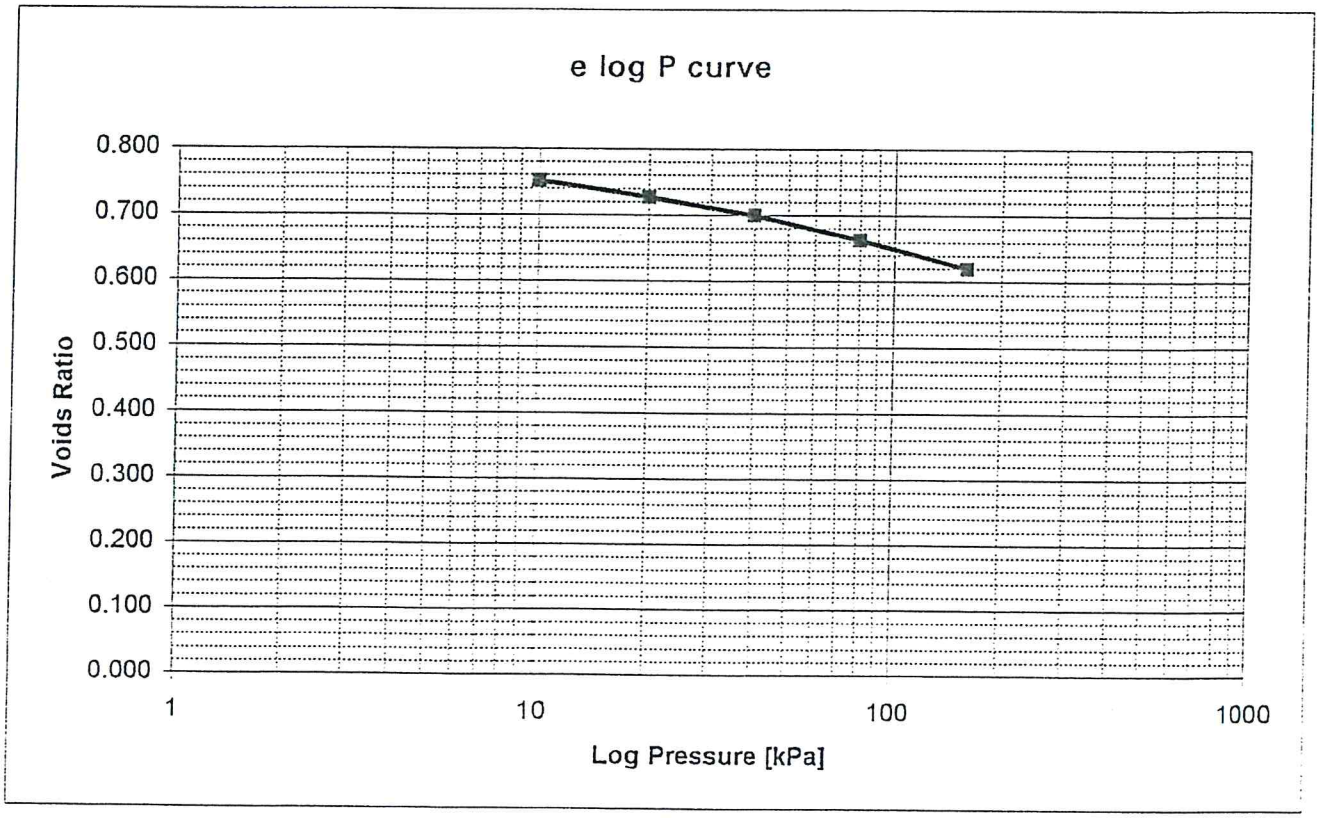
Hole	BH17
Sample	U3
Depth [m]	1.00
Depth within U100 sample [mm]	250

Sample Description / Test Comments

Soft to firm, grey brown, silty CLAY.

Initial Values		
Diameter	[mm]	75.07
Height	[mm]	19.920
Mass	[g]	173.8
Moisture Content	[%]	33
Bulk Density	[Mg/m^3]	1.97
Dry Density	[Mg/m^3]	1.48
Particle Density	Assumed [Mg/m^3]	2.65
Voids Ratio		0.792
Saturation	[%]	111.4
Swelling Pressure	[kPa]	n/a

Stage Number		1	2	3	4	5
Initial Pressure	[kPa]	0	10	20	40	80
Final Pressure	[kPa]	10	20	40	80	160
Voids Ratio		0.751	0.727	0.699	0.662	0.619
mv	[m^2/MN]	2.3	1.4	0.80	0.54	0.33
cv - Log time method	[m^2/Year]	27	4.1	3.5	3.1	2.9
cv - Root time method	[m^2/Year]					
Csec Not Requested						
Test Temperature	[Degrees C]	20.0	20.5	20.5	21.3	20.0
Mean Test Temperature	[Degrees C]	20.5				



Checked

Approved

Issue Date - 07/11/01 - 02:43 PM

DOS = BH17 - U3.xls

Determination of the One Dimensional Consolidation Properties

BS1377:Part 5:1990:Clause 3

C.J. associates

Site	**A487 Machynlleth**
Client	Powys County Council
Job Number	M0525
Lab Number	L4552

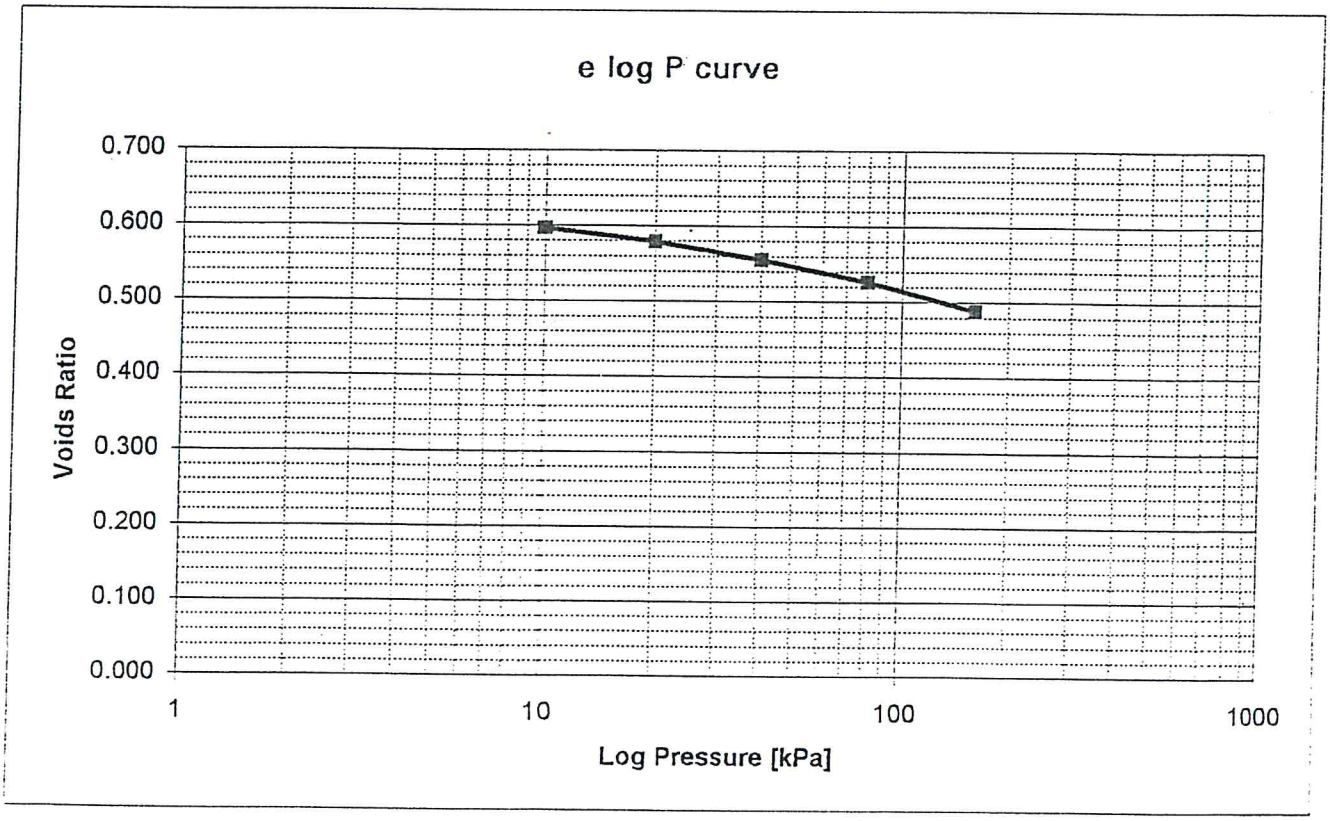
Hole	**BH18**
Sample	**U2**
Depth [m]	**1.00**
Depth within U100 sample [mm]	**20**

Sample Description / Test Comments

Soft, grey green, sandy CLAY.

Initial Values		
Diameter	[mm]	75.01
Height	[mm]	19.620
Mass	[g]	176.6
Moisture Content	[%]	28
Bulk Density	[Mg/m^3]	2.04
Dry Density	[Mg/m^3]	1.60
Particle Density Assumed	[Mg/m^3]	2.65
Voids Ratio		0.661
Saturation	[%]	110.9
Swelling Pressure	[kPa]	n/a

Stage Number		1	2	3	4	5
Initial Pressure	[kPa]	0	10	20	40	80
Final Pressure	[kPa]	10	20	40	80	160
Voids Ratio		0.596	0.579	0.554	0.526	0.488
mv	[m^2/MN]	3.9	1.1	0.78	0.45	0.31
cv - Log time method	[m^2/Year]	*	6.8	7.7	4.9	6.0
cv - Root time method	[m^2/Year]					
Csec Not Requested						
Test Temperature	[Degrees C]	20.5	21.3	20.0	20.0	20.0
Mean Test Temperature	[Degrees C]	20.4				



Checked

Approved

Issue Date - 19/11/01 - 01:33 PM

DOS=BH18 - U2.xls

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

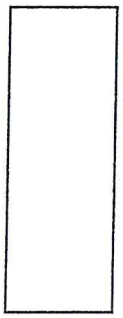
Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

Hole		BH 2
Sample		U5
Depth	m	2.00
Depth within original sample	mm	50

Description
Grey, clayey SAND.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	210.0
Mean initial sample diameter	mm	104.8
Sample mass	g	3312.5
Initial moisture content	%	34
Rate of strain	%/min	1.43
Initial bulk density	Mg/m^3	1.83
Initial dry density	Mg/m^3	1.36

Failure Mode



Membrane type	Latex
Membrane thickness	0.3

Cell pressure	kPa	40
Membrane correction	kPa	1.1
Deviator stress	kPa	23
Cumulative strain at failure	%	20
Shear strength	kPa	12
Consistency		Very Soft

Checked

Approved

Issue Date 09/11/01 20:15

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

Hole		BH 3
Sample		U5
Depth	m	2.00
Depth within original sample	mm	50

Description
Soft, grey / green, sandy CLAY.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	211.0
Mean initial sample diameter	mm	107.0
Sample mass	g	3712
Initial moisture content	%	30
Rate of strain	%/min	1.42
Initial bulk density	Mg/m^3	1.96
Initial dry density	Mg/m^3	1.50

Failure Mode



Membrane type	Latex
Membrane thickness	0.3

Cell pressure	kPa	40
Membrane correction	kPa	1.1
Deviator stress	kPa	46
Cumulative strain at failure	%	20
Shear strength	kPa	23
Consistency		Soft

Checked

Approved

Issue Date 09/11/01 20:08

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

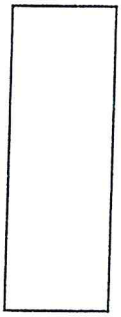
Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

Hole		BH 4
Sample		U2
Depth	m	1.00
Depth within original sample	mm	30

Description
Soft, brown / grey, silty CLAY, with occasional gravels.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	211.0
Mean initial sample diameter	mm	104.2
Sample mass	g	3363.5
Initial moisture content	%	38
Rate of strain	%/min	1.42
Initial bulk density	Mg/m^3	1.87
Initial dry density	Mg/m^3	1.36

Failure Mode



Membrane type		Latex
Membrane thickness		0.3

Cell pressure	kPa	20
Membrane correction	kPa	1.1
Deviator stress	kPa	28
Cumulative strain at failure	%	20
Shear strength	kPa	14
Consistency		Very Soft

Checked

Approved

Issue Date 05/11/01 18:36

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

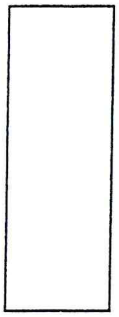
Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

Hole		BH 4
Sample		U7
Depth	m	3.00
Depth within original sample	mm	30

Description
Soft, grey, silty CLAY.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	210.0
Mean initial sample diameter	mm	104.7
Sample mass	g	3040
Initial moisture content	%	60
Rate of strain	%/min	1.43
Initial bulk density	Mg/m^3	1.68
Initial dry density	Mg/m^3	1.05

Failure Mode



Membrane type	Latex
Membrane thickness	0.3

Cell pressure	kPa	60
Membrane correction	kPa	1.0
Deviator stress	kPa	16
Cumulative strain at failure	%	18
Shear strength	kPa	8
Consistency		Very Soft

Checked

Approved

Issue Date 05/11/01 18:53

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

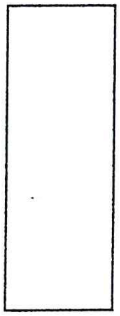
Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

Hole		BH 5
Sample		U2
Depth	m	1.00
Depth within original sample	mm	50

Description
Soft, grey / brown, silty CLAY.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	212.0
Mean initial sample diameter	mm	105.2
Sample mass	g	3174.5
Initial moisture content	%	38
Rate of strain	%/min	1.42
Initial bulk density	Mg/m^3	1.72
Initial dry density	Mg/m^3	1.24

Failure Mode



Membrane type	Latex
Membrane thickness	0.3

Cell pressure	kPa	20
Membrane correction	kPa	1.1
Deviator stress	kPa	34
Cumulative strain at failure	%	20
Shear strength	kPa	17
Consistency		Very Soft

Checked

Approved

Issue Date 09/11/01 20:03

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

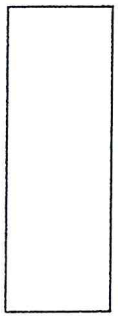
Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

Hole		BH 6
Sample		U2
Depth	m	1.00
Depth within original sample	mm	40

Description
Grey / brown, clayey SAND, with many fine, medium and coarse gravels.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	212.0
Mean initial sample diameter	mm	103.2
Sample mass	g	3470.5
Initial moisture content	%	22
Rate of strain	%/min	1.42
Initial bulk density	Mg/m^3	1.96
Initial dry density	Mg/m^3	1.61

Failure Mode



Membrane type	Latex
Membrane thickness	0.3

Cell pressure	kPa	20
Membrane correction	kPa	1.1
Deviator stress	kPa	27
Cumulative strain at failure	%	20
Shear strength	kPa	13
Consistency		Very Soft

Checked

Approved

Issue Date 09/11/01 20:19

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

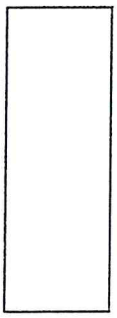
Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

Hole		BH 7
Sample		U2
Depth	m	1.00
Depth within original sample	mm	60

Description
Soft, grey / brown, silty CLAY.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	85.7
Mean initial sample diameter	mm	38.2
Sample mass	g	171
Initial moisture content	%	45
Rate of strain	%/min	2.33
Initial bulk density	Mg/m^3	1.74
Initial dry density	Mg/m^3	1.20

Failure Mode



Membrane type	Latex
Membrane thickness	0.2

Cell pressure	kPa	20
Membrane correction	kPa	2.0
Deviator stress	kPa	56
Cumulative strain at failure	%	20
Shear strength	kPa	28
Consistency		Soft

Checked

Approved

Issue Date 05/11/01 19:30

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

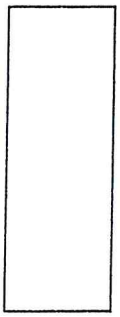
Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

Hole		BH 9
Sample		U2
Depth	m	1.00
Depth within original sample	mm	30

Description
Loose to dense, grey / brown, slightly clayey fine SAND.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	213.0
Mean initial sample diameter	mm	105.5
Sample mass	g	3175.5
Initial moisture content	%	17
Rate of strain	%/min	1.41
Initial bulk density	Mg/m^3	1.70
Initial dry density	Mg/m^3	1.45

Failure Mode



Membrane type	Latex
Membrane thickness	0.3

Cell pressure	kPa	20
Membrane correction	kPa	1.0
Deviator stress	kPa	61
Cumulative strain at failure	%	17
Shear strength	kPa	31
Consistency		Soft

Checked

Approved

Issue Date 09/11/01 19:58

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

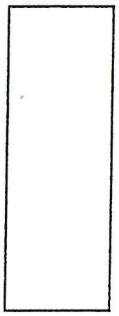
Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

Hole		BH 9
Sample		U7
Depth	m	3.00
Depth within original sample	mm	60

Description
Dark grey, clayey fine SAND.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	213.0
Mean initial sample diameter	mm	104.7
Sample mass	g	3475.5
Initial moisture content	%	27
Rate of strain	%/min	1.41
Initial bulk density	Mg/m^3	1.90
Initial dry density	Mg/m^3	1.49

Failure Mode



Membrane type	Latex
Membrane thickness	0.3

Cell pressure	kPa	0
Membrane correction	kPa	0.8
Deviator stress	kPa	44
Cumulative strain at failure	%	14
Shear strength	kPa	22
Consistency		Soft

Checked

Approved

Issue Date 09/11/01 20:17

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

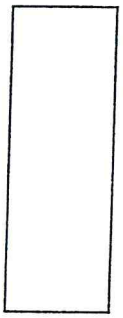
Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

Hole		BH 16
Sample		U2
Depth	m	1.00
Depth within original sample	mm	30

Description
Soft, grey / green, silty CLAY, with many fine, medium and coarse gravels and occasional cobbles.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	214.0
Mean initial sample diameter	mm	103.8
Sample mass	g	3191
Initial moisture content	%	27
Rate of strain	%/min	1.40
Initial bulk density	Mg/m³	1.76
Initial dry density	Mg/m³	1.39

Failure Mode



Membrane type		Latex
Membrane thickness		0.3

Cell pressure	kPa	20
Membrane correction	kPa	0.5
Deviator stress	kPa	52
Cumulative strain at failure	%	8
Shear strength	kPa	26
Consistency		Soft

Checked

Approved

Issue Date 05/11/01 19:22

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

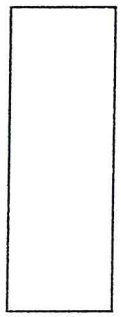
Hole		BH 17
Sample		U3
Depth	m	1.00
Depth within original sample	mm	30

Description

Top:- Fine, medium and coarse GRAVEL, in a grey sandy matrix. Base:- Soft to firm, grey / brown, slightly sandy silty CLAY.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	212.0
Mean initial sample diameter	mm	105.2
Sample mass	g	3419.5
Initial moisture content	%	18
Rate of strain	%/min	1.42
Initial bulk density	Mg/m^3	1.86
Initial dry density	Mg/m^3	1.57

Failure Mode



Membrane type	Latex
Membrane thickness	0.3

Cell pressure	kPa	20
Membrane correction	kPa	0.9
Deviator stress	kPa	47
Cumulative strain at failure	%	15
Shear strength	kPa	24
Consistency		Soft

Checked

Approved

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

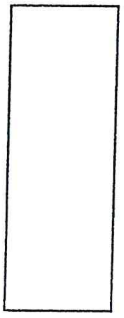
Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

Hole		BH 18
Sample		U2
Depth	m	1.00
Depth within original sample	mm	50

Description
Soft, grey / green, sandy CLAY.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	213.0
Mean initial sample diameter	mm	104.3
Sample mass	g	3573.5
Initial moisture content	%	22
Rate of strain	%/min	1.41
Initial bulk density	Mg/m^3	1.96
Initial dry density	Mg/m^3	1.61

Failure Mode



Membrane type	Latex
Membrane thickness	0.3

Cell pressure	kPa	20
Membrane correction	kPa	0.6
Deviator stress	kPa	64
Cumulative strain at failure	%	9
Shear strength	kPa	32
Consistency		Soft

Checked

Approved

Issue Date 05/11/01 19:14

Determination of Undrained Shear Strength in Triaxial Compression Without Measurement of Pore Pressure

BS1377:Part 7:1990: Clause 8

C.J. associates

Site	A487 Machynlleth.
Client	Powys C.C.
Job Number	M0525
Lab Number	L4552

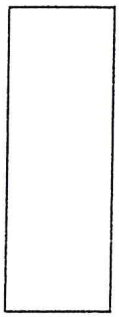
Hole		BH 19
Sample		U4
Depth	m	2.00
Depth within original sample	mm	40

Description

Top:- Friable, grey / brown, sandy CLAY, with many fine, medium and coarse gravels. Base :- Fine, medium and coarse GRAVEL, in a grey silty sand matrix.

Orientation within original sample		Vertical
Preparation		Undisturbed
Mean initial sample height	mm	212.0
Mean initial sample diameter	mm	105.1
Sample mass	g	3795
Initial moisture content	%	5.4
Rate of strain	%/min	1.42
Initial bulk density	Mg/m^3	2.06
Initial dry density	Mg/m^3	1.96

Failure Mode



Membrane type	Latex
Membrane thickness	0.3

Cell pressure	kPa	40
Membrane correction	kPa	0.7
Deviator stress	kPa	96
Cumulative strain at failure	%	12
Shear strength	kPa	48
Consistency		Soft to Firm

Checked

Approved

C.J.
associates

CONTAMINATION TEST RESULTS

CAS

CITY ANALYTICAL SERVICES PLC

23 October 2001

C.J. Associates Ltd.
Soils Laboratory
Received 25 OCT 2001
by

Ms L Simmons
C.J. Associates Geotechnical Limited
King Road Avenue
Avonmouth
Bristol
BS11 9HF

Test Report : CJG /53605

Dear Ms Simmons

Please find enclosed the results of the analysis carried out on the samples submitted from A487 Machynlleth on 11 October 2001.

I trust you will find these satisfactory but should you have any queries please contact me.

Yours sincerely

S M Hart
AUTHORISED SIGNATORY

C.J. ASSOCIATES GEOTECHNICAL LTD
25 OCT 2001
RECEIVED

Determinations marked * in this certificate are not included in the UKAS accreditation schedule for our laboratory. Opinions and interpretations expressed herein, and marked #, are outside the scope of UKAS accreditation. Determinations marked S were subcontracted. Unless otherwise stated, CAS plc was not responsible for sampling. Information about methods and performance charactoristics of the determinations are available on request. Unless otherwise agreed, as received soils will be disposed of after 30 days; dried soils after 30 days and waters/leachates after 10 days from the issue of the final report. Soil analysis is carried out on air-dried and ground test portion of the sample.

CAS
CITY ANALYTICAL SERVICES PLC

Soil Analysis

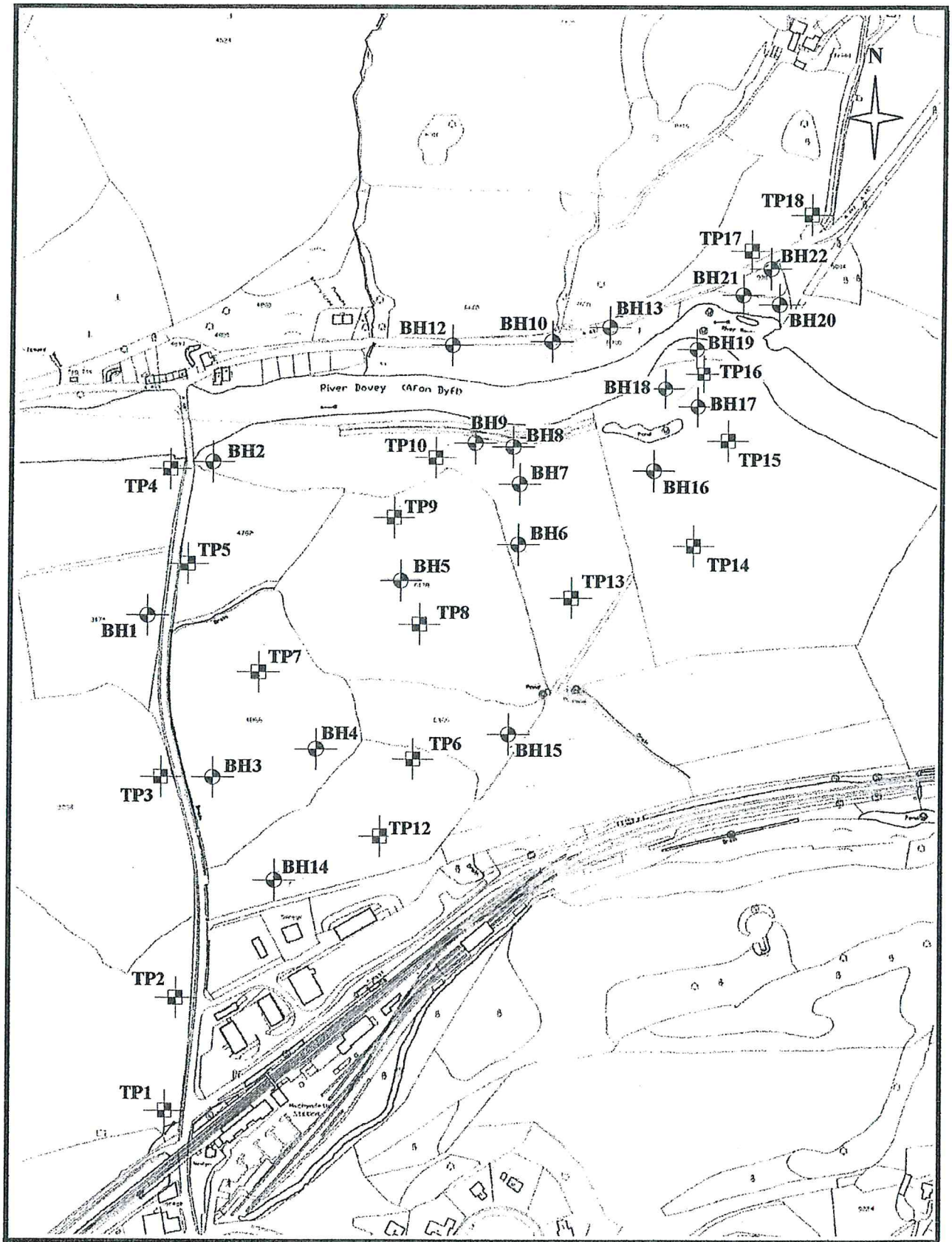
CJG /53605
A487 Machynlleth
Your Reference:- M0525-L4552
Your Order:-

CAS Number:			188245	188246	188247	188248
Sample Ref			TP 2	TP 7	TP13	TP16
Detname	**Det**	**Units**	**0.80m**	**1.00m**	**1.00m**	**1.00m**
Arsenic (Total)	AsTS3	mg/kg	14	15	15	14
Boron (Soluble)	BSS3	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10
Cadmium (Total)	CdTS3	mg/kg	< 0.50	< 0.50	< 0.50	1.2
Chromium (Total)	CrTS3	mg/kg	17	21	18	14
Copper (Total)	CuTS3	mg/kg	34	35	33	31
Lead (Total)	PbTS3	mg/kg	280	73	100	150
Mercury (Total)	HgTS3	mg/kg	0.17	< 0.10	< 0.10	< 0.10
Nickel (Total)	NiTS3	mg/kg	19	24	21	19
Selenium (Total)	SeTS3	mg/kg	0.16	0.38	0.28	0.25
Zinc (Total)	ZnTS3	mg/kg	99	98	100	200
Carbonate as CO2*	CarbS1	%	1.7	0.17	0.17	< 0.10

Key
N/S - Not Scheduled
I/S - Insufficient Sample

C.J.
associates

SITE PLANS



Title:

Location of Boreholes & Trial Pits
Machynlleth

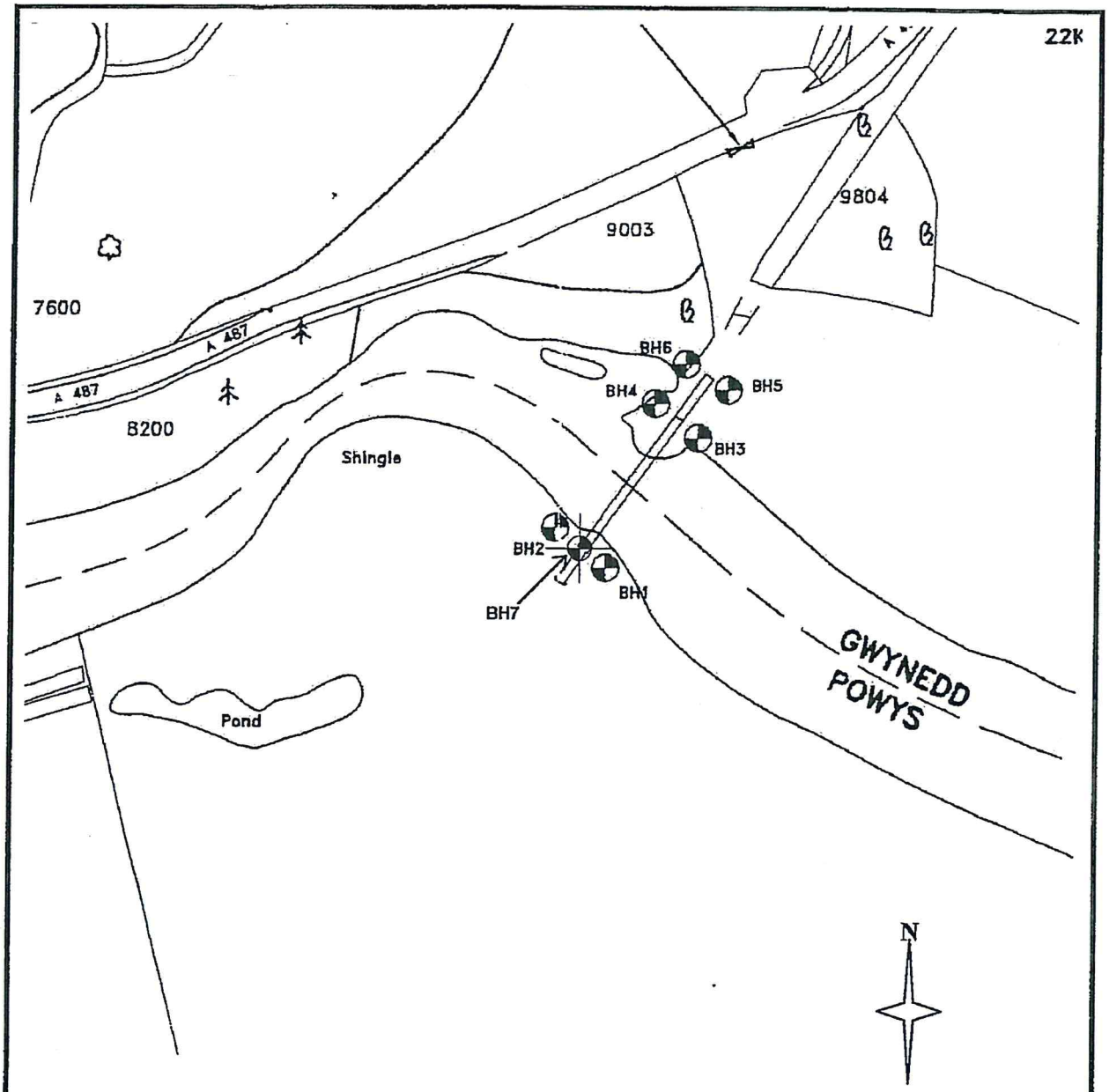
Job no. M0525	Drawn by: JAG	Date: NOV 01	Scale: NTS

C.J. associates

Appendix E

Extracts from Report No K0613 – Machynlleth.

CJ Associates, November 1999



Title: Borehole location plan – River Dyfi crossing

Job no. K0613	Drawn by: IH	Date: Sept 1999	Scale: NTS

C.J. associates

Llandovery age. These are generally shales and mudstones with occasional interbedded sands and grits.

3. FIELDWORK

3.1 - General

Fieldwork was carried out generally in accordance with BS 5930:1981 "Code of Practice for Site Investigations" and the Engineer's instructions unless otherwise stated. On completion all samples recovered from the site were taken to C.J.Associates Geotechnical Limited's NAMAS accredited laboratory for further examination and testing.

Details of the depths and type of samples recovered are included on the attached log sheets. The locations of the boreholes are shown approximately on the borehole location plan.

3.2 - Cable Percussive Boring

Seven boreholes, using both 200 mm and 150 mm diameter casing, were sunk by cable percussion equipment to depths of between 1.80 m and 13.70 m below existing ground level at positions indicated by the Engineer. Representative disturbed samples were recovered as drilling proceeded. Standard penetration tests using the split spoon sampler or cone point were conducted at regular intervals of depth and undisturbed 100 mm diameter samples were recovered as appropriate.

Where necessary, chiselling techniques were employed to advance the boreholes through obstructions or into a hard stratum (as defined in the Specification for Ground Investigation). The latter does not necessarily represent a suitable bearing stratum and may only be an obstruction.

Details of groundwater conditions were noted. These observations are those at the time of the investigation and do not necessarily reflect seasonal fluctuations. Water levels were monitored during site work but not subsequently. Water levels may have been affected by the installation of casing or the addition of water to aid boring. These effects were assessed as closely as possible during boring.

The boreholes were backfilled on completion with arisings as specified.

4. LABORATORY WORK

Samples were selected as relevant to the objectives of the investigation in accordance with the Engineer's instructions, and subjected to the following tests according to BS 1377:1990 "Methods of Test for Soils for Civil Engineering Purposes", unless otherwise stated. Reference is made to the test schedule issued by C.J. Associates on 2nd August 1999.

BS 1377 Test No.	Description
Part 2 Clause 3.2	Moisture content
Part 2 Clauses 4.4 and 5	Liquid and plastic limits and plasticity index
Part 2 Clause 9.2	Particle size distribution by wet sieving
Part 3 Clause 3	Organic matter content
Part 3 Clause 5.2	Total sulphate content of soil
Part 3 Clause 5.3	Sulphate content of aqueous soil extracts
Part 3 Clause 7	Chloride content of soil
Part 3 Clause 9.5	pH value (electrometric method)

Part 5 Clause 3	One-dimensional consolidation properties
Part 7 Clause 9	Quick undrained triaxial compression without pore water pressure measurement (100 mm diameter)

Details of test results are shown in the attached appendix and discussed in the following sections.

5. FINDINGS AND OBSERVATIONS

The ground conditions encountered in each exploratory hole are described on the attached borehole log sheets. The strata revealed by this investigation can be generally summarised as follows:

Stratum	Depth range (m)	Stratum Description
A	0.00 – 0.10	TOPSOIL
B	0.10 – 3.00	Soft to firm grey-brown sandy silty CLAY with increasing gravel with depth
C	1.00 – 13.70	Medium dense becoming dense shale GRAVEL
D	1.50 – 6.20	Dark grey SHALE (Boreholes 3, 4, 5 and 6 only)

Groundwater was encountered at depths ranging between 1.40 m and 3.00 m below ground level.

Stratum A

The base of this material was encountered at a depth of 0.10 m in all of the exploratory holes.

Stratum B

The top of this material was encountered at a depth of 0.10 m in all of the exploratory holes. Its base was found at between 1.00 m and 3.00 m. A single triaxial test result

revealed a cohesion of 31 kN/m². Consolidation test results indicate that this deposit is in the range of medium to high compressibility. Based on the Extended Casagrande Soil Classification the liquid and plastic limits and plasticity index tests classified the fine grained fraction of this material as CL or MEO, silty clay of low plasticity or organic clayey silt of extremely high plasticity. Chemical test results indicate that Class 1 conditions apply in respect of total or aqueous sulphate content with pH values between 8.1 and 5.8.

Stratum C

The top of this material was encountered at depths of between 1.00 m and 3.00 m. Its base was found at between 1.50 m and 4.90 m in boreholes 3, 4, 5 and 6. Its base was not encountered in boreholes 1, 2 and 7. SPT N-values ranged from 7 to over 50 indicating that it ranges from loose to very dense, averaging medium dense.

Stratum D

The top of this material was encountered at depths of between 1.00 m and 3.00 m. It was not encountered in boreholes 1, 2 and 7.

C.J. associates

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the boreholes indicate that the site is underlain, on the north side of the river, by approximately 1.50 m of soft silty clay over generally medium dense gravels to between 1.50 – 4.90 m over shale rock. On the south side of the river, the site is underlain by approximately 1.50 m of soft to firm silty clay over medium dense to dense gravels and occasional loose sands to at least 13.70 m. shale rock was not encountered in the boreholes on the south side of the river.

The shale rock represents the Llandovery age deposits described above and conform with the predicted geological sequence. All the overlying deposits represent flood plain deposits of the River Dyfi.

In the absence of full detailed design information the following recommendations with regard to foundation solutions are necessarily general.

On the southern side of the river, the soft to firm silty clays at shallow depth should give an allowable bearing pressure of 75 kN/m² based on a square pad footing not exceeding a total area of four square metres at a depth of 1.0 m below existing ground level. A strip footing of similar area would give excessive vertical stress within the gravels underlying the clays (those with N-values of 9-11) which would only support an allowable bearing pressure of 50 kN/m² for a 1.0 m wide footing reducing to 20 kN/m² for a 4.0 m wide footing.

If the above allowable bearing pressures are insufficient for the proposed structure, it will be necessary to transfer the loads to a greater depth by means of a piled foundation. Quotations should be sought from reputable piling contractors who should be provided with a copy of this report. The possibility of damage to any adjacent services should be considered if a piled foundation is adopted.

Bedrock was not encountered in the boreholes on the southern side of the river. Examination of the geological map of the area, however, indicates that the rock type on each side of the river can be assumed to be the same. Study of the shale rock recovered from boreholes 3, 4, 5 and 6 on the northern side of the river show that individual fragments vary in strength from moderately weak to moderately strong (i.e. ranging in compressive strength from 5 MN/m^2 to 50 MN/m^2). Conservatively taking the lower end of this range, due to the lack of direct information regarding the rock on the southern side of the river, an ultimate end bearing capacity of 20 MN/m^2 is predicted for concrete piles driven to refusal in the likely shale bedrock.

The choice between driven or bored piles must consider (1) the presence of relatively high running water at the site, (2) possible artesian water pressure in the superficial deposits and (3) probable non-uniformity of the shale rock head across the site.

The presence of water in the first two instances causes construction difficulties and makes for particularly unfavourable conditions for bored or replacement piles. Possible pile defects may also occur after the withdrawal of casing for cast-in-situ piles through pile necking due to the washing out of cement by running water.

A driven precast pile solution would therefore seem most applicable at this site. Such piles should be driven to refusal considering the variability of superficial deposits, the probable non-uniformity of the shale rock-head and the possible presence of interbedded weaker stratum within the shales. The ultimate load capacity of the piles will depend on their material and geometry and should be discussed with any reputable contractors contacted for quotations.

The likely need to adjust pile lengths can be overcome by employing jointed precast concrete piles. With these, adjustments in length can be made by adding or taking away short lengths of pile which are jointed by devices capable of developing the same

bending and tensile resistance as the main body of the pile. It should be noted that certain minimum unjointed pile lengths are required by some Codes. Once again, reputable contractors should be consulted regarding the maximum safe working loads of their proprietary designs. Uniform joint-length piles could also be used but the relatively low safe working load of these would probably necessitate an increase in the number of piles.

Pile driving should be carefully controlled to avoid excessive crushing of the shale bedrock and to ensure that the pile concrete is not damaged.

Horizontal loading of the piles, for instance during times of flooding, should also be considered. The ultimate horizontal load on a pile depends on its stiffness, the compressibility of the soil and depth of embedment of the pile. The latter of these cannot be determined at this stage.

In general, vertical piles offer poor resistance to horizontal loads and, if flooding is thought to be a danger, it would be advisable to make field loading tests on trial piles having at least three different shaft lengths in order to assess the effect of embedment depth and structural stiffness. Alternatively, the use of raking piles, which are more appropriate for this purpose, should be considered.

Sand layers were encountered in some of the boreholes. The problem of "False Sets" should therefore be appreciated. This may become apparent where the piles pass through large proportions of saturated fine sand. If piles appear to have reached refusal, and such horizons are suspected, driving should cease for approximately 30 minutes to allow pore water pressures to dissipate before attempting to continue driving.

Pile tests should be conducted on working piles chosen at random, to a load of 1.5 times the intended working load. It is generally suggested that two tests should be carried out on each pile group. It should be noted that particular care is usually exercised in testing

piles driven to refusal in mudstone to ensure adequate bearing capacity. It may therefore be necessary to make other test pile arrangements outside the pile group but within the immediate vicinity of the proposed structure.

If end-bearing piles are considered it would be prudent to confirm the integrity of the bedrock by rotary core drilling.

There may be differential settlement between piled structures and the surrounding ground level. Provision should, therefore, be made to make up ground levels at threshold positions.

On the northern side of the river, rock was encountered at depths of between 1.50 m and 5.90 m. Above this lie gravels with N-values varying from 11 to over 50 and generally soft silty clays. The clays are likely to give an allowable bearing pressure of not more than 40 kN/m² while the lowest N-values within the gravels indicate an allowable bearing pressure of 50 kN/m² for a 1.0 m wide footing reducing to 20 kN/m² for a 4.0 m wide footing. Given these low allowable bearing pressures it is recommended that footings on the northern side of the river be taken to the rock. The depth to the rock varies significantly across the site and may require a relatively complex foundation solution incorporating some or all of (1) conventional footings, (2) deep trench footings, (3) benching and (4) piling. There may be potential for differential settlement depending upon the exact solution chosen.

With loads of the magnitudes quoted above total settlements are not considered likely to exceed the generally accepted tolerance of 25 mm. Differential settlements of up to approximately half this value may occur.

Comments regarding piling given above for the south bank of the river should also be considered for the north bank.

Where pads are to be used on one bank of the river and piles on the other, it will be essential to ensure suitable articulation in the bridge to allow for differential settlement between supports.

On either bank of the river, consideration may also be given to the adoption of vibroflotation techniques to improve the bearing capacity of the existing ground. Given the generally granular nature of the superficial deposits at the site and the presence of water within these, it is thought that vibroflotation may well be successful. The improvement in bearing capacity available will depend upon the particular technique used. Quotations and design advice should therefore be sought from reputable contractors who should be provided with a copy of this report. It is thought, however, that due to the limited area of ground to be treated, vibroflotation may not be economically viable when compared to piling. The possibility of damage to any adjacent services should be considered if this method of ground improvement is adopted.

The foundations of the proposed structure will be based on the flood plain of a large river. The clays and great thickness of gravels encountered in the boreholes are river flood plain deposits and illustrate the potential power of floodwaters. All foundations should therefore be designed bearing in mind the possibility of flooding and possible severe scouring around the footings. It should be noted that the site contains the derelict remnants of an earlier bridge (possibly narrow gauge railway?) and that the abutments of this have shaped upstream faces to divert flow. Considerations of scour and flooding are beyond the scope of this report save that piled foundations probably have greater resistance to the former.

If ground water or surface run-off is allowed to stand within excavations, rapid softening and resulting loss of strength of any cohesive material, especially in the excavation walls,

may result. If excavations are to remain open before construction proceeds a thin blinding layer of concrete should be laid immediately after excavation.

Deep excavations will probably encounter ground water ingress and specialist advice may be necessary.

All excavations should be closely inspected by a suitably qualified and experienced Chartered Civil Engineer before construction proceeds. Any soft spots should be removed and replaced by selected, well-compacted granular fill or lean mix concrete. Care must be taken in such circumstances to avoid the development of local "quick" conditions.

The possibility of softening and heave must be taken into account at this site as changing values of overburden and porewater pressure can lead to substantial loss of shear strength.

Details of the foundations of the derelict bridge are not known at present. Where former foundations exist, new foundations should be set at a greater depth than those existing.

The presence of trees within and close to the site boundaries indicates that foundations could be within their influence zone. The possibility of excessive settlement due to water removal by trees during dry periods or ground heave due to tree removal should be considered in the design of footings.

The results of the chemical tests indicate that the site may be considered as falling within Class 1 of the classification given in the Building Research Establishment Digest 363 "Sulphate and Acid Resistance of Concrete in the Ground". The recommendations given in this digest with respect to minimum cement content and water:cement ratio should be followed for all below ground level concrete.

The results of the chemical tests also indicate that moderate to high acidic conditions exist at this site. In addition, the presence of a high water table indicates that a potential problem of acid attack is present. It is therefore recommended that all below ground level concrete incorporates a sacrificial layer and an inert membrane.

The above notes apply only to the sulphate content and pH of the ground. A contamination survey has not been carried out. Consideration of the effects of such contamination, if it exists, is therefore beyond the scope of this report. C.J.Associates Geotechnical Limited does not accept any liability for pollution or contamination.

Cable Percussive Borehole Log Sheet

Site **MACHYNLLETH**
Job Number K0613
Machine Type DANDO 2000
Client POWYS COUNTY COUNCIL

BH No 1
Sheet 1 of 2
Logged by RDJC
Vertical Scale 1:50

C.J. associates

Date	Test / Sample Ref.	Test / Sample Depth (m)	SPT Results Seating 75mm	Seating 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test/ Sample Details	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. OD)
08/07/99										0.10	(0.10)		TOPSOIL.	
	D1	0.60											Soft to firm friable grey brown, sandy, silty CLAY, with occasional fine, medium and coarse gravel.	
	C2	1.00	4	5	5	4	4	5	N=18		(1.70)		Gravel content increasing below 1.0m.	
	D3	1.60												
	C4	2.00	4	5	6	9	9	14	N=38	1.80			Medium dense and occasionally dense, fine to medium, rounded and subrounded shale GRAVEL, with occasional coarse gravel and cobbles, in coarse grey sandy matrix. Occasional boulders.	
	D5	2.60												
	C6	3.00	6	8	9	10	12	18	N=49				Becoming dense below 10.0m.	
	D7	3.60												
	C8 W1	4.00 4.00	3	4	3	3	4	3	N=13					
	D9	4.60												
	C10	5.00	2	3	3	4	4	3	N=14					
	D11	5.60												
	C12	6.00	2	2	2	3	3	3	N=11		(8.90)			
12/07/99	D13	6.60												
	C14	7.00	2	3	4	5	9	13	N=31					
	C16	8.00	4	5	5	5	4	4	N=18					
	D17	8.60												
	C18	9.00	3	4	3	3	4	3	N=13					
	D19	9.60												
	C20	10.00	6	9	12	19	19		N>50 -40mm					

Inspection Pit

Depth (m)	
Length (m)	
Width (m)	
Notes	

Casing Record

Date	Diameter (mm)	Depth (m)
08/07/1999	200mm	6.00
12/07/1999	200mm	9.00
12/07/1999	150mm	10.60

Chiselling

Time (hr)	From (m)	To (m)
3.00	2.50	5.00
1.50	10.40	10.60

Water level observations (depths in m. below G.L.)

Date	Hole/ Strike	Casing	Water	Water (20 mins)	Remarks
08/07/1999	2.80	2.80		2.80	Medium

General Remarks
Water added to assist boring to 6.45m

Cable Percussive Borehole Log Sheet

Site **MACHYNLLETH**
Job Number K0613
Machine Type DANDO 2000
Client POWYS COUNTY COUNCIL

BH No 1
Sheet 2 of 2
Logged by
Vertical Scale 1:50

C.J. associates

Date	Test / Sample Ref.	Test / Sample Depth (m)	SPT Results Seating 75mm	Seating 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test/ Sample Details	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. OD)
12/07/99														
	D21	10.40												
	C22	10.60	25 -25mm		50 -50mm				N>50	10.70			END OF BOREHOLE	

Inspection Pit	Casing Record			Chiselling			Water level observations (depths in m. below G.L.)					
	Date	Diameter (mm)	Depth (m)	Time (hr)	From (m)	To (m)	Date	Hole/ Strike	Casing	Water	Water (20 mins)	Remarks
Depth (m)												
Length (m)												
Width (m)												
Notes												

General Remarks
Water added to assist boring to 6.45m

Cable Percussive Borehole Log Sheet

Site **MACHYNLLETH**
Job Number K0613
Machine Type DANDO 2000
Client POWYS COUNTY COUNCIL

BH No 2
Sheet 1 of 2
Logged by RDJC
Vertical Scale 1:50

C.J. associates

Date	Test / Sample Ref.	Test / Sample Depth (m)	SPT Results Seating 75mm	SPT Results Seating 75mm	SPT Results Test Drive 75mm	SPT Results Test Drive 75mm	SPT Results Test Drive 75mm	SPT Results Test Drive 75mm	Test/ Sample Details	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. OD)
06/07/99										0.10	(0.10)		TOPSOIL	
													Firm, very friable, grey brown, sandy, silty CLAY, becoming gravelly below 2.0m.	
	D1	0.60												
	U2	1.00							30 b 90%r					
	D3	1.40									(2.90)			
	U4	2.00							100 b 90%r					
	D5	2.40												
	C6	3.00	2	3	3	4	3	3	N=13	3.00				
	D7	3.60											Medium dense, fine to medium rounded and subrounded shale GRAVEL, with occasional coarse gravel and cobbles, in coarse grey sandy matrix.	
	C8	4.00	2	3	2	2	3	2	N=9					
	W1	4.00												
	D9	4.60												
	C10	5.00	2	3	4	4	4	4	N=16					
	D11	5.60									(4.60)			
	C12	6.00	5	6	8	8	8	8	N=32					
	D13	6.60												
	C14	7.00	3	4	5	6	6	5	N=22					
	D15	7.60								7.60				
	S16	8.00	1	2	1	1	2	3	N=7				Loose grey medium SAND.	
	D17	8.60									(1.30)			
	C18	9.00	1	2	2	2	3	2	N=9	8.90				
	D19	9.60											Medium dense becoming dense, fine to medium rounded and subrounded shale GRAVEL, with occasional coarse gravel and cobbles in coarse grey sandy matrix.	
	C20	10.00	4	2	4	4	3	5	N=16					

Inspection Pit	
Depth (m)	
Length (m)	
Width (m)	
Notes	

Casing Record		
Date	Diameter (mm)	Depth (m)
06/07/1999	150mm	10.00
07/07/1999	150mm	12.80

Chiselling		
Time (hr)	From (m)	To (m)
1.00	12.40	12.80

Water level observations (depths in m. below G.L.)					
Date	Hole/ Strike	Casing	Water	Water (20 mins)	Remarks
06/07/1999	3.00	3.00		2.90	Medium

General Remarks

Cable Percussive Borehole Log Sheet

Site **MACHYNLLETH**
Job Number K0613
Machine Type DANDO 2000
Client POWYS COUNTY COUNCIL

BH No 2
Sheet 2 of 2
Logged by
Vertical Scale 1:50

C.J. associates

Date	Test / Sample Ref.	Test / Sample Depth (m)	SPT Results Seating 75mm	Seating 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test/ Sample Details	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. OD)
07/07/99	D21	10.60									(4.35)			
	D22	11.60												
	C23	12.00	6	9	10	10	12	12	N=44					
	D24	12.30												
	C25	12.80	8	8	9	10	10	14	N=43					
										13.25			END OF BOREHOLE	

Inspection Pit	Casing Record			Chiselling			Water level observations (depths in m. below G.L.)					
	Date	Diameter (mm)	Depth (m)	Time (hr)	From (m)	To (m)	Date	Hole/ Strike	Casing	Water	Water (20 mins)	Remarks
Depth (m)												
Length (m)												
Width (m)												
Notes												

General Remarks

Cable Percussive Borehole Log Sheet

Site **MACHYNLLETH**
Job Number K0613
Machine Type DANDO 2000
Client POWYS COUNTY COUNCIL

BH No 3
Sheet 1 of 1
Logged by RDJC
Vertical Scale 1:50

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Date	Test / Sample Ref.	Test / Sample Depth (m)	SPT Results Seating 75mm	SPT Results Seating 75mm	SPT Results Test Drive 75mm	SPT Results Test Drive 75mm	SPT Results Test Drive 75mm	SPT Results Test Drive 75mm	Test/ Sample Details	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. OD)
14/07/99										0.10	(0.10)		TOPSOIL.	
	D1	0.60											Firm, very friable grey brown, sandy, silty CLAY, becoming gravelly below 1.2m.	
	S2	1.00	2	3	3	2	3	3	N=11		(2.00)			
	D3	1.60												
	C4	2.00	3	4	4	4	5	5	N=18	2.10				
	D5	2.60											Medium dense, fine to medium, rounded and subrounded shale GRAVEL, with occasional coarse gravel and cobbles in coarse grey sandy matrix.	
	C6	3.00	3	4	5	4	3	3	N=15		(2.00)			
	D7	3.60												
	C8	4.00	8	17		50			N>50					
	W1	4.00		-15mm		-50mm				4.10				
	D9	4.10									(0.40)		Dark grey SHALE, (recovered as moderately weak - moderately strong fragments)	
	C10	4.40	25		50				N>50	4.50			END OF BOREHOLE	
			-25mm		-20mm									

Inspection Pit	
Depth (m)	
Length (m)	
Width (m)	
Notes	

Casing Record		
Date	Diameter (mm)	Depth (m)
14/07/1999	200mm	4.10

Chiselling		
Time (hr)	From (m)	To (m)
1.00	4.10	4.40

Water level observations (depths in m. below G.L.)					
Date	Hole/ Strike	Casing	Water	Water (20 mins)	Remarks
14/07/1999	2.10	2.00		2.00	Medium

General Remarks

Cable Percussive Borehole Log Sheet

Site **MACHYNLLETH**
Job Number K0613
Machine Type DANDO 2000
Client POWYS COUNTY COUNCIL

BH No 4
Sheet 1 of 1
Logged by RDJC
Vertical Scale 1:50

C.J. associates

Date	Test / Sample Ref.	Test / Sample Depth (m)	SPT Results Seating: 75mm	75mm	Test Drive: 75mm	75mm	75mm	75mm	Test/ Sample Details	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. OD)
14/07/99										0.10	(0.10)		TOPSOIL.	
	D1	0.60											Soft friable, grey brown, sandy, silty CLAY, with occasional fine to medium gravel.	
											(1.30)			
	S2	1.00	2	3	4	4	9	9	N=26					
										1.40				
	D3	1.60											Medium dense, fine to medium, rounded and subrounded shale GRAVEL, with occasional coarse gravel and cobbles, in coarse grey sandy matrix.	
	C4	2.00	4	6	9	9	10	10	N=38					
	D5	2.60												
	C6	3.00	6	8	12	12	14	13	N>50					
	D7	3.60									(4.50)			
	C8	4.00	3	4	4	3	3	4	N=14					
	D9	4.60												
	C10	5.00	3	4	3	3	2	3	N=11					
15/07/99	D11	5.60												
	C12	6.00	25		50				N>50	5.90				
	D13	6.10	-25mm		-20mm						(0.30)		Dark grey SHALE, (recovered as moderately weak - moderately strong fragments).	
										6.20			END OF BOREHOLE	

Inspection Pit	
Depth (m)	
Length (m)	
Width (m)	
Notes	

Casing Record

Date	Diameter (mm)	Depth (m)
14/07/1999	200mm	5.00
15/07/1999	200mm	5.90

Chiselling

Time (hr)	From (m)	To (m)
2.50	1.50	3.00
1.25	5.90	6.20

Water level observations (depths in m. below G.L.)

Date	Hole/ Strike	Casing	Water	Water (20 mins)	Remarks
14/07/1999	1.40	1.00		1.40	Medium

General Remarks

Cable Percussive Borehole Log Sheet

Site **MACHYNLLETH**
Job Number K0613
Machine Type DANDO 2000
Client POWYS COUNTY COUNCIL

BH No 5
Sheet 1 of 1
Logged by RDJC
Vertical Scale 1:50

C.J. associates

Date	Test / Sample Ref.	Test / Sample Depth (m)	SPT Results Seating 75mm	Seating 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test/ Sample Details	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. OD)
13/07/99										0.10	(0.10)		TOPSOIL.	
	D1	0.60											Soft friable, grey brown, sandy, silty CLAY, with some roots and occasional fine to medium gravel.	
	S2	1.00	1	2	1	1	2	2	N=6		(1.40)			
	D3	1.50								1.50				
	S4	1.70	25 -25mm		50 -15mm				N>50	1.80	(0.30)		Dark grey SHALE, (recovered as moderately weak - moderately strong fragments). END OF BOREHOLE	

Inspection Pit	
Depth (m)	
Length (m)	
Width (m)	
Notes	

General Remarks

Casing Record		
Date	Diameter (mm)	Depth (m)
13/07/1999	200mm	1.70

Chiselling		
Time (hr)	From (m)	To (m)
1.25	1.50	1.70

Water level observations (depths in m. below G. L.)					
Date	Hole/ Strike	Casing	Water	Water (20 mins)	Remarks
13/07/1999	1.40	1.40		1.40	Slow

Cable Percussive Borehole Log Sheet

Site **MACHYNLLETH**
Job Number K0613
Machine Type DANDO 2000
Client POWYS COUNTY COUNCIL

BH No 6
Sheet 1 of 1
Logged by RDJC
Vertical Scale 1:50

C.J. associates

Date	Test / Sample Ref.	Test / Sample Depth (m)	SPT Results Seating 75mm	Seating 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test/ Sample Details	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. OD)
13/07/99										0.10	(0.10)		TOPSOIL.	
	D1	0.60									(0.90)		Soft friable, grey brown, sandy, silty CLAY, with occasional fine to medium gravel.	
	C2	1.00	2	3	3	2	3	3	N=11	1.00				
	D3	1.60											Medium dense, fine to medium, rounded and subrounded shale GRAVEL, with occasional coarse gravel and cobbles, in coarse grey sandy matrix.	
	C4	2.00	2	3	4	9	21	20 -15mm	N>50					
	D5	2.60									(3.00)			
	C6	3.00	4	5	4	3	3	3	N=13					
	D7	3.60												
	C8	4.00	25 -10mm		50				N>50	4.00				
	D9	4.00								4.20	(0.20)		Dark grey SHALE, (recovered as moderately weak - moderately strong fragments). END OF BOREHOLE	

Inspection Pit	Casing Record			Chiselling			Water level observations (depths in m. below G. L.)					
	Date	Diameter (mm)	Depth (m)	Time (hr)	From (m)	To (m)	Date	Hole/ Strike	Casing	Water	Water (20 mins)	Remarks
Depth (m)	13/07/1999	200mm	4.00	1.00	2.40	2.90	13/07/1999	2.10	2.00		1.90	Medium
Length (m)				1.50	4.00	4.20						
Width (m)												
Notes												

General Remarks

Cable Percussive Borehole Log Sheet

Site **MACHYNLLETH**
Job Number K0613
Machine Type DANDO 2000
Client POWYS COUNTY COUNCIL

BH No 7
Sheet 1 of 2
Logged by RDJC
Vertical Scale 1:50

C.J. associates

Date	Test / Sample Ref.	Test / Sample Depth (m)	SPT Results Seating 75mm	Seating 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test/ Sample Details	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. OD)
15/07/99										0.10	(0.10)		TOPSOIL.	
	D1	0.60											Soft to firm, friable grey brown, sandy, silty CLAY, with fine, medium and coarse gravel.	
	C2	1.00	8	8	12	12	14	14	N>50					
	D3	1.60									(2.90)			
	C4	2.00	4	5	9	9	10	10	N=38					
	D5	2.60												
	C6	3.00	2	3	2	2	3	4	N=11	3.00				
	D7	3.60											Medium dense, fine to medium, rounded and subrounded shale GRAVEL, with occasional coarse gravel and cobbles, in coarse grey sandy matrix.	
	C8	4.00	2	3	3	2	2	3	N=10					
	D9	4.60											Becoming dense below 10.0m.	
	C10	5.00	2	3	5	7	7	7	N=26					
	D11	5.60												
	C12	6.00	3	4	3	4	4	4	N=15					
	D13	6.60												
	C14	7.00	3	4	4	3	3	4	N=14					
16/07/99	D15	7.60												
	C16	8.00	2	3	4	4	5	6	N=19					
	D17	8.60									(10.70)			
	C18	9.00	3	4	5	6	6	6	N=23					
	D19	9.60												
	C20	10.00	7	8	9	10	10	12	N=41					

Inspection Pit

epth (m)
ength (m)
idth (m)
otes

Casing Record

Date	Diameter (mm)	Depth (m)
15/07/1999	200mm	7.00
16/07/1999	150mm	13.50

Chiselling

Time (hr)	From (m)	To (m)
1.50	1.20	2.00
2.00	12.40	13.50

Water level observations (depths in m. below G.L.)

Date	Hole Strike	Casing	Water	Water (20 mins)	Remarks
15/07/1999	3.00	3.00		3.00	Medium

eneral Remarks
Vater added to assist boring from 1.0m. - 3.0m.

Cable Percussive Borehole Log Sheet

Site . **MACHYNLLETH**
Job Number K0613
Machine Type DANDO 2000
Client POWYS COUNTY COUNCIL

BH No 7
Sheet 2 of 2
Logged by
Vertical Scale 1:50

C.J. associates

Date	Test / Sample Ref.	Test / Sample Depth (m)	SPT Results Seating 75mm	Seating 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test Drive 75mm	Test/ Sample Details	Depth (m)	Thickness (m)	Legend	Description of Strata	Reduced Level (m. OD)
	D21	11.00												
	C22	12.00	8	9	10	10	12	18	N=50					
	D23	13.00												
	C24	13.50	12	13 -40mm		27	23 -45mm		N>50	13.70			END OF BOREHOLE	

Inspection Pit	Casing Record			Chiselling			Water level observations (depths in m. below G.L.)					
	Date	Diameter (mm)	Depth (m)	Time (hr)	From (m)	To (m)	Date	Hole/ Strike	Casing	Water	Water (20 mins)	Remarks
Depth (m)												
Length (m)												
Width (m)												
Notes												

General Remarks
Water added to assist boring from 1.0m - 3.0m

